Treatment of Losses by Network Operators

ERGEG Position Paper for public consultation

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1 Responding to this Public Consultation

ERGEG invites all interested parties to comment on this ERGEG Position Paper.

Following the end of the public consultation period, ERGEG will publish all comments and replies to questions received from stakeholders.

If a respondent would like ERGEG to treat their contribution with confidentiality then this must be explicitly mentioned in their reply. Unless marked as confidential, all responses will be published by placing them on the ERGEG website www.energy-regulators.eu.

Any comments should be received by **30 September 2008** and should be sent by e-mail **losses@ergeg.org** .

Any questions relating to this document should in the first instance be directed to:

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2 Executive Summary

ERGEG's analysis of network losses gives an overview of national practices regarding the definition, procurement, financial recovery of network losses and incentives for their reduction. Furthermore, it shows the actual practices regarding network losses in Europe by means of representative case studies from some Member States and comparative analysis.

In addition, relevant features that need to be tackled in order to promote a level-playing field in the treatment of losses at a European-wide level have been discussed. To this end, some questions are presented to stakeholders during this public consultation.

This document and the public consultation will serve as the background for further discussions and the development of Guidelines of Good Practice on losses, which will serve as the basis for future more detailed technical rules and / or codes according to the proposed amended Regulation 1228/2003.

3 Introduction

Losses in electricity networks are a significant part of the overall losses in the electric power system. A reduction of network losses would make an important contribution to the EU's plan to increase energy efficiency in electricity supply. Furthermore, the following policy issues call for appropriate treatment of losses and adequate incentives for the TSOs and DSOs to do so:

- Priority for energy efficiency improvements in general and reduction of electrical losses in particular, within the scope of the Energy Efficiency Directive 2006/32/EC;
- Green Paper[1] and request to ERGEG by the EC in 2006 to work on network losses;
- 3rd package proposal to amend Regulation 1228/2003, with Article 2c 3(k) where detailed technical and market codes are required for energy efficiency regarding electricity networks.

ERGEG has analysed the national practices and experiences of the Member States concerning network losses, as a first step, to find out the present status of this issue. As a second step, a report will be delivered on options for adequate incentives for the network operators and network users for the adequate treatment and methodologies for the consideration and reduction of losses in the transmission and distribution networks.

An analysis of national practices will cover aspects of network losses such as:

- **Definitions:** There is no common definition of losses within the EU. This leads to a situation where different definitions in the Member States exist. It is obvious that technical losses are the main part of network losses but there are Member States where non-technical losses like theft or non-metered consumption are included in the losses. A comparison of network losses needs a common definition of losses.

- **Calculation methodologies:** The definition of network losses is very complicated, because losses have to be calculated and cannot be measured in most cases. The measurement of network losses would only be possible in networks with continuous metering of all consumption and generation, which is not currently the case, especially in distribution networks. As network losses must be calculated, a comparison of network losses must also include an overview of the different calculation methodologies in the Member States. It is also of relevance at which voltage levels it is possible to measure network losses.

- **Procurement of network losses:** Directive 2003/54/EC obliges network operators to procure the energy they use to cover network losses according to transparent, non-discriminatory and market-based procedures, whenever they have this function. In many Member States, network operators are responsible for the procurement of energy for losses, but it is also possible to oblige the suppliers to cover the losses. In these cases, there is no need for a separate procurement system for network losses.

- **Consideration of costs in the tariff system:** In many Member States, there are separate network tariff components for losses, whereas in some Member States losses are included in a common network tariff.

[1] Green Paper on "A European Strategy for Sustainable, Competitive and Secure Energy" [COM(2006)105], March 2006

- **Regulatory incentives for the reduction of losses:** Energy efficiency is an issue of increasing importance. Therefore, an incentive for taking measures to reduce losses should be provided to network operators. There are also different approaches for such incentives and these have to be compared.

ERGEG's analysis of network losses gives an overview of national practices regarding the definition, procurement and financial recovery of network losses as well as on incentives for their reduction. Furthermore, it shows the best practices on network losses in Europe, by means of representative case studies from some Member States.

The analysis can serve as background for further discussions and the development of Guidelines of Good Practice on losses. The scope of the future Guidelines on Energy Efficiency in Electricity will be defined depending on the outcome of the ongoing ERGEG work on network losses mentioned above, on the implementation of the Directive on Energy End-Use Efficiency and Energy Services and other related issues, notably the "Green Package"[2].

4 General considerations about losses

Power losses can be broadly defined as the difference between the amount of electricity entering the transmission system and the aggregated consumption registered at end-user meter points. From an operational point of view, electricity losses are an unavoidable cost of the transfer of energy across electricity transmission and distribution networks which need to be appropriately tackled, as they impose an additional demand and energy load on the system.

Power losses in electrical systems can be categorised in several ways according to the different sources they stem from. Conventionally, losses are broken down into technical (or physical) and non-technical (or commercial) losses. The former are the result of the inherent resistance of electrical conductors, which causes electric energy to be transformed to heat and noise whenever current flows through them. The latter have to do with those units that are delivered for consumption but which are not paid for as a consequence of a wide variety of factors ranging from theft and non-registered consumptions to differences in billing and metering.

Additionally, categorising on the basis of the type of network where losses occur, we can distinguish between transmission and distribution losses. The measurement of losses is dependent on the voltage level of the network. In particular, transmission losses (in higher voltage networks) are accurately measured by means of continuous metering. On the other hand, distribution losses (in lower voltage networks) are estimated, with a degree of uncertainty, with register metering procedures.

Losses result in considerable financial and environmental costs. It should be noted that power losses in transmission and distribution networks may account for up to 10-15% of the total amount of electricity produced. The costs related to these losses are borne by final

[2] On 23 January 2008, the European Commission published a package of Climate Action proposals, http://ec.europa.eu/energy/energy_policy/index_en.htm.

customers, as they are obliged to pay for an energy supply that includes the load of energy that is 'lost' and, therefore, not consumed.

The environmental impact of losses is borne by society as a whole, as a result of the emission of air pollutants associated with the additional generation that is needed to cover losses. Therefore, the objective of the regulatory treatment of losses is twofold: on the one hand, to protect the interest of customers and on the other hand, to promote the efficiency of the network system.

In order to keep losses at a low and reasonable level, regulators have designed incentive mechanisms which deliver rewards (or penalties) for network operators whenever losses are below (or above) a pre-set target level. These mechanisms are justified by the fact that network operators have, to some extent, the ability to control losses since they are responsible for several activities such as network design, maintenance and investment decisions regarding the installation of grid elements that play a significant role in the determination of losses. Therefore, it is important to ensure that network operators face adequate incentives so that they make an appropriate effort on evaluating the costs and benefits of reducing losses and, hence, optimise the level of losses in the most efficient way.

By contrast, there are a number of external factors with significant influence on the level of losses. In particular, the geographical size of the market as well as the number and degree of dispersion of customers connected to distribution networks are important driving factors which cannot be modified.

Due to its complexity, the treatment of losses is also deeply related to other regulatory and operational issues, such as energy efficiency schemes, infrastructure planning and network reconfiguration, that are far beyond the scope of this document. Generally, it should be stated that losses are proportional to the amount of energy that is delivered, the distance between generation and consumption, and inversely related to the voltage level of the network. Consequently, any measures or actions focused on reducing or smoothing the demand for energy, (re)locating generation plants closer to demand, and upgrading the voltage level of the network, will have a positive impact on losses.

From European Commission's point of view, the treatment of losses is a key topic which needs to be addressed in order to achieve energy efficiency improvements in electricity networks. This objective is explicitly set[3] as one of the tasks of the future European Network of Transmission System Operators (ENTSO) for Electricity in the legislative proposal for a Third Energy Package published on the 19 September 2007[4].

Remarkably, to-date there have been no formal attempts to harmonise the treatment of network losses at a pan-European level. However, several analyses of losses have been carried out within the scope of benchmarking studies of electricity transmission tariffs prepared by the European Commission, the European Transmission System Operators

[3] Article 2c 3k) of COM (2007)531, Proposal for Amending Regulation (EC) Nº 1228/2003 on conditions for access to the network for cross-border exchanges in electricity.

[4] In addition, following the publication of the Green Paper, the EC requested that ERGEG work on network losses, within the scope of the Energy Efficiency Directive 2006/32/EC.

(ETSO) and the Council of European Energy Regulators (CEER)/European Regulators' Group for Electricity and Gas (ERGEG)[5].

Any attempt devoted to promoting a level-playing field for the treatment of losses at European level must consider the legal, economic and technical aspects of losses. For this reason, a close cooperation among all interested/affected parties (including the EC, national governments, national regulatory authorities and transmission and distribution network operators) is necessary in order to achieve a satisfactory outcome.

The preliminary analysis carried out by ERGEG, in order to set the stage for this discussion paper, has focused on several features regarding current practices in a sample of seventeen EU countries and Norway[6]. Namely, definitions of losses, valuation methods, recorded values, procurement, tariffs and regulation, and incentive mechanisms have been analysed.

After studying national practices throughout Europe, a selection of case studies was identified. Austria, Czech Republic, Finland, France, Norway, Portugal and Sweden were highlighted as being representative of the different regulatory models currently available.

The treatment of losses across Europe differs significantly from country to country. For benchmarking purposes, this situation hinders the comparative analysis of national figures, the suitability of certain procurement procedures and the effectiveness of regulatory incentive mechanisms.

5 Benefits of losses reduction

The losses in transmission and distribution networks have a significant influence on the efficiency of the whole electricity supply system. The comparison of the actual losses in chapter 6.3 shows that for several Member States the average losses in transmission networks are between 1% and 2.6 % and the losses in distribution networks are between 2.3% and 11.8%. Although there are different definitions of losses and different approaches according to the reference values for the losses (energy output or input of the grid), it is clear that a reduction of losses can lead to an extensive increase in the efficiency of transmission and distribution.

The collected figures show that, in particular, some new Member States have much higher losses at the distribution level than the other Member States. The reason for that could be the actual condition of the networks with relatively small cross-sections of the lines together with a higher-than-average amount of non-technical losses, e. g. from unmetered consumption, metering errors and theft.

Depending on the mechanism for covering the losses, the costs for technical losses have to be covered by the network customers with correctly metered consumption. The identification

[5] e.g. CEER Tariff Task Force, Tariff Harmonisation and Long Term Locational Signals, Report 15.7.2003, Consult Study for EC, Benchmark of Electricity Transmission Tariffs, October 2002 and ETSO overview of Transmission Tariffs in Europe: Synthesis 2005, 2006 and 2007.

[6] Austria, Czech Republic, Denmark, Finland, France, Greece, Hungary, Italy, Luxembourg, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden and United Kingdom.

and reduction of non-technical losses and the installation of meters to all consumers helps to ensure that the actual amount and costs of technical losses can be charged to the customers (or suppliers) in a cost-reflective and fair way. The reduction of non-technical losses leads to non-discriminatory treatment of all customers according to the cost coverage for network losses.

The reduction of technical losses is also of high importance. The amount of technical losses can be influenced by the network operators, at least in the medium term, by appropriate investments in the networks. This is the basis for the implementation of incentive mechanisms for the reduction of losses which support network operators in these efforts. The pre-condition for these incentive mechanisms is that they have overall positive effects. This implies that the investments in the networks to reduce the losses must be lower than the costs of the technical losses. In such a case, the network operator will be able to invest as long as the marginal costs for the reduction of losses align with the marginal costs of network losses.

The reduction of losses in general brings benefits to the whole electricity supply system. It leads to fair cost coverage for losses and to advancements in the transmission and distribution systems. Furthermore, the reduction of losses supports the efforts of the Green Paper to reach the targets of the Energy Efficiency Directive 2006/32/EC.

All in all, regulators must consider an appropriate treatment of losses and implement adequate incentives such that transmission system operators (TSOs) and distribution system operators (DSOs) act efficiently with regard to the priority placed on energy efficiency improvements in general and the reduction of network losses in particular.

6 Current practices

This section is based on an internal questionnaire completed by national regulatory authorities and it describes the current practices related to treatment of losses by network operators regarding the following relevant issues:

6.1 Definition of losses

This section is aimed at providing a brief overview of the definition of power losses and current regulatory practices throughout Europe.

Power losses is quite a broad term, commonly defined as the difference between the amount of electricity entering the transmission system and the aggregated consumption registered at end-user meter points.

From an operational point of view, electricity losses are an unavoidable cost of the transfer of energy across electricity transmission and distribution networks which need to be appropriately tackled, as they impose an additional demand and energy load on the system.

In order to ease the analysis and properly account for the different sources of this phenomenon, power losses in electrical systems are conventionally broken down into two categories:

- Technical losses
- Non-technical losses.

Technical losses are the result of the inherent resistance of electrical conductors, which causes electrical energy to be transformed to heat and noise whenever current flows through them. The loss of energy stemming from the dissipation of heat in electrical networks (lines, cables, transformers and other elements of the grid) is usually referred to as 'physical (or ohmic) losses'.

Technical losses vary with the level of utilisation of the network capacity, i.e. the quantity of electricity being transmitted/distributed. In particular, they are proportional to the square of the current. As a result, transmission networks experience a lower level of losses because at higher voltages a lower current is required to transmit the same amount of electric energy. Conversely, distribution networks (at lower voltages) are subject to a higher level of losses. Additionally, technical losses are also dependent on the length and the cross section of the network line.

Within technical losses, transmission losses can be more accurately estimated than distribution losses (see section 6.2 Valuation).

On the other hand, non-technical losses comprise electricity that is delivered mostly for consumption but which is not paid for. They are mainly caused by in-house consumption (also known as "hidden" losses); the illegal abstraction of electricity (energy theft); non-metered supplies (such as public lighting); as well as errors in metering, billing and data processing. Additionally, there are errors resulting from the time-lag between meter readings and statistical calculations. Non-technical losses are also referred to as 'black losses' or 'commercial losses', since they are socialised and not directly charged by suppliers or distribution companies.

"Hidden" non-technical losses are typically associated to in-house consumption, but also to electricity consumed in order to cool transformers, and operate the control system. Energy theft consists of tampering with meters and illegal connections. It is difficult to gauge the exact extent of this type of losses as a large proportion of it is likely to go undetected.

Regarding non-metered supplies, public lighting is a prominent case. For practical reasons, the consumption of this type of electrical installations is usually calculated by means of equipment inventories, estimated usage or known hours of operation. However, these procedures turn out to be rather inaccurate.

Last, but not least, differences in metering, billing and data processing basically account for the remaining non-technical losses. These errors are responsible for hampering the estimation of non-technical losses (as they may eventually lead to an over-reporting of consumption).

Figure I summarises the categorisation of losses stated above.

As a consequence of the wide range of sources for power losses, current regulatory definitions of this term vary significantly from country to country. For benchmarking purposes, this circumstance seriously hinders the analysis of percentages of losses across countries (see section 6.3 Values).

Table I summarises the answers submitted by seventeen European countries (Austria, Czech Republic, Denmark, Finland, France, Greece, Hungary, Italy, Luxembourg, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden and United Kingdom) in a questionnaire on losses and their treatment launched by ERGEG in 2007 (see Appendix 1).

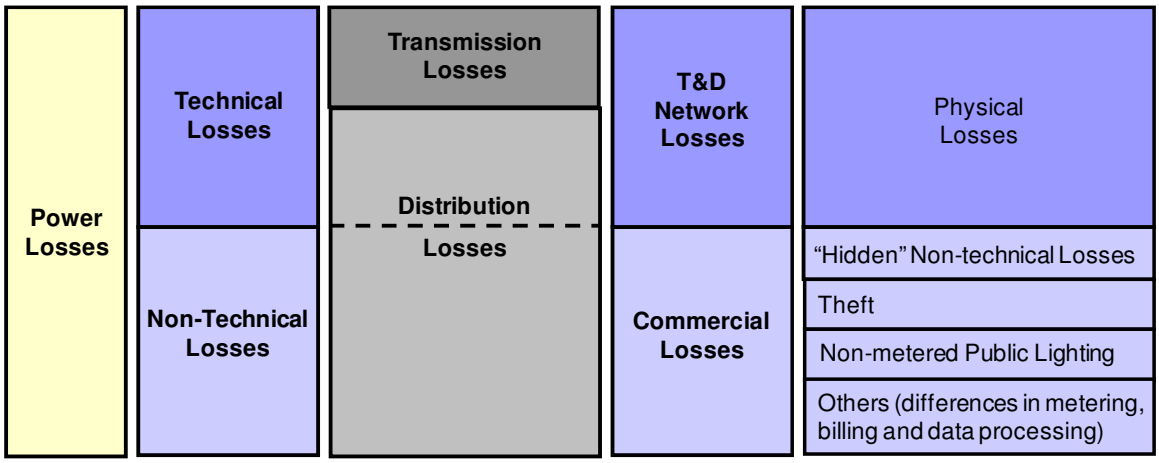

Figure 1 – Categorisation of losses

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For the sake of comparability, power losses are divided into the following five classes:

a) Physical losses in transportation/distribution of electricity
b) "Hidden" non-technical losses (e.g. in-house consumption)
c) Thefts
d) Non-metered public lighting
e) Others (e.g. metering errors)

Remarkably, most countries show certain symmetry within their definitions for transmission and distribution losses. In addition, the whole set of countries under analysis agrees to account for physical losses.

However, regarding non-technical losses, the exercise reveals a noteworthy heterogeneity in the definitions. Overall, the vast majority of the countries considered broadly account for physical losses, thefts and metering errors in their regulation, since there is no remedy to prevent it.

6.2 Valuation

This section gives information about the ex-post valuation of the losses in the transmission and distribution European electricity networks.

Losses are calculated for each voltage level. The valuation methodology depends on the metering equipment.

Nr. Crt.	Country	Operator Type	**a.** Physical losses in transport/distribution of electricity	**b.** … "hidden" non-technical losses (e.g. in-house consumption - electricity consumption to cool the transformer, control system operation, etc)	**c.** … theft (should not be mixed with losses)	**d.** … non-metered public lighting (street lamps)	**e.** … others (please specify)	Comments
1.	Austria	TSO	√	√				
		DO	√	√	√			
2.	Czech Republic	TSO	√	√	√	√	√	Total losses consist of mainly technical losses in the grids (lines and transformers) + other non-technical losses (non-metered consumption, undetected theft etc.)
		DO	√	√	√	√	√	
3.	Denmark	TSO	√					Transmission losses consist of technical losses in the grids (lines, cables and transformers).
		DO						No answer
4.	Finland	TSO	√				√	include metering errors
		DO	√				√	include metering errors
5.	France	TSO	√	√	√			Theft (non technical losses) according to 2 b.
		DO	√	√	√		√	Public lighting is partially included in losses. The cities pay public lighting according to a profile. The differences between the real lamps consumption and this template are part of losses. Losses include metering errors and theft (non technical losses).
6.	Greece	TSO	√					
		DO	√		√			Further investigation is needed on in house consumption
7.	Hungary	TSO	√		√		√	Commercial losses included
		DO	√		√		√	Commercial losses included
8.	Italy	TSO	√		√		√	Include metering errors
		DO	√		√		√	Include metering errors
9.	Luxembourg	TSO	√					
		DO	√					
10.	Norway	TSO	√		√			include metering errors
		DO	√		√		√	include metering errors
11.	Poland	TSO	√					
		DO	√		√		√	Include metering errors
12.	Portugal	TSO	√		√		√	In-house consumptions are measured and paid by regular tariffs as any other normal consumption. Include metering errors
		DO	√		√		√	
13.	Romania	TSO	√		√		√	Losses include the difference between estimated consumption and the achieved one for non metered public lighting. Include metering differences
		DO	√		√		√	
14.	Slovakia	TSO	√		√		√	Include metering differences
		DO	√		√		√	Include metering differences
15.	Spain	TSO	√					
		DO	√	√	√		√	
16.	Sweden	TSO	√					
		DO	√		√		√	Include metering errors
17.	United Kingdom	TSO	√		√			
		DO	√		√			

Table 1 – Components of losses

At the voltage levels where every connection point is subject to continuous[7] metering, losses are calculated by hourly energy balance (difference between injections and withdrawals). This is usually the case at high voltage levels or transmission networks. Continuous metering leads to an accurate valuing of the losses at high voltage levels (transmission networks).

[7] Continuous metering: the energy is metered continuously by short intervals of time and the hourly load curve is available.

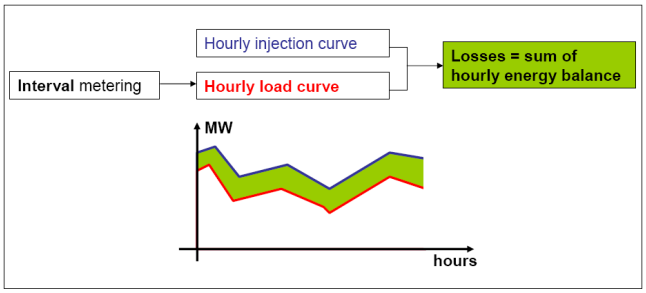


Figure 2 – Continuous metering

At lower voltage levels or distribution networks, most of the connection points are subject to register[8] metering. Technical losses (in lines and transformers) may be calculated on the basis of a mathematical formula. An example of implementing this procedure is as follows: the formula's parameters are revised yearly or at each new regulatory period. Each year, the total metered consumption is dispatched to build an hourly load curve. This dispatching is done on the basis of estimated load profiles. Non-technical losses (thefts, public lighting) are set so that total incoming flows are balanced hourly by the flows to different voltage levels, the computed consumption and the computed technical losses. The register metering leads to uncertainties in valuing the losses at the lower voltage levels (distribution networks).

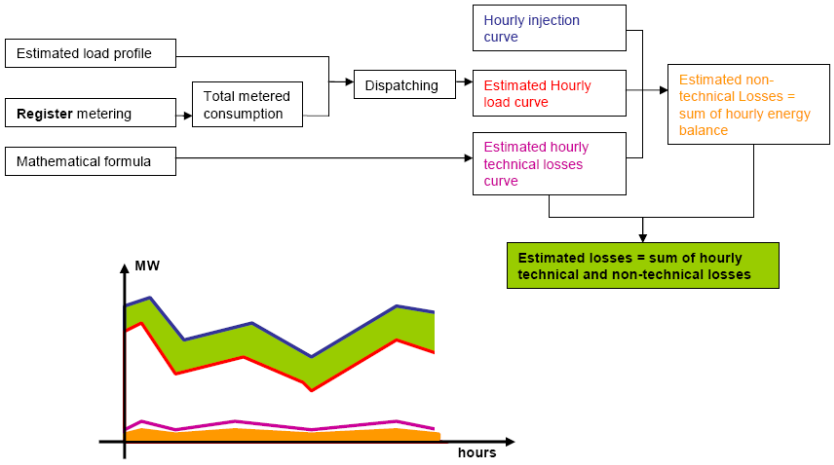


Figure 3 – Register metering

[8] Register metering: the values are not collected, energy is not metered continuously and the hourly load curve is not available.

6.3 Values

This section gives information about the percentage (%) of losses in the European electricity transmission and distribution networks. Depending on the countries, some values refer to 2006 and others to 2005.

Country	Average % of losses in TSO	Average % of losses in DSO
Austria	1,5 % of output	4,5 % of output
Czech Republic	1,5 % of output	7,0 % of output
Finland	1,6 % of input	4,7 % of input
France	2,3 % of output	5,0 % of output
Greece	2,4 % of input	6,8 % of input
Hungary	1,4 % of input	9,2 % of input
Norway	1,6 % of input	5,0 % of input
Poland	2,1 % of input	11,8 % of output
Portugal	1,1 % of input	6,4 % of input
Romania	2,6 % of output	13,5 % of output
Slovakia	1,0 % of output	8,3 % of output
Spain	1,2 % of input	7,1 % of input
Sweden	2,1 % of input	2,3 % of input
United Kingdom	1,6% of input	< 6,0 % of input

Table 2 – Level of the losses in the transmission and distribution European electricity networks

The differences in the percentages of losses are mainly due to:

- The national definition of what voltage levels are operated by TSOs and DSOs. If the TSO operates not only the transmission grid but also the regional grids, the average percentage of losses will be higher than if the TSO operates only the transmission grid. If the DSO operates not only the distribution grids but also the regional grids, the average percentage of losses will be lower than if the DSO operates only the distribution grids.
- Values have been calculated with accordance to national regulatory definitions that differ from country to country.
- The reference for the percentage. The level of the input includes the losses when the level of output does not. If the percentage of losses refers to output, it will be higher than if it refers to input.

- The level of theft on DSOs. As the DSO losses generally include theft, the higher the level of theft is, the higher the percentage.

6.4 Procurement

Directive 2003/54/EC obliges the network operators to procure the energy they use to cover network losses according to transparent, non-discriminatory and market-based procedures, whenever they have this function.

Usually the network operators (TSOs and DSOs) are responsible for the procurement of losses but it is also possible to oblige the suppliers to cover the losses. Therefore there are two main possibilities for procuring the energy to cover network losses in place.

Option A – Network operator is responsible for the procurement

The network companies are responsible for network losses and purchase the electric energy to cover the expected losses in their grids. Energy is procured:

- on the power exchanges – PEX (day ahead or longer contracts),
- bilaterally – OTC,
- by auctions/tenders (generators or traders submit their price offers).

It is common to use several possibilities together, for instance a combination of PEX and bilateral (longer term hedged contracts). Average costs of losses are accepted by the regulator and used in the tariff calculation.

Imbalances caused by losses are usually handled in the balancing like any other imbalance.

This option is used in many Member States, namely Austria, the Czech Republic, Denmark, Finland, France, Germany, Hungary, Luxemburg, Poland, Norway, Romania, Slovakia and Sweden.

Option B – Supplier is responsible for the procurement

Losses are physically injected by the suppliers. Each supplier injects its own energy for a compensation of the losses related to the consumption of its clients in the same period; estimated losses are priced at the same price as load.

Losses are treated like any other induced or occurred imbalance, the difference between effective losses and estimated losses on the network is priced at the cost of providing the extra energy on the balancing market.

This option is used in Greece, Italy and Portugal.

The following table summarises the different solutions adopted by the countries from the case studies presented in Appendix 1.

<table>
<tr><th></th><th>Who</th><th>How</th><th>Tariffs</th></tr>
<tr><td>Finland</td><td rowspan="5">Network operators</td><td rowspan="4">PEX or bilaterally</td><td rowspan="5">Paid by network tariffs</td></tr>
<tr><td>France</td></tr>
<tr><td>Norway</td></tr>
<tr><td>Sweden</td></tr>
<tr><td>Czech Republic</td><td>Annual tenders</td></tr>
<tr><td>Austria</td><td>Special balancing group</td><td>Paid by dedicated tariff</td></tr>
<tr><td>Portugal</td><td colspan="2">Injected by suppliers</td><td>No tariffs for losses</td></tr>
</table>

Table 3 – Procurement solutions in some European countries

6.5 Tariffs and regulation

In many countries like France, Sweden, Norway, Finland and the Czech Republic, where the network operators are responsible for the coverage of the network losses, there are no special tariffs for losses. Therefore the costs for the procurement of the losses have to be considered and included in the network tariffs.

- France has taken into account the short term evolution of the charges for losses in the network tariffs and put a mechanism in place which measures the gap between the estimation which was the basis for the defined tariff level and the real development of charges for losses. The differences are supposed to be integrated in the next regulatory period.
- According to the national Electricity Act, the network tariffs in Sweden shall be reasonably related to the quality of supply. For the transmission network, the tariff model states that the losses are covered by a tariff dependent on current use. There is also a fixed part of the tariff which covers the network operator's capital costs.
- Similar to the Swedish model, Norway has two main groups of tariffs. There are tariffs dependent on current use which shall only cover marginal costs and other tariffs which shall basically cover fixed costs. In the main transmission grid, marginal losses in all nodes are calculated. These marginal costs are the basis for tariff calculation in the regional and in the transmission networks.
- In the Czech Republic, the variable component of transmission and distribution charges has to cover the losses. There is a special formula for the calculation of the prices for the use of the network. All inputs and resulting prices from this formula are tailored for different network operators and voltage levels.

In Austria, the network operator is also responsible for the procurement of losses but there is a special network tariff for losses which has to be paid by the customers in addition to the tariffs for the use of the network. The tariff for losses is calculated by the regulatory authority according to a formula which considers peak and base components in the procurement of the losses. There are different tariffs for losses in different voltage levels and network areas.

Portugal has a model for the covering losses which is very different to the models of the other analyzed Member States. In Portugal, the supplier has to inject the energy for the compensation of losses physically and therefore there is no special tariff for losses. The suppliers are obliged to inject the energy for the compensation of the losses related to the consumption of their customers according to special losses profiles which are suggested by the network operators and approved by the regulatory authority.

6.6 Regulatory and incentive mechanisms

The following table summarises the actual practices from the case studies, which are representative of the different solutions put in place in the European countries.

	Regulatory incentives	Incentive mechanism
Finland	None	None
Sweden	For distribution networks, standard losses are included in network performance assessment model	
Norway	Yardstick regulation. Costs related to network losses are treated as any other cost within the regulatory model	
France	TSO: none. DSO: incentive for thefts reduction	None
Austria	Allowed rate of losses to include in tariffs capped to a maximum value in % (only TSO)	
Czech Republic	Allowed rate of losses to include in tariffs capped to a maximum value in % (TSO and DSO)	An annual loss efficiency factor is in place (only for DSO)
Portugal	Total network losses should below a specified value in %. An incentive mechanism exists to reduce losses in the distribution networks.	Tariff Code includes an incentive mechanism to reduce losses in distribution networks allowing the DSO to be rewarded (or charged) if global distribution losses lower (or above) than a reference value set by the regulator, for each year, are achieved

Table 4 – Regulatory incentives

The analysis of the previous tables, illustrates the following adopted solutions for regulatory or incentive mechanisms to reduce power losses in the transmission or distribution networks:

- No regulatory or incentive mechanism (which is common among countries);
- Incentive-based regulatory model where the incentives for the network losses are equal to the incentives for any other costs;
- Allowed rate of losses to include in tariffs capped to a maximum value in %;
- Incentive mechanism allowing the network operator to be rewarded (or charged) if global network losses lower (or above) than a reference value are achieved.

Variants may be found, such as annual loss efficiency factors, or special dedicated incentives, such as the one to reduce thefts.

7 Issues of importance, evaluations and recommendations

The previous sections of this document were intended to provide a brief overview of the main issues concerning electricity losses and their treatment by network operators. In particular, several features of current practices in a sample of European countries are described, namely the definitions of losses, valuation methods, recorded values, procurement, tariffs and regulation, and incentive mechanisms.

After studying national practices throughout Europe, a selection of case studies were identified and are further developed in Appendix 1. In particular, Austria, Czech Republic, Finland, France, Norway, Portugal and Sweden were highlighted for being representative of the different regulatory models currently available.

This section will focus on those relevant features that need to be tackled in order to promote a level-playing field in the treatment of losses at a European-wide level. Obviously, any attempt devoted to harmonising national practices must address legal, economic and technical aspects of losses. However, the main purpose herein is to design a regulatory framework aimed to enhance certain level of convergence among the Member States. Indeed, it should be stressed that the in-depth analysis of loss management practices by TSO and DSO is far beyond the scope of this document.

In order to gain a deeper understanding of this topic, ERGEG would welcome replies to the specific questions set out below as well as other views and comments from all interested parties. Based on these responses, the specific recommendations on how to deal with losses will be compiled into an ERGEG position paper and will eventually be developed into Guidelines of Good Practice.

Regulatory definition of losses

A first milestone in the process of harmonisation involves the introduction of a common regulatory definition of losses. As section 6.1 shows, definitions vary significantly from country to country. In accordance with the different sources from whence they stem, losses can be categorised in several ways (technical vs. non-technical losses, transmission vs. distribution losses, etc.). As a result, some countries use a broader term for electricity losses than others.

Questions:

1. What is considered an acceptable definition of losses?

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

3. Which are the key components for defining losses?

Valuation procedures

Regarding valuation procedures, section 6.2 pointed out that at high voltage levels (i.e. transmission networks) continuous metering leads to an accurate calculation of losses, whereas at lower voltage networks (i.e. distribution networks) losses are inaccurately estimated by means of register metering.

Question:

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

Values

Concerning values, the figures reported for each country should be carefully compared since they have been computed according to national regulatory definitions. The percentage of losses in transmission networks varies from 1% (Slovakia) to 2.6% of output (Romania). In contrast, distribution losses are significantly higher and widely range from 2.3% of input (Sweden) to 13.5 % of output (Romania).

Questions:

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

6. Which types of losses could be most easily reduced?

Procurement of losses

The procurement of losses has been analysed by means of who-how-tariffs approach intended to identify which market agent is in charge of providing the energy that is lost, the procedure for buying these losses and the tariff mechanism employed to cover those losses. Four case studies (Finland, France, Norway and Sweden) share a common procurement of losses based on network operators buying energy in PEX or bilaterally with network tariffs.

Questions:

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

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

8. Should the costs of losses be covered by a special tariff?

Regulatory incentives

Finally, several regulatory incentives have been implemented in both absolute and relative terms. For instance, in Norway costs related to network losses are treated like any other cost within the regulatory model used, whereas in Austria and Czech Republic there is a maximum percentage value for losses. For distribution losses, the Czech Republic employs an annual loss efficiency factor mechanism, and in Portugal the DSO is rewarded (or charged) if registered losses are below (or above) a pre-set reference value.

Questions:

9. What are the advantages and disadvantages of the aforementioned incentive mechanisms?

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

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

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

Annex 1 – Case studies – losses and their treatment

The present Annex contains a more structured and descriptive picture of the different models adopted for treatment of losses by network operators in several representative countries in 2007.

A1.1 Austria

Losses

Losses are calculated by the TSOs and DSOs and audited annually by the regulator. The losses include the components related to the following:

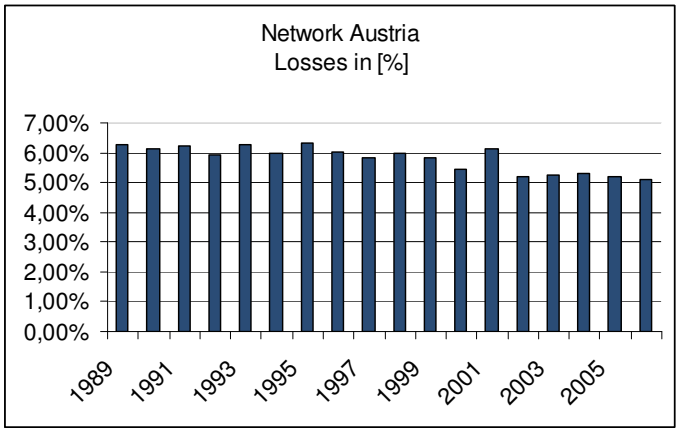
- Regular network operation;
- Fraud;
- Wrong identification or measurement (failure);
- Unidentified output;
- Metering fault on identified output.

In-house consumption is not included.

For network losses there is a special balancing group. The TSOs and DSOs must procure the energy for losses in a market-oriented way.

Values

The evolution of transmission and distribution network losses, referring to total energy injected in the networks, is shown below.



The losses in the transmission network are metered, the losses in the distribution networks are based on some (but not harmonised) empirical formulas/keys.

Procurement

Through the net loss payment, those costs are paid to the network operator, which are used for the procurement of the energy necessary for the reconciliation of net losses.

For the calculation of the net loss payment, an energy-related net price is used. For simplified accounting, it is possible to include, and to only prove on-demand separately, the net loss payment and the gross portion into the energy-related part of the net use payment.

The allocation of costs to the individual network levels, which can be paid off, are based on the results from measurements (measuring data). If no reliable measured data is available, the allocation will be done by an empirical allocation key.

Tariffs and regulation

A dedicated tariff for losses is defined. The price is based on a special formula, which includes the peak and the base prices. For 2007, it was 55,38 Euro/MWh.

	Price at the stock exchange in EUR/MWh	Base/Peak	weighted Procurement	Weighted price in EUR/MWh
Procurement 2004:				
Annual average value 2002 F1 BY 04	24,29	67%	30%	4,88
Annual average value 2002 F1 PY 04	35,99	33%	30%	3,56
Annual average value 2003 F1 BY 04	27,96	67%	70%	13,11
Annual average value 2003 F1 PY 04	43,53	33%	70%	10,05
Sum				31,61
Procurement 2005:				
Annual average value 2003 F1 BY 05	28,53	67%	30%	5,73
Annual average value 2003 F1 PY 05	44,39	33%	30%	4,39
Annual average value 2004 F1 BY 05	33,49	67%	70%	15,71
Annual average value 2004 F1 PY 05	49,13	33%	70%	11,35
Sum				37,19
Procurement 2006:				
Annual average value 2004 F1 BY 06	34,10	67%	30%	6,85
Annual average value 2004 F1 PY 06	51,10	33%	30%	5,06
Annual average value 2005 F1 BY 06	41,26	67%	70%	19,35
Annual average value 2005 F1 PY 06	56,34	33%	70%	13,01
Sum				44,28
Procurement 2007:				
Annual average value 2005 F1 BY 07	39,94	67%	30%	8,03
Annual average value 2005 F1 PY 07	54,38	33%	30%	5,38
Annual average value 2006 F1 BY 07	55,15	67%	70%	25,86
Annual average value 2006 F1 PY 07	80,68	33%	70%	18,64
				57,91
subtraction Annual average value 2004, 2005 and 2006				5,63%
				54,65
Cost balance energy 2006				0,73
Price for losses 2007				55,38

Regulatory incentives

As already indicated, the regulator audits the reported losses quantities. For the tariff calculation, the recognised losses are included in the tarification, with the maximum level defined for a given year in %, based on 2003 (incentive regulation of the DSOs excludes losses).

Incentive mechanism

A new mechanism for the treatment of losses in the 2nd regulatory period of the DSOs is under development.

A1.2 Czech Republic

Losses

Losses refer to the global energy balance of the system, i.e. total injections to the grid minus total withdrawals (consumption) from the transmission and distribution system. According to regulatory perspectives, total losses consist of technical losses and non-technical losses:

- **Technical losses** - electricity essential for grid operating (electricity wasted in lines, transformers and other grid equipments include transformer cooling),
- **Non-technical losses** – electricity unrelated with grid itself (non-metered consumption, undetected theft, etc.)

Valuation

Losses are calculated by network type (transmission and distribution) and voltage level (VHV, HV, MV, LV) and by the global energy balance of the system and networks (difference between injections and withdrawals) done in the following year (Y+1). The calculating model (provided by en external consultant) is evaluated for every regulatory period (every 5 years).

In general, each customer has a metering system. Nevertheless, due to directly non-metered losses (mainly technical losses in the grid) and small consumers non-continuing metering as well, the amount of the electricity balance (total flows from/to different voltage levels) is used for losses calculation → every connection point between different networks and voltage levels is subject to metering.

Annual technical losses are generally calculated on the basis of mathematical formulas for setting losses (losses in lines and transformers). Annual non-technical losses are set so that total flows to particular voltage levels are lowered by directly metered consumption (or computed annual consumption in case of non-continuous metering on low voltage level), and overflows to different voltage levels and technical losses allocated to particular voltage levels.

Values

For 2007, total losses at TSO level are approximately 0,9 TWh (rate of losses is 1,5 %), total losses at DSO level are 4,6 TWh (rate of losses is 6,3 % - 7,9 % for individual DSOs - depending on region and range of meshing).

Procurement

According to Czech energy legislation (the Energy Act), the TSO or the DSO shall be entitled to acquire/buy, at the lowest cost, the support services and electricity needed to cover the losses from the transmission system or distribution system and to meet its own needs.

TSO and DSOs usually purchase electricity needed to cover the losses in their grids by annual tenders in which electricity providers (generators or traders) submit their price offers. Tenders are supervised by the regulator.

Tariffs and regulation

The variable component of transmission or distribution charges (called price of network usage) different for voltage levels and eventually tariffs (low voltage level), in CZK/MWh, covers the cost of losses.

Formula for setting price of network usage is:

$$NU_i = CL_i / TU_i$$

where NU … average price for network usage (CZK/MWh)
CL … cost of losses (CZK)
TU … planed amount of technical units (MWh) – total withdrawals
i … regulated year (Y+1)

All inputs and resulting prices are tailored for different grid operators and voltage levels.

Regulatory incentives

Reduction of losses aims at achieving better energy efficiency and to reduce global costs to the system.

There is a so-called “allowed rate of losses” set by the regulator. For 2007 “total allowed rate of losses” was 1,5 % for TSO and between 6,3 % - 7,9 % for individual DSOs respectively. “Allowed rate of losses” consists of “technical allowed rate of losses” and “non-technical allowed rate of losses”. Costs of losses are covered in regulated transmission or distribution charges only up to “total allowed rate of losses”.

Incentive mechanism

For DSOs, the losses efficiency factor is in place. The efficiency factor reduces annually the non-technical part of allowed rate of losses (appr. 2 % annually) during the second regulatory period (2005–2009). The technical part of allowed rate of losses is fixed for the whole regulatory period.

A1.3 Finland

Losses

Losses are calculated by the global energy balance of the system and are generally defined by the difference between metered input and metered output. Losses include physical losses and metering errors. Losses in the low voltage distribution network are defined with more uncertainty than in the transmission grid due to non-coincident meter readings with small customers and applied load profiling.

In-house consumption is measured and can be separated from network losses. Public lighting is not treated as a loss because it is metered. However, there are some places where metering does not exit (e.g. temporary installations for public events) where the consumption is estimated not metered (and these are not included in losses).

Valuation

Losses are calculated based on measurements (input and output) by network type and voltage level. Load profiling requires some calculation method to be applied when hourly and annual losses are calculated. Here calculated loss percentages may be applied. Another method is to use a network simulator and define losses in pre-defined loading.

Losses are calculated annually ex-post by network type (TSO, DSO) and generally by voltage level by global energy balance (difference between injections and withdrawals). For hourly use (e.g. in balancing), losses are quantified by means of load profiles set in a decree by the Ministry of Trade and Industry.

Every connection point between different networks and voltage levels is subject to metering. The accuracy classes of the measurement equipment are set according to the standards applied in EU (e.g. IEC 62052-11, IEC 62053-11, IEC 62053-21, IEC 62053-22). EMA has approved the terms and conditions for distribution network services, where it is stated: “Measuring equipment shall be in construction and accuracy according to standards and common practice and fulfil the requirements set in the electricity market legislation.” Furthermore, the Energy Industries Association has set the recommendations for measurements.

All customer facilities (connection points) are subject to metering. However, the reading process for the majority of meters is not yet automated (reading once a year by the company or a customer is the main procedure at the moment) and thus estimates and load profiling may be used to evaluate the losses, which causes some uncertainty in defining the losses at lowest voltage level (400 V network)

Values

For 2006, the total losses and percentage of losses is shown below:

Year 2006	Total losses (GWh)	Losses (%) ref. to total energy transferred
Transmission network	67304	1,59
Distribution networks	57893	3,3

The percentages of losses in transmission and distribution networks during 1996 – 2006 are shown in figures 1 and 2. By default, the loss reduction is taken into account, by TSO and DSO, in the planning phase of network development as a cost component, as a criterion for selection between different technical solutions. However, TSO/DSOs are not obliged to do anything on loss reduction by law/regulation. The only obligation existing in legislation requires them to buy losses through market-based method.

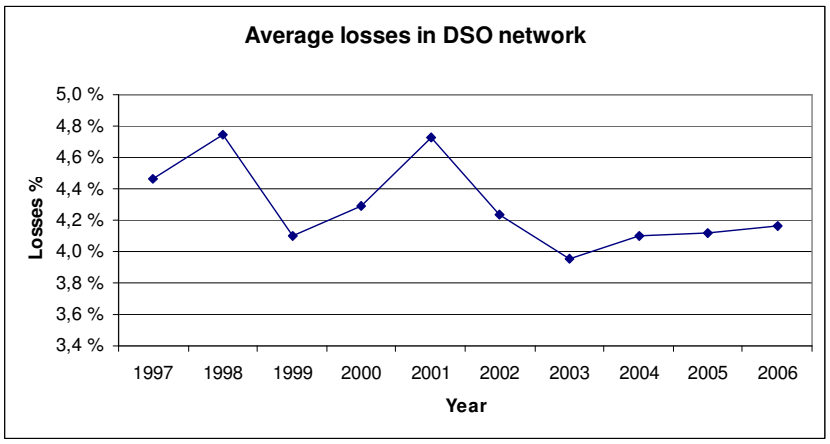


Figure 1. Average percentage of losses by individual DSO.

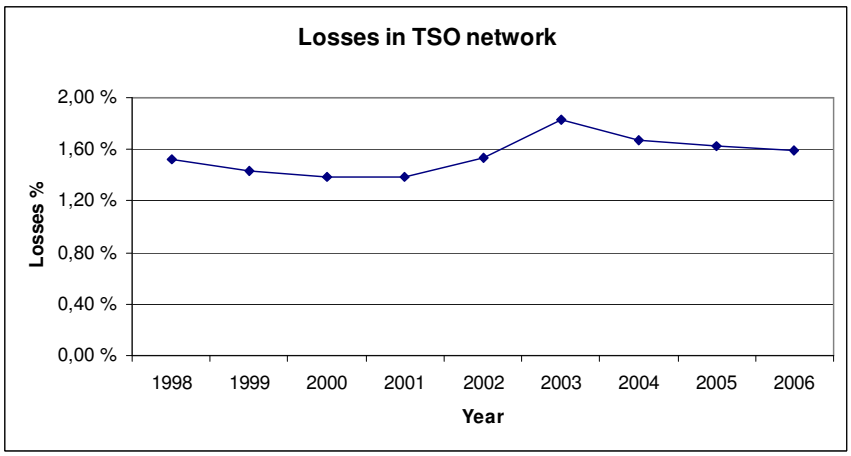


Figure 2. Percentage of losses in TSO network.

Procurement

In Finland, procurement of losses is market-based and the TSO/DSO purchases the losses either from PEX or bilaterally. Pricing is market-based and generally follows the price in PEX (Nordpool). Some operators may apply hedging due to the variations in the losses around the year. In this case, there exist fixed amounts of losses which are mainly bought using longer term contracts with fixed prices and variable parts which are bought from PEX and maybe hedged.

Tariffs and regulation

There is no specific tariff for losses in Finland. Losses are included in network tariffs.

Regulatory incentives / Incentive mechanism

Presently no regulatory incentives are applied for losses in Finland. Only purchasing of losses has been defined by legislation and it should apply market-based method.

A1.4 France

Losses

Losses, calculated by the global energy balance of the system, include physical losses, unavoidable thefts and metering errors. Once detected, fraud is subject to criminal procedure, with the operators being compensated for the estimated value.

In-house consumption is included in losses.

Public lighting is treated as a loss, for those parts where there is no metering.

Valuation

Losses are calculated by network type (transmission and distribution) and voltage level (VHV, HV, MV, LV) for the next tariff period: in May 2005, the losses for 2006 and 2007 were calculated.

Nearer to real time, losses are quantified 2 days in advance by means of hourly loss profiles.

Values

For 2006, the value of losses by network type is shown below.

Total production in networks = 549,1 TWh

Total Withdrawals in networks = 478,4 TWh

Total losses in networks = 31 708 GWh = 6,63 % in ref. to withdrawals.

year 2006	Losses (GWh)	Losses (%)	
		ref. to production	ref. to withdrawals
Transmission network	11 427	2,08	2,39
Distribution networks	20 281	3,69	4,24

By default, the concern about loss reduction is taken into account, by TSO and DSO, in the planning phase of network development, as a criterion for selection between different technical solutions.

Procurement

In France, hourly products to cover losses are bought by the networks operators according to transparent, non-discriminatory and market-based public consultations until 2 days before the real time.

Losses imbalances are treated in the networks operators balancing perimeters in the balancing mechanism.

Tariffs and regulation

As they are bought by the networks operators, the cost of losses is included in the charges to be covered by the tariffs.

For example, to assess the tariff level of the on-going regulatory period, the amount of charges for losses in the transmission network was estimated at 487 M€ and at 837 M€ in the distribution networks for 2006.

In the on-going regulatory period, the French regulator has taken into account the short term evolution of the charges which cannot be controlled by the networks operators, such as those related to losses. A mechanism for measuring the gap between the estimation which has lead to the tariff level on the one hand, and the real charges on the other hand, was put in place. The differences are supposed to be integrated in the next regulatory period.

Regulatory incentives

The percentage of losses on all the French networks is below 7% of internal consumption.
The French transmission system operator does not yet have incentives to reduce the losses on its network.

For the main distribution system operator in France, which represents more than 90% of the distribution networks, the level of charges for losses in the ongoing regulatory period takes into account objectives of theft reduction (0,5% to 1,5% depending on the region where it applies).

Incentive mechanism

The French regulator and the networks operators are jointly considering an incentive mechanism on losses to be put in place for the next regulatory period (2009-2011).

To implement this incentive mechanism, a reference amount for losses charges in M€ has to be defined for the transmission and distribution networks, respectively. Each year, if the amount for losses charges is below (or above) the reference value, the TSO/DSO would be entitled to a financial reward (or penalty) proportional to the difference between those values.

A1.5 Norway

Losses

Losses are defined as the difference between metered input and metered output from the network. The losses in the distribution grid are calculated with more uncertainty than in the transmission grid due to differences in the accrual of measurements and uncertainties in reported consumption. Uncertainties in reported consumption are mainly due to infrequent reporting and observation errors. As theft is by definition unmetered consumption, theft will also be included in the calculation of losses.

Valuation

Losses are calculated by network type (transmission and distribution). In the transmission network, the losses will be accurate due to hourly metering and because connection points between different networks and voltage levels are subject to metering. In the distribution network, the households will read and report their meter manually. This causes uncertainties in settling the losses at this level.

In the transmission network, the marginal costs are calculated hourly for all nodal points. The transmission system operator announces the figures for marginal losses every week.

Values

For 2006, total network losses and losses as a percentage of input are shown below:

Year 2006	Losses (GWh)	Losses (%) ref. to total input
Transmission network	1990	1,6
Distribution networks	4970	5,0

Calculation of losses: Percentage loss = losses/(energy output + losses)*100.

The income-framework regulation includes incentives to reduce losses; if the cost of reducing the network loss is less than the reduced cost of losses, the company will be measured as more efficient and get a higher rate of return (See chapter “Regulatory incentives”).

Procurement

In Norway the network company is responsible for network losses, and purchases the expected loss either on the power exchange (Nord Pool Spot) or bilaterally. Prices included in the permitted income are volume weighted area prices, based on the monthly area price quoted on Nord Pool Spot and monthly volumes from NVE's consumption statistics. (See chapter "Regulatory incentives"). Imbalances are handled in the balancing market like any other imbalance.

Tariffs and regulation

Tariffs in Norway are divided into two main groups: tariffs dependent on current use and other tariffs.

The main rule is that the dependent tariff shall only cover the marginal losses. In the distribution grid, however, the dependent tariff can also cover a part of the fixed costs. In grids with limited capacity, a capacity tariff can be introduced. Other tariffs shall cover all residual costs not covered trough the dependent tariff, and can be a fixed tariff and a tariff based on used effect. The fixed tariff in the distribution network can be differentiated by objective criteria relevant for the grid. Marginal losses in the central transmission grid are calculated in each node. The marginal losses in the nodes are symmetrical around zero, and used as a basis for tariff calculations. Production will face a positive marginal loss percentage in areas with excess power production; hence consumption will face negative marginal loss percentages in the same node.

Regulatory incentives /Incentive mechanism

Monopolies providing transmission and distribution services in Norway face an incentive-based yardstick regulation. Annually, the permitted income is set based on a 40/60 split between the companies own costs with a two year lag and a norm cost based on a benchmarking analysis. Permitted income covers all cost, including network losses.

However, only the physical losses measured in MWh are included in the cost base and the benchmarking exercises. Permitted income is annually adjusted as such according to a volume weighted area price, based on the monthly area price quoted on Nord Pool Spot and monthly volumes from NVE's consumption statistics. This arrangement is based on the assumption that the network owner can do little to influence the price of buying energy on the spot market element and consequently should not be subject to this risk.

However, it is NVE's view that the network owner can influence the physical network loss in MWh (volume), both in the short run (through network operation) and in the long run (through an investment strategy). As such, network losses in terms of volume are included in the yardstick income regulation, and the network owner must work out a strategy of how to deliver adequate services at the minimum total cost, where network losses constitute one cost element. If the cost of reducing the network-losses is less than the reduced cost of losses, the company will be measured as more efficient and get a higher rate of return.

A1.6 Portugal

Losses

Losses, calculated by the global energy balance of the system, include physical losses, unavoidable theft and metering errors. Once detected, fraud is subject to criminal procedure, with the operators being compensated for the estimated value.

In-house consumption is measured and paid for by regular tariffs, like any other normal consumption.

Public lighting is not treated as a loss. Public lighting metering is implied by the Tariff Code. A specific Public Lighting Tariff exists that can be optionally applied instead of regular tariffs. There are also facilities where transitory arrangements still apply.

Valuation

Losses are calculated by network type (transmission and distribution) and voltage level (VHV, HV, MV, LV) by the global energy balance of the system and networks (difference between injections and withdrawals) done in the following year (Y+1).

For use in the running year, losses are quantified by means of hourly loss profiles, approved by the energy regulator (ERSE) upon a proposal from the network operators.

Every connection point between different networks and voltage levels is subject to metering.

Values

In 2006, total emission to networks, the values of losses by network type, the percentage referring to emissions or withdrawals of the networks are shown below.

Total emission to networks = 49 177 GWh

year 2006	Losses (GWh)	Losses (%) ref. to emission	ref. to withdrawals
Transmission network	562	1,14	1,28
Distribution networks	3 168	6,44	7,20

By default, the concern about loss reduction is taken into account, by TSO and DSO, in the planning phase of network development, as a criterion for selection between different technical solutions.

The National Plan for Climatic Changes (PNAC), approved by the Government, states that until 2010 total networks losses (transmission and distribution) should be below 8,60%.
Through regulation, the DSO is incentivised to keep the losses of the distribution networks below a reference value set by ERSE.

Procurement

In Portugal, losses are physically injected by suppliers.

Each supplier injects its own energy for compensation of the losses related to the consumption of its clients in the same period, based on hourly loss profiles approved by ERSE.

Regarding the global system balance, there is no specific treatment, or dedicated group. Losses are treated like any other induced or occurred imbalance.

Tariffs and regulation

As they are physically injected, there is no specific tariff for losses.

Concerning energy, for each programming hour, each supplier must inject its own energy for compensation of the losses related to the consumption of its clients in the same hour period, by injecting the client's energy consumption affected by hourly loss profiles. These hourly loss profiles (8760 values), differentiated by network type and voltage level, are approved by ERSE upon a suggestion by the network operators. For an LV client with an EC-estimated energy consumption for an hour h, the supplier must provide the injection of the EP energy as follows:

hour h: $EP = EC \times (1+p_{HV/RT}) \times (1+p_{HV}) \times (1+p_{MV}) \times (1+p_{LV})$

where:

$p_{HV/RT}$ – VHV transmission network loss profile, including VHV/HV transformers.
p_{HV}, p_{MV} and p_{LV} – HV, MV and LV distribution network loss profiles.

Regarding the use of infra-structure tarification, the prices of the components of the related tariffs (use of networks and global use of the system) are affected by loss adjustment factors, converting the consumption quantities measured at the client referential (metering point for tariffs application) to the energy injection referential, assumed to be VHV plant bus bars.

These loss adjustment factors, differentiated by types of network, by voltage level and by time of day (peak, partial peak, valley, and super valley) are approved and published by ERSE every year upon a proposal by the network operators. For the present year (2007) these values are, in percentages:

		Hourly period			
		Peak	Partial peak	Valley	Super valley
Transm.	γ_{VHV}	1.8	1,7	2,3	2,3
	$\gamma_{HV/RNT}$	2,1	2,0	2,6	2,6
Distrib.	γ_{HV}	1,52	1,37	1,08	0,99
	γ_{MV}	4,66	4,16	3,27	2,92
	γ_{LV}	7,24	6,53	5,91	4,70

Regulatory incentives

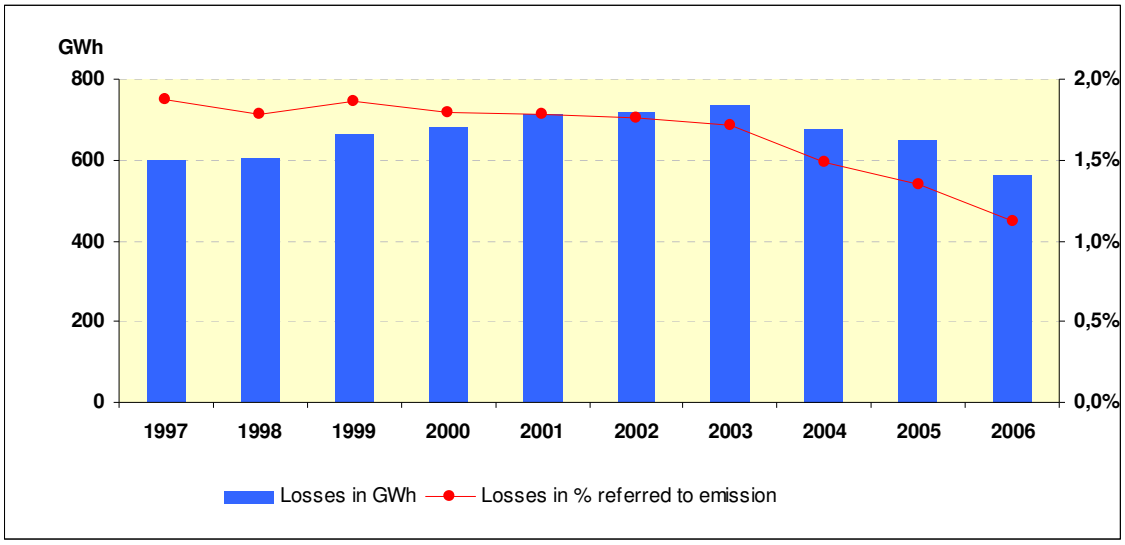
Reduction of losses aims at achieving better energy efficiency and reducing global costs to the system.

By law, the National Plan for Climatic Changes (PNAC), approved by the Government, states that until 2010 total networks losses (transmission and distribution) should be lower than 8,60%.

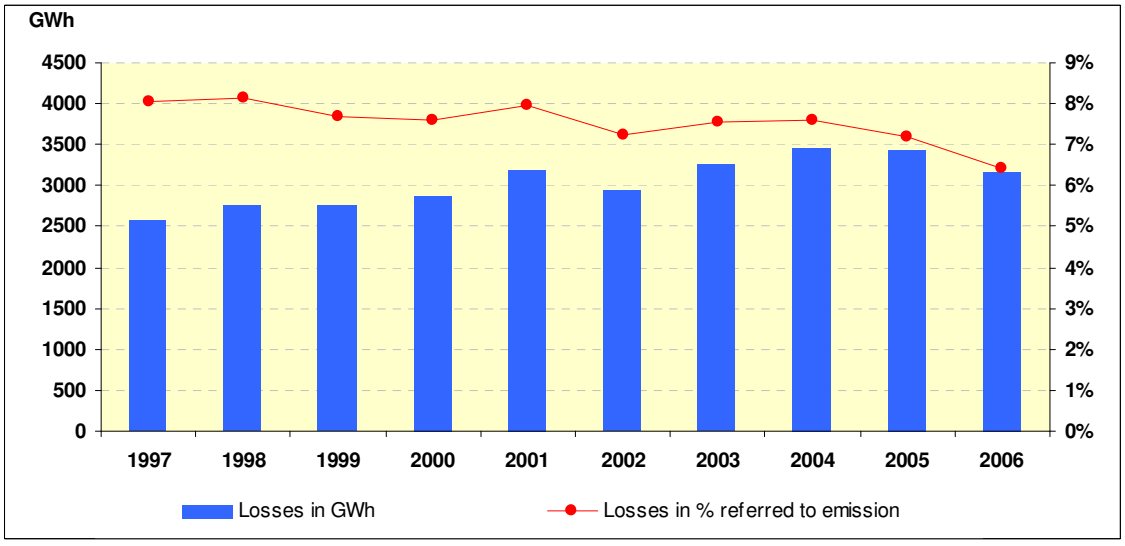
By regulation, the Tariff Code includes an incentive mechanism to reduce losses in distribution networks allowing the DSO to be rewarded (or charged) if it achieives global distribution losses lower (or above) than a reference value set by ERSE, for each year.

The evolution of transmission and distribution network losses, referred to total energy injected in the networks, is shown below.

Evolution of losses in the transmission network:



Evolution of losses in the distribution networks:

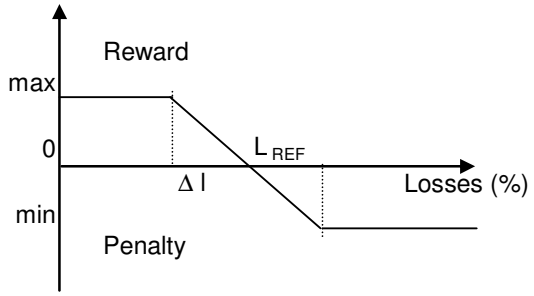


The 8,60% PNAC objective for losses for 2010 was already achieved in 2006 with a global value of 8,47%.

Incentive mechanism

Based on the specificity and value of losses for each network type, the present incentive mechanism applies only to distribution networks.

At the beginning of the present regulatory period (2006 – 2008), ERSE defined the reference values for the distribution networks losses. In each year, if the losses lies under (or above) the reference value, the DSO is entitled to a financial reward (or penalty) proportional to the difference between those values, capped to a maximum value set by ERSE, as shown below.

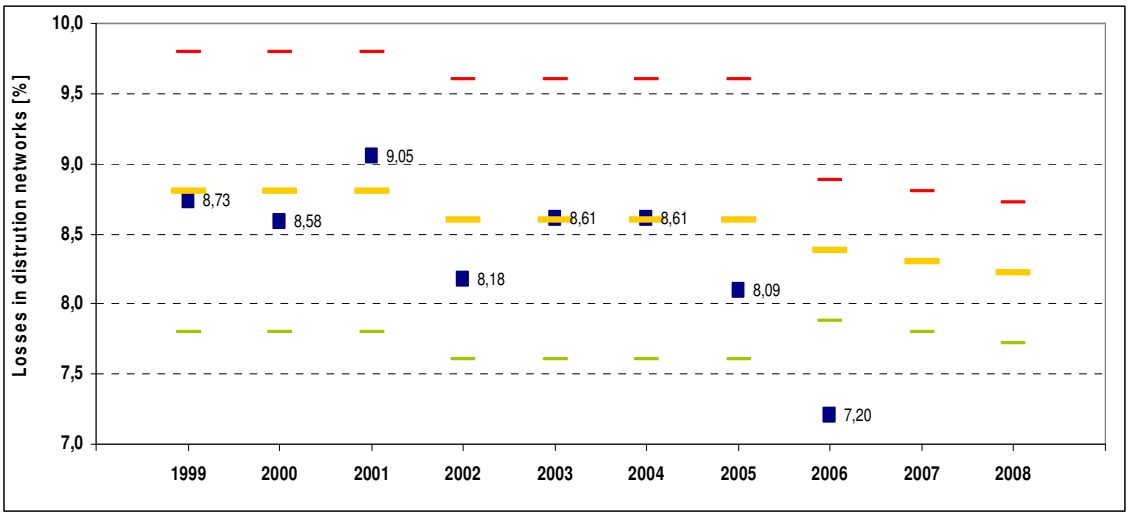


According to legal understanding, for the application of the incentive mechanism, these reference values for distribution losses refer to the total energy withdrawal from distribution networks.

The reference loss values defined by ERSE for the present regulatory period are presented below:

	2006	2007	2008
L_{REF}	8,38%	8,30%	8,22%
Δl	0,5%	0,5%	0,5%

The reference loss values for the present regulatory period and the evolution of losses in the distribution networks, referring to total energy withdrawal, is shown below.



A1.7 Sweden

Losses

Losses are defined as the difference between measured consumption and production. The losses in the distribution grid are calculated with more uncertainty than in the transmission grid due to differences in the accrual of measurements and uncertainties in reported consumption. Uncertainties in reported consumption are mainly due to infrequent reporting and observation errors. The situation is improving since AMR was rolled out (the meters of all customers will have to be read at least monthly by July 1, 2009 which has led to a massive rollout of AMR – today most customer meters are read yearly).

Valuation

Losses are calculated by network type (transmission and distribution – distribution is divided between regional distribution and local distribution). In the transmission and regional distribution network, the losses will be accurate as a result of hourly metering and because connection points between different networks and voltage levels are subject to metering. In the local distribution network, there are uncertainties – see above.

In the transmission network, the marginal costs are calculated hourly for all nodal points. The TSO announces the figures for marginal losses every week.

Values

For 2006, total network losses and losses as a percentage of energy transported* are shown below:

Year 2006	Losses (GWh)	Losses (%) ref. to total energy transported*	Total energy transported (GWH)
Transmission network	2500	2,1	117300
Regional distribution networks	2000	1,22	161568
Local distribution networks	4093	4,01	102035
Total	6093	2,31	263603

*Calculation of losses: Percentage loss = losses/(energy transported + losses)*100. In the distribution networks, transported energy is defined as local input in surplus areas and consumption in shortage areas; the biggest figure of distributed energy and input (from generation in own network and input from adjacent networks) for each DSO is used in the calculation.

Procurement

In Sweden, the network company is responsible for network losses, and purchases the expected loss either on the power exchange (Nord Pool Spot) or bilaterally. The network company can also cover its losses with own production. Ownership of production by network companies is only allowed for this purpose. Imbalances are handled in the balancing market like any other imbalance.

Tariffs and regulation

There are no special rules for how the tariffs should be constructed – according to the Electricity Act the tariffs shall be reasonable, related to the quality of supply. For the transmission network, the published tariff model states that the losses are covered by the dependent tariff while the fixed part of the tariff covers capital costs.

Regulatory incentives/Incentive mechanism

The regulation of local networks is done ex post in Sweden – an ex ante method has been studied and will probably be introduced in a few years. The regulation of the local networks is based on the network performance assessment model. The network performance assessment model builds a reference grid, customised for each company based on the actual sites and other data of customers and production and exchange with other networks. In this model, the losses of the reference grid are included. These reference losses are priced with the average spot price for the year before.

All network companies have to report their losses, among other data, in a special report each year. This data is published by EMI. They are also used in the monitoring process. Losses are not a very large concern in Sweden, since there are other developments that will reduce losses. One of these developments is the above mentioned rollout of AMR, the other development is related to new incentives to modernise and qualify local networks, especially networks that go through forested areas in order to improve security of supply for customers in these areas.

Annex 2 – Comparative Analysis

This Annex presents a comparative analysis of several issues related to losses and their treatment by network operators based on the NRA responses.

A2.1 Losses Components

Nr. Crt.	Country	Operator Type	**a.** Physical losses in transport/distribution of electricity	**b.** … "hidden" non-technical losses (e.g. in-house consumption - electricity consumption to cool the transformer, control system operation, etc)	**c.** … theft (should not be mixed with losses)	**d.** … non-metered public lighting (street lamps)	**e.** … others (please specify)	Comments
1.	Austria	TSO	√	√				
		DO	√	√	√			
2.	Czech Republic	TSO	√	√	√	√	√	Total losses consist of mainly technical losses in the grids (lines and transformers) + other non-technical losses (non-metered consumption, undetected theft etc.)
		DO	√	√	√	√	√	
3.	Denmark	TSO	√					Transmission losses consist of technical losses in the grids (lines, cables and transformers).
		DO						No answer
4.	Finland	TSO	√				√	include metering errors
		DO	√				√	include metering errors
5.	France	TSO	√	√	√			Theft (non technical losses) according to 2 b.
		DO	√	√	√		√	Public lighting is partially included in losses. The cities pay public lighting according to a profile. The differences between the real lamps consumption and this template are part of losses. Losses include metering errors and theft (non technical losses).
6.	Greece	TSO	√					
		DO	√		√			Further investigation is needed on in house consumption
7.	Hungary	TSO	√		√		√	Commercial losses included
		DO	√		√		√	Commercial losses included
8.	Italy	TSO	√		√		√	Include metering errors
		DO	√		√		√	Include metering errors
9.	Luxembourg	TSO	√					
		DO	√					
10.	Norway	TSO	√					include metering errors
		DO	√				√	include metering errors
11.	Poland	TSO	√					
		DO	√		√		√	Include metering errors
12.	Portugal	TSO	√		√		√	In-house consumptions are measured and paid by regular tariffs as any other normal consumption.
		DO	√		√		√	Include metering errors
13.	Romania	TSO	√		√		√	Losses include the difference between estimated consumption and the achieved one for non metered public lighting.
		DO	√		√		√	Include metering differences
14.	Slovakia	TSO	√		√		√	Include metering differences
		DO	√		√		√	Include metering differences
15.	Spain	TSO	√					
		DO	√	√	√		√	
16.	Sweden	TSO	√					
		DO	√		√		√	Include metering errors
17.	United Kingdom	TSO	√		√			
		DO	√		√			

A2.2 Level of losses

Nr. Crt.	Country	Operator Type	a. Level of losses (%)						b. Strategy to reduce the losses
			Related to output	2003	2004	2005	2006	Comments	
1.	Austria	TSO	√				1,50		Regulatory cap for losses in % in place; Additional incentive scheme for the next regulatory period;
		DO	√				4,47		
2.	Czech Republic	TSO	√			1,50		0,9 TWh (2007);	Technical and non - technical regulated allowed rate of losses in place (1,5% for TSO, 6,3% - 7,9% for DOs), out of which 2% annually for non technical losses;
		DO	√			7,00		5,5% to 8,5% (depends on region and range of meshing), 4,6 TWh (2007);	
3.	Denmark	TSO	√				1,80	Of total electricity transported; Losses represent 663 GWh.	
		DO						No answer	No answer
4.	Finland	TSO				1,60		Percentage of electricity injected in the networks;	No low/regulation requirements to reduce losses;
		DO				4,70		Average values; Percentage of electricity injected in the networks;	
5.	France	TSO					2,30	Average values of the total consumption;	Financial incentive to reduce theft;
		DO	√				5,00	Of the energy consumed in distribution power system;	
6.	Greece	TSO			2,40	2,40		Of the total energy injected to the system	No special incentives;
		DO			6,80	6,80		Average values of electricity injected to the distribution system out of witch 3,2% for medium voltage network;	The current draft of the not yet approved Code establishes an annual losses target (in MW) and a unit price (in €/MW)for any positive or negative deviation from this target.
7.	Hungary	TWO		1,50	1,30	1,50	1,30	Of electricity injected into the grid;	Justified cost of losses is determined each year.
		DO		9,60	9,10	8,80	9,20	Of electricity injected into the grid;	Establishment of losses (GWh) followed by regulated national tariff for losses; both not reviewed during a regulatory period. Higher profit due to smaller losses;
8.	Italy	TSO	√			6,20		Of final consumption excluding pumped storage; 20,6 TWh	Incentive scheme in place to reduce losses;
		DO							
9.	Luxembourg	TSO					2,50		No legal or regulatory obligations to reduce losses;
		DO							
10.	Norway	TSO					1,55	Of total energy transported; Losses represent 1,99 TWh	The income-framework regulation includes incentive to reduce losses; if the cost of reducing the networkloss is less than the reduced cost of losses, the company will be measured as more efficient and get a higher rate of return
		DO		4,9	5,6	5,30	5,00	Average loss in all DSOs, in percentage of input from generators or distributed volume (biggest figure) Losses represent 4,97 TWh	
11.	Poland	TSO					2,10	Of electricity injected into the grid (technical losses);	Regulatory level of justified losses (DOs: 1% - 2,78% reduction per year);
		DO	√				11,80	8% of electricity injected to the grid (technical losses); 11,8% of electricity delivered to the consumers (overall losses);	
12.	Portugal	TSO					1,14	Of energy injected in the networks	The National Plan for Climatic Changes (PNAC), approved by the Government, states that until 2010 total network losses (Transmission and Distribution) should be below 8,60%;
		DO					6,44	Of energy injected in the networks	The National Plan for Climatic Changes (PNAC), approved by the Government, states that until 2010 total network losses (Transmission and Distribution) should be below 8,60%; Regulatory incentive scheme versus reference value; 2006 - 8,38%; 2007 - 8,30%; 2009 - 8,22% related to injected electricity
13.	Romania	TSO	√			2,66	2,53	Losses represent 989 GWh in 2006: 2,47% of total electricity injected into the transmission grid (input).	
		DO	√			13,55	13,49	In 2006: Losses represent 6,85 TWh. 10,34% - 18,23% of total electricity delivered from distribution grid (output); Average value: 13,49%; 9,40% - 15,40% of total electricity injected into the distribution grid (input); Average value: 11,88% In 2005: Losses represent 6,80 TWh 11,00% - 18,62% of total electricity delivered from distribution grid (output); Average value: 13,55%; 9,92% - 15,68% of total electricity injected into the distribution grid (input); Average value: 11,93%	Regulatory cap in place for losses of 9,5% for year 2012 for electricity injected to the distribution network. For the next regulatory period, regulatory voltage level caps will be introduced and the global cap will diminish to 8.5% from 9.5%. 0,5 TWh belong to the small DOs.
14.	Slovakia	TSO	√			1,00			
		DO	√			8,25		7,5% to 9% for 3 DOs;	Regulatory voltage level cap for losses in place;
15.	Spain	TSO					1,19	Of energy injected in the networks	
		DO					7,09	Of energy injected in the networks	
16.	Sweden	TSO					2,13	Of energy injected in the networks	
		DO					2,31	Of energy injected in the networks	
17.	United Kingdom	TSO				1,60	1,60	Of total energy generated;	
		DO					< 6		The distribution price control includes incentive to reduce losses against a DNO - specific benchmark. The incentive is set at £48/MWh for the 2005 - 10 distribution price control.

A2.3 Calculation versus metering

Nr. Crt.	Country	Operator Type	a. Losses establishment			c. HV/MV metering	d. Accuracy / class of metering equipment						e. Obligation regarding to the meter installation	
			a.1. Ex-ante calculation (estimation)	a.2. Ex-post calculation	a.3. Metering		Active power meter	Reactive power meter	Current transformer	Voltage transformer	Voltage drop	Comments	On customer	Comments
1.	Austria	TSO			YES							according to the standards	NO	
		DO	YES			YES						according to the standards	NO	
2.	Czech Republic	TSO		YES	YES								NO	Generally, each customer has meters. LV - non-countinuous meters
		DO		YES	YES								NO	
3.	Denmark	TSO			YES									Hourly metering in HV and MV
		DO		YES	YES	YES								
4.	Finland	TSO		YES	YES		0.2S		0.2S	0,2	0.05 %	IEC 62052-11, IEC 62053-11, IEC 62053-21, IEC 62053-22. direct metering for	YES	Load profiling according to the Ministry of Trade and Industry Decree. Losses are determined by voltage level. Majority of meters are not automated (including reading once a year).
		DO		YES	YES	YES	1 - 0.2S				0.2 - 0.05 %		YES	
5.	France	TSO		YES			0.5S		0.2S	0,5		IEC 60687, IEC 61036.	YES	
		DO		YES			MV - 0.5S; LV and P>36 kVA - 1; LV and P<36 kVA - 1.5.		MV - 0.2S	MV -0.5			YES	Excluding customer smaller or equal than 36 kVA
6.	Greece	TSO		YES		YES	2 - 0.2S		0.5S - 0.2S	0.5 - 0.2			NO	TSO responsibility
		DO		YES		YES						no requirements yet, but planned	NO	DO responsibility
7.	Hungary	TSO			YES		0,5						YES	
		DO		YES			0,5						YES	
8.	Italy	TSO	YES	YES	YES	YES	0,5						YES	TSO's customers pay for expected losses and than covers the difference to actual losses. DO's customers pay for standard losses. HV/MV - hourly metering; smart metering for 95% of customers by end 2011.
		DO	YES	YES		YES	0.5 for HV, 1 for others						YES	
9.	Luxembourg	TSO			YES									
		DO												
10.	Norway	TSO		YES		YES							Generators responsible for	Installation is TSOs responsibility
		DO		YES		YES		For some customers					Generators responsible for	Installation is DOs responsibility
11.	Poland	TSO			YES	YES	0.5 - 0.2						NO	TSO responsibility
		DO	YES			YES	0.5 - 0.2 HV/MV, 3 - 1 LV						NO	DO responsibility
12.	Portugal	TSO	YES	YES	YES	YES	0,2	0,5	0,2	0,2		according to the standards	YES	Load profiling approved by Regulator
		DO	YES	YES	YES	YES	1 - 0.2 for HV/MV, 1 - 2 LV	2 - 0.5 for HV/MV, 2 for LV and S>0.0414 MVA	1 - 0.2 for HV/MV, 1 for LV and S>0.0414 MVA	1 - 0.2 for HV/MV, 1 for LV and S>0.0414 MVA		according to the standards	YES	
13.	Romania	TSO	YES		YES	YES	0.2S	1	0,2S	0,2	0.05V	IEC 60687, IEC 61268, IEC 60044-1, IEC 60044-2, IEC 60186.		Losses are annualy adjusted based on metered quantities.
		DO	YES	YES		YES	0,2S for S>100MVA or E>100GWh, 0,5 for S<100MVA or E=0.2-100GWh, 1 for E=50-200MWh, 2 for E<50MWh	1 for S>100MVA or E>100GWh, 2 for S<100MVA or E=0.2-100GWh, 3 for others	0,2S for S>100MVA or E>100GWh, 0,5 for S<100MVA or E=0.2-100GWh, 1 for others	0,2 for S>100MVA or E>100GWh, 0,5 for S<100MVA or E=0.2-100GWh, 1 for others	0,05V for S>100MVA or E>100GWh, 0,25V for S<100MVA or E=0.2-100GWh, 0.5V for others			
14.	Slovakia	TSO		YES	YES	YES								Each customer has installed metering system. (In-house consupmtion is separately computed.) Metering is being made on each voltage level.
		DO		YES	YES	YES								
15.	Spain	TSO	YES	YES	YES		TSO meters the net active power injected in each node of the grid						NO	
		DO	YES	YES									NO	
16.	Sweden	TSO			YES	YES	0,5% over 10 kV; 1% under 10 kV						NO	Hourly meetering above 63 A; Profiles for small customers
		DO		YES		YES							NO	
17.	United Kingdom	TSO		YES		YES						Subject to metering codes of practice	YES	Transmission sites above 50 MW are metered on a real time basis
		DO	YES	YES		YES							YES	Half-hourly and non half-hourly customers.

A2.4 Losses cost

Nr. Crt.	Country	Operator Type	a. Losses procurement	b. Losses pricing	Comments
1.	Austria	TSO		54,56 €/MWh (2007)	
		DO		55,38 €/MWh (2007)	
2.	Czech Republic	TSO	by tenders	41,36 €/MWh (2007)	1159 CZK
		DO	by tenders	48,64 €/MWh (2007)	1363 CZK
3.	Denmark	TSO	PEX - DAM	59,80 €/MWh (2006)	The cost in 2006 for 663 GWh was 295 mio.kr.
		DO			
4.	Finland	TSO	PEX or bilaterally		Some operators may apply hedging du to the variations in the losses around the year. In this case there exists fixed amount of losses which is mainly bought longer term contracts with fixed price and variable part which is bought from PEX and maybe hedged.
		DO			
5.	France	TSO	public consultation	39,27 €/MWh (2006)	TSO/DOs buy losses via "public consultation" whitch are sort of auctions.
		DO	public consultation	45,49 €/MWh (2006)	
6.	Greece	TSO	by injection		A mechanism for balancing losses is built in the daily wholesale market mechanism. Power quantities offered for injection are reduced to account for transmission system losses, and load power declarations are increased to account for distribution system losses. As a result, power can be considered to be sold/bought on the borders between transmission and distribution, and losses are charged on SMP. Transmission losses are actually charged to injectors (generators and importers) and distribution losses to suppliers.
		DO	by extraction		
7.	Hungary	TSO	open tender		Plan to switch to market procurement.
		DO	on regulated price for all DOs		
8.	Italy	TSO	by extraction for standard losses		Estimated losses are priced at the same price as load; the difference between effective losses and estimated losses on the transmission network is priced at the cost of providing the extra energy on the balancing market. DSO standard losses are acquired by Single Buyer at the day-ahead market price
		DO			
9.	Luxembourg	TSO	bilaterally		Market-based pricing through a supply contract (OTC) with a supplier.
		DO			
10.	Norway	TSO	PEX or bilaterally	Market price PEX or OTC	Price used within the income-framework regulation: 31,9 €/MWh in 2005, 51,4 €/MWh in 2006
		DO	PEX or bilaterally	Market price PEX or OTC	Price used within the income-framework regulation: 31,9 €/MWh in 2005, 51,4 €/MWh in 2006
11.	Poland	TSO	bilaterally	35,00 €/MWh	
		DO			
12.	Portugal	TSO	by injections		Each supplier injects its own energy for compensation of the losses related to the consumption of its clients in the same period, based on hourly loss profiles approved by ERSE.
		DO	by injections		
\3.	Romania	TSO	regulated quantities and prices plus bilateral contracts, DAM and BM	53,94 €/MWh (2006)	
		DO		52,31 €/MWh (2006)	
14.	Slovakia	TSO	by auction		
		DO			
15.	Spain	TSO	Procured like the rest of energy delivered. At PEX, bilateral contracts	Same market price than the energy consumed	Losses are valued at the same price as the rest of the electricity load. End-users have to pay the 100% of the cost of the (ex-ante) losses resulting from the application of the coefficient of losses associated to their tariff (they are billed for the energy consumed as well as for the losses). Distributors
		DO			
16.	Sweden	TSO	PEX or bilaterally		
		DO			
17.	United Kingdom	TSO	by generator	43,1 €/MWh (2005/2006)	Losses incentive is set to about 43,1 €/MWh (2005/2006)
		DO	by extraction	71.2 €/MWh (2005/2006)	Line loss factors are published by each company setting out. Losses incentive is set to about 71.2 €/MWh (2005/2006)

A2.5 Embedding of Solution for Losses in the Market System

Nr. Crt.	Country	Operator Type	a. Dedicated "losses balancing groups"	b. Tratament of losses in balancing system	c. Generator's role and obligations	Comments
1.	Austria	TSO				
		DO	Yes	Included (No special consideration)		
2.	Czech Republic	TSO	No	Costs of losses including imbalances are covered by regulated prices.	There is no obligation for generators in force.	TSO and DSOs are not directly balancing responsible parties. Balancing responsible parties are subjects (usually traders) that supply TSO or DSOs by electricity (mainly by electricity for losses covering).
		DO				
3.	Denmark	TSO	Yes	TSO buys the losses in market (PEX).		
		DO	No			The DSOs are not balancing responsible parties themselves and they buy the losses through an electricity supplier or through another balance responsible party.
4.	Finland	TSO	No	Losses are treated as any other imbalance.	No role or obligations	
		DO				
5.	France	TSO	Yes	Losses are treated as any other imbalance.	None	TSO and DSOs are responsible for losses compensation and associated imbalance settlement.
		DO				
6.	Greece	TSO	No		Generators are charged for transmission system losses, based on losses factors which depend on the location of each unit (zonal system) and the time-of-day.	
		DO	No			
7.	Hungary	TSO	Yes	Losses are treated as any other imbalance.	No	No internal invoicing in case of the transmission losses balancing group;
		DO	No			
8.	Italy	TSO	No	Treated as other load		
		DO				
9.	Luxembourg	TSO	Yes	Treated as other load	Not known	
		DO				
10.	Norway	TSO	No	Losses are treated as any other imbalance.	None	
		DO				
11.	Poland	TSO	No	Separate balancing unit		
		DO	No	Covered by consumption units of Distribution Companies (still vertically integrated)		
12.	Portugal	TSO	No	Losses are treated as any other imbalance.	None specific	Each supplier injects its own energy for losses related to the consumption of its clients in the same period
		DO				
13.	Romania	TSO	Yes	Losses are treated as any other imbalance.	None	
		DO				DO have a single BRP for losses and captive end-users. After distribution and supply unbundling process ends, DO's must have individual BRP for losses.
14.	Slovakia	TSO	No			No special solution for losses in the market system exists
		DO				
15.	Spain	TSO	No		None	The market agents, including both those making offers and those making bids for power, shall be responsible for submitting offers and bids to purchase and sell power in which they shall internalise the transmission grid losses corresponding to them on account of their participation in the production market.
		DO				
16.	Sweden	TSO	No	Losses are treated as any other imbalance.	None	
		DO				The DSOs are not balancing responsible parties themselves and they buy the losses through an electricity supplier or through another balance responsible party.
17.	United Kingdom	TSO	No	Outputs are scaled up or down depending on whether they are generation or demand, and are in an exporting or importing zone. Losses aren't explicitly charged via the balancing mechanism. Central systems automatically downgrades or upgrades volumes	Generators and suppliers are allocated transmission losses in proportion to their metered output or metered offtake. In practice this means that a generator is required to generate more than it has expected in order for it to meet its contracted output.	
		DO			On distribution system generator is subject to LLFs	

A2.6 Integration of Losses in Tariffs and Regulation

Nr. Crt.	Country	Operator Type	Losses cost included in TSO/DO tariff	Dedicated TSO/DO tariffs component for losses
1.	Austria	TSO	Yes	Yes
		DO		
2.	Czech Republic	TSO	Yes	No
		DO		
3.	Denmark	TSO	Yes	No
		DO		
4.	Finland	TSO	Yes	No
		DO		
5.	France	TSO	Yes	No
		DO		
6.	Greece	TSO	No	No
		DO		
7.	Hungary	TSO	Yes	No
		DO	Yes	Yes
8.	Italy	TSO	No*	No
		DO	No	No
9.	Luxembourg	TSO	Yes	Yes
		DO		
10.	Norway	TSO	Yes	Yes
		DO		
11.	Poland	TSO	Yes	Yes
		DO		
12.	Portugal	TSO	No	No
		DO		
13.	Romania	TSO	Yes	No
		DO		
14.	Slovakia	TSO	Yes	Yes
		DO		
15.	Spain	TSO	No	No
		DO	No***	No
16.	Sweden	TSO	Yes	No
		DO		
17.	United Kingdom	TSO	No**	No
		DO	No	No

* There is a dedicated system tariff (different from transmission tariff) to cover the potential extra costs arising from the difference between estimated losses and actual losses (on transmission).

** There is not a dedicated tariff for transmission losses, with the exception of the assumed market price across GB as used in the SO incentive scheme;

*** The Ministry of Industry, Tourism and Trade sets (at national level) the percentages of T&D losses associated to each of the electricity tariffs in both the regulated and liberalised markets according to the voltage levels and consumption types. The energy paid in the bill is increased in those percentages.

A2.7 Regulatory Incentives to Reduce Losses

Nr. Crt.	Country	Operator Type	a. Levers for energy effciency	b. Costs for grid users (€ / MWh) and economic/regulatory objective	c. Effects of this incentives	d. Details on related regulatory arrangements	e. Lessons learned and experiences from the regulation
1.	Austria	TSO	Additional incentive scheme for the next regulatory period;			Regulatory cap for losses in % in place;	
		DO					
2.	Czech Republic	TSO					
		DO				Regulatory cap for losses in % in place;	
3.	Denmark	TSO				There are no direct incentives to reduce transmissions losses.	
		DO					
4.	Finland	TSO	No	Only purchasing is defined by legislation (market based method);	N/A	N/A	N/A
		DO					
5.	France	TSO				Financial incentive to reduce theft;	
		DO					
6.	Greece	TSO				No special incentives;	
		DO	The current draft of the not yet approved Code establishes an annual losses target (in MW) and a unit price (in €/MW)for any positive or negative deviation from this target.				
7.	Hungary	TSO	Plan to switch to market procurement.			Justified cost of losses is determined each year.	
		DO				Establishment of losses (GWh) followed by regulated national tariff for losses; both not reviewed during a regulatory period. Higher profit due to smaller losses;	
8.	Italy	TSO					
		DO				Distributors receive payments only for standard losses.	
9.	Luxembourg	TSO	Incentive-based regulation has not been implemented yet. The objective of the regulator is to reach a public tendering process for the supply of the network losses.				
		DO					
10.	Norway	TSO				The income-framework regulation includes incentive to reduce losses; if the cost of reducing the networkloss is less than the reduced cost of losses, the company will be measured as more efficient and get a higher rate of return	
		DO					
11.	Poland	TSO	Yes	Yes, according to level of justified losses			
		DO					
12.	Portugal	TSO		By law, the National Plan for Climatic Changes (PNAC), approved by the Government, states that until 2010 total networks losses (Transmission and Distribution) should be lower than 8,60%.	The 8,60% PNAC objective for losses for 2010 was already achieved in 2006 with a global value of 8,47 %.	Regulatory incentive scheme versus reference value; 2006 - 8,38%; 2007 - 8,30%; 2009 - 8,22% related to withdraws from distribution networks	
		DO					
13.	Romania	TSO	For the next regulatory period, a losses cap of 2.1% from the transported electricity will be introduced		Rate of losses decreased with 0.4% in 2006/2005		
		DO	For the next regulatory period, regulatory voltage level caps will be introduced and the global cap will be diminish to 8.5% from 9.5%		Rate of losses decreased with 4.9% in 2006/2005	Regulatory cap in place for losses of 9,5% for year 2012 for electricity injected to the grid.	
14.	Slovakia	TSO				The regulator is directly setting (by secondary legislation, RONI Decree of 21. June 2006 No. 2/2006) the percentage of allowed losses on particular voltage level.	
		DO					
15.	Spain	TSO					
		DO	The incentive for losses for the year n is in the range of +/-1% of the remuneration for year n-1 (R.D. 222/2008)			Additionally the % of losses set by the Ministry may be considered as an incentive. Since the year 2000 the coefficients are fixed which allows distributors to profit from reductions of losses.	
16.	Sweden	TSO				For local DSOs which are regulated in relation to a standardised grid, there are calculated standardised losses and costs for losses in the network performance assessment model which is used ex-ante by DSOs and ex-post by regulator	
		DO					
17.	United Kingdom	TSO		Losses are paid by customers to generators; the cost of incentive scheme are paid by customer to the TSO through theTSO's tariff		Incentive scheme with a prescribed multiplier to reduce the output of a generator and increase the offtake of a supplier provides an incentive for market participants to contract for delivery in an efficient manner.The scheme is based on a market based static price, multiplied by a pre-set volume of losses, to create a financial incentive that the SO aims to beat.	We believe the appropriate regulatory approach is to incentivise parties that have direct control over transmission losses. We consider that output-based measures are more appropriate than input-based measures with regard to incentivising reduced transmission losses, such as purchasing low-loss transformers. Our belief in the importance of output-based measures places emphasis on utilising accurate meter reading to provide robust data on generation and demand patterns.
		DO				The distribution price control includes incentive to reduce losses against a DNO-specific benchmark. The incentive is set at 71.2€/MWh for the 2005-10 distribution price control.	Not entirely clear what wanted – SDC report gives 'results'.