30 November 2015

APPENDIX 2

Regulation methods in the fourth regulatory period of 1 January 2016 – 31 December 2019 and the fifth regulatory period of 1 January 2020 – 31 December 2023

Electricity distribution network operations

High-voltage distribution network operations

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1 REGULATION METHODS – SUMMARY

In this document, the Energy Authority (Authority) sets out the methods for regulating the reasonableness in pricing of electricity network operations for 2016–2023. These methods apply to distribution system operators (DSOs) and high-voltage distribution system operators.

The Authority will confirm the final regulation methods to the DSO as an appendix to the confirmation decision by the end of 2015.

The regulation methods for high-voltage distribution system operators differ in part from those for the distribution system operators. These differences occur in the incentive methods used in the calculation of realised adjusted profit: the quality incentive (which is dealt with in chapter 6.2 of this document), the efficiency incentive (6.3) and the security of supply incentive (6.5).

The guidelines have been drawn up by government officials in the Energy Authority. The principles governing the choices presented in this document are derived especially from the following legislation:

- Act on the supervision of the electricity and natural gas market (590/2013, Supervision Act)
- Electricity Market Act (588/2013)
- Government proposal on legislation concerning the electricity and natural gas market (HE 20/2013 vp)
- committee report by the Commerce Committee's (TaVM 17/2013 vp)
- other legislation issued by virtue of the Electricity Market Act.

The Energy Authority has also taken into account the decisions by the Market Court and the Supreme Administrative Court on complaints concerning previous regulation methods.

In the development of regulation methods, the Authority has also drawn on the practical experience it has gained from regulation.

Moreover, the Authority has used expert reports and statements as background material in the preparation of the guidelines and regulation methods. These are referred to in the references.

In the preparation of the guidelines and the regulation methods for the regulatory decisions, the Authority has extensively consulted the system operators. During

2014 and 2015, the Energy Authority organised a total of over sixty public hearings with system operators and stakeholders.

1.1 SUMMARY OF THE REGULATION METHODS

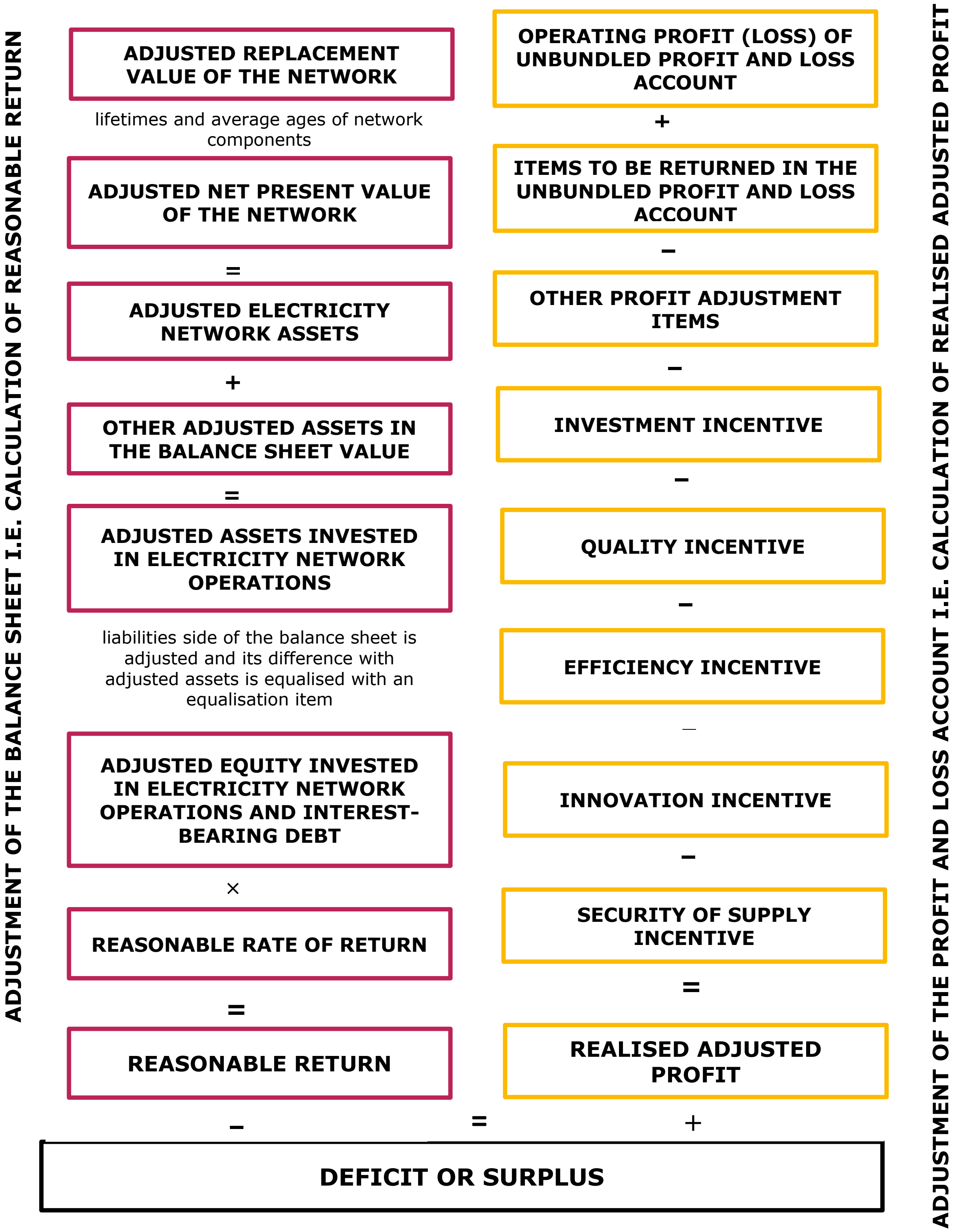

Figure 1. *Regulation methods during regulatory periods 2016–2019 and 2020–2023*

The regulation methods consist of several different methods, which together form the entity presented in Figure 1. This entity is used for regulating the reasonableness of pricing in network operations. All individual methods are described in this document.

The methods of calculating the adjustment of the balance sheet, i.e. reasonable return, are presented on the left-hand side of Figure 1 (2, 3 and 4). The methods of calculating the adjustment of the profit and loss account, i.e. realised adjusted profit, are presented on the right-hand side of the figure (5, 6 and 7).

LEARNING ABOUT THE REGULATION METHODS

A general picture of the regulation methods can be obtained by reading chapters 1, 4 and 7 first. The methods are described in further detail in chapters 2, 3, 5 and 6.

1.1.1 Adjustment of balance sheet, i.e. calculation of reasonable return

Adjusted assets invested in network operations consist of adjusted electricity network assets in the non-current assets (2.1), other non-current assets (2.2) and current assets (2.3) in the unbundled balance sheet.

The adjusted capital invested in network operations is obtained by adding together adjusted equity (2.4.1), interest-bearing debt (2.4.2) and non-interest-bearing debt (2.4.2). An equalisation item (2.4.1) is also added to this in order to reconcile the different sides of the balance sheet.

Reasonable rate of return (3) is calculated on the basis of the weighted average cost of capital (WACC model).

Reasonable return is calculated by multiplying the adjusted capital invested in network operations (2.4) by the reasonable rate of return (3.4).

1.1.2 Adjustment of profit and loss account, i.e. calculation of realised adjusted profit

The calculation of realised adjusted profit is started with the operating profit (loss) of the DSO's profit and loss account in the unbundled profit and loss account.

When calculating the realised adjusted profit, the annual change in refundable connection fees according to the unbundled balance sheet, as well as network rents according to the unbundled profit and loss account, depreciations on goodwill, planned depreciation in the unbundled profit and loss account and write-down of network assets, and the loss of sales resulting from the sale of a network section entered under other operating expenses are returned (5.1). However, the profit from the sale of a network section entered under other operating income is deducted (5.1) when calculating the realised adjusted profit.

After that, reasonable costs of financial assets (5.3) are deducted as profit adjustment items.

The impacts of incentives are also deducted. Incentives include the investment incentive (6.1), quality incentive (6.2), efficiency incentive (6.3), innovation incentive (6.4) and security of supply incentive (6.5).

The sum total of the calculation is the realised adjusted profit.

1.1.3 Deficit and surplus

The deficit or surplus of the return is obtained by deducting the reasonable return from the realised adjusted profit.

The return is in surplus if the result of the subtraction is positive. The return is in deficit if the result of the subtraction is negative.

1.2 THE ENTITY FORMED BY REGULATION METHODS

In this document, the Energy Authority describes the entity formed by the regulation methods. Reasonable pricing referred to in electricity market legislation is determined on the basis of this entity taken as a whole.

The regulation methods form a carefully considered entity. As the Market Court has stated in its decision (MAO:271-344/06), in addition to the fact that it must be possible to independently study and assess individual sections and parameters included in the methods, the confirmation decision represents a carefully considered entity. This must be taken into account when developing the entity and individual methods because the methods and variables interact with one another.

When individual sections are assessed out of the context of the entity formed by the methods, a certain degree of caution should be exercised (precautionary principle). That way, for example, possible changes will not result in an internal conflict, illogicality, or taking the same factors into account several times over in the regulation methods. In addition, even fairly small deviations in the values selected for the parameters may result in considerable differences in terms of the entity of methods.

It is not possible in practice or even in terms of clarity in the administrative decision to draw up the regulation methods with a degree of accuracy where the treatment of every single factor is exhaustively justified.

If necessary, the Energy Authority will specify the contents of the regulation methods with written instructions. When issuing supplementary instructions, the Authority will apply the methods and principles of the confirmation decision in order to safeguard equal operating opportunities for DSOs.

OBJECTIVES OF REGULATION

According to electricity market legislation, the main objectives of special regulation of natural monopoly are the reasonableness of pricing and high quality of network services. Therefore, the Energy Authority seeks these with the entity formed by the regulation methods and with the practical steering impacts of the methods on the DSO's business operations.

In addition to the main targets of regulation, other key targets include equality and network development, as well as the sustainability, continuity, development, and efficiency of business operations.

Equality means social income distribution between the owners of the regulated enterprises and the customers. The level of profits must not be too high, for example, in relation to investments which the owners could make in other business operations of a similar risk level.

Sustainability, continuity and development mean that regulation must ensure necessary investment and other network development in order to safeguard sufficient security of supply. Other appropriate development and vitality of business operations must also be safeguarded in the long term.

Efficiency means that the service required by the customer is provided at the lowest cost possible. The pricing of network operations is not subject to market pressure, in which case the DSO has no incentive to improve the efficiency of its operations. In such a case, without regulation, any cost ineffectiveness could be compensated with higher prices. Therefore, reasonableness of monopoly pricing must be regulated in order to ensure that the DSO achieves a cost level that is actually achievable.

Consumer rights

According to the objective stated in the Internal Market in Electricity Directive (2009/72/EC 51 introductory part), the interests of consumers are essential. Furthermore, the quality of the service must also be an important area of responsibility for the DSO.

As the national regulatory authority, the Energy Authority has a task of making sure that consumer rights are enforced. Consumer rights must be reinforced and safeguarded, and the related openness must be increased.

DEVELOPMENT OF REGULATION

In terms of their key parts, the regulation methods have become established on the basis of decisions issued by the Energy Authority and those issued by the Market Court and the Supreme Administrative Court relating to them.

The Authority's task is to develop the regulation methods. According to the legislative history of the act on regulation (HE 20/2013 vp, detailed justification of section 10 of the act on regulation), the Energy Authority must prepare a new confirmation decision, in which the methods of the decision have been developed on the basis of experience, as necessary. The Authority must also ensure that the confirmation decision will be subject to sufficient public debate at the draft stage.

When developing regulation, the Energy Authority must take into account the targets and principles of natural monopoly expressed in electricity market legislation and in case law. The Authority must also take these into consideration in the application of the regulation method.

DISCRETION

The Energy Authority has ex ante competence in key regulation issues. The objective of legislation (Directive 2003/54/EC 15 introductory part) in adopting ex ante regulation was to reduce uncertainty and expensive and time-consuming disputes.

Electricity market legislation gives wide discretion to the Authority with regard to its application. This also applies to regulation methods and their development and application. Even if the regulation methods were drawn up with the utmost detail, there would still remain ambivalent issues, which the Energy Authority as an independent regulatory authority would have to resolve within the limits of its discretionary power.

The Supreme Administrative Court has also stated (KHO 2010/86) that legislation gives the Energy Authority a wide margin of discretion in the development of regulation methods.

When developing and applying the regulation methods and in regulation in general, the Authority takes into account the limits of the principles of good administration and fundamental rights in its use of discretion with respect to all parties subject to specific regulation.

EQUALITY AND REASONABLENESS FROM THE DSO'S POINT OF VIEW

The regulated DSOs must be treated equally.

However, the fact that the different elements of the methods give a different end result to different DSOs is no justification to non-application of the method in question.

On the other hand, special obligations resulting from legislation have been accepted in case law as a ground for different treatment of transmission system operators and distribution system operators in the regulation methods (MAO:268/06).

When examining from the DSO's point of view whether the regulation methods have, in reality, achieved a reasonable end result in accordance with their objectives, certain aspects must be taken into account. Based on the legislative history of the legislation (HE 20/2013, detailed justification of section 24), these include whether the DSO has been able to

- make sufficient investment in the network
- meet its costs
- pay a yield to its owners.

If the DSO has achieved these or it would have been possible, the DSO has met its obligations within the scope of the regulation methods.

1.3 AMENDING THE CONFIRMATION DECISION

During the regulatory period, the Energy Authority may amend the confirmation decision with a new decision in situations prescribed in section 13 of the act on regulation.

UPDATING THE PARAMETERS OF THE CONFIRMATION DECISION FOR THE FIFTH REGULATORY PERIOD

For the fifth regulatory period, the Authority will update the following parameters of the regulation methods during 2019:

- debt premium relating to the reasonable rate of return (4.2)
- reference level of outage costs (6.2.3)
- efficiency frontier (6.3.3)
- reference level of efficiency costs (6.3.4).

These updates are not amendments to the methods. They are updates to the parameters of the regulation methods comparable to the annual update of parameters, for example, in the calculation of a reasonable rate of return.

The update to the parameters for the fifth regulatory period will be made in the same way as their determination for the fourth regulatory period, using the methods described in this document.

With respect to updates, the Authority will not submit a separate decision, but the DSO will be notified of them in a regulation letter.

1.4 REGULATORY DATA

It is the requirement of regulation that the DSO delivers to the Authority the actual copies of the necessary regulatory data in the correct format and on schedule.

By virtue of section 30 of the act on regulation, the DSO is obliged to deliver to the Energy Authority the information required in regulation.

1.4.1 Regulatory data required in regulation

The regulatory data required in the application of the regulation methods is specified in the following documents:

- the Ministry of Trade and Industry’s decree on the unbundling of electricity network operations (KTMa 79/2005, decree on unbundling)
- the Energy Authority’s regulation on the key figures of electricity network operations and their publication (EMV 963/002/2011, regulation on key figures)

the regulation on key figures will be updated during 2015 and published in the same connection with issuing the confirmation decisions

- regulation methods (this document).

Key regulatory data includes the unbundled financial statements, network structure, and financial and technical key figures.

DECREE ON UNBUNDLING

The DSO must provide with the regulatory data the unbundled financial statements (profit and loss accounts and balance sheets) confirmed in accordance with section 10, paragraph 2 of the decree on unbundling, including additional information and notes.

REGULATION ON KEY FIGURES

The DSO must deliver in the regulatory data the information and key figures referred to in the appendices of the regulation on key figures.

REGULATION METHODS

The DSO must deliver in the network structure data the quantity and average age data of the electricity network's components that are in its possession and actually used by the DSO. The data will be delivered divided according to Appendix 1 and as values corresponding to the situation on the last day of December each year.

The DSO must report the quantity data of network components invested in and removed from the electricity network during each year with a corresponding division. If the DSO has purchased or sold sections of the electricity network, the DSO must report the quantity data of network components purchased or sold, including average age data, with a corresponding division. In addition, the DSO must report the quantity data of replacement investments with a corresponding division. The lifetimes of network components must also be supplied, if necessary.

The DSO must also report other breakdowns required in the adjustment of the unbundled balance sheet and profit and loss account of network operations. These are referred to in chapters 2.1, 2.2, 2.4.2, 5.1, 5.2, 5.3, 6.4.1, and 6.5.2. The DSO must be able to verify the validity of the breakdowns in a reliable way.

1.4.2 Delivering the regulatory data

The network structure data must be delivered to the Energy Authority by the end of March each year. Information about the financial statements and the technical key figures must be delivered to the Energy Authority by the end of May.

As a rule, the DSO must deliver the regulatory data via the online-based regulatory data system of the Energy Authority.

If the data must be delivered any other way, the Authority will provide separate instructions in writing.

If the DSO neglects to deliver the regulatory data to the Energy Authority, the Authority may impose a penalty payment on it in accordance with paragraph 31 of the act on regulation.

1.4.3 Validity of the regulatory data

The regulatory data supplied by the DSO must be valid, i.e. genuine and reliable.

The DSO must comply with the regulatory data when determining and delivering written instructions, definitions and specifications, which are presented in

- the decree on unbundling
- the regulation on key figures
- the regulation methods
- the regulatory data system
- other instructions issued by the Authority.

In unclear cases, the DSO must request the Authority for more detailed instructions.

The validity of regulatory data is mainly based on trust that the Energy Authority has towards the DSO. The DSO calculates and delivers the data independently. The Authority does not have the resources to systematically verify all data. For this reason, the DSO's own legal and moral responsibility for the correctness of the regulatory data is emphasised.

The interest liability on the surplus is taken into account in the regulatory decision when calculating the deficit or surplus transferred to the next regulatory period.

The DSO must be able to verify the regulatory data it has delivered during regulation visits by the Energy Authority or when otherwise separately requested by the Authority.

1.5 UNBUNDLING OF OPERATIONS

According to paragraph 77 of the Electricity Market Act, a DSO shall unbundle electricity network operations from other electricity trade operations, and electricity trade operations from other business operations. The unbundling of operations also applies to legally unbundled DSOs.

In accordance with paragraph 6 of the decree on unbundling, the DSO must enter the income (5.1) and costs (5.2), as well as asset items (2.1, 2.2 and 2.3) and capital items (2.4), which directly pertain to the electricity network operations, directly to the unbundled financial statements of the electricity network operations.

Operations open to free competition by law cannot be unbundled to electricity network operations. Construction of connection lines is one example of this. These kinds of operations are not subject to the regulation methods, either.

The treatment of matters related to unbundling in the regulation methods is specified in the Energy Authority's recommendation[1] on the imputed unbundling of the electricity and natural gas business operations.

1.6 LEASED NETWORKS

The DSO is in an equal position regardless of whether it owns the electricity network in its area of responsibility according to the network licence or whether it has otherwise acquired possession of it.

If the DSO has leased an electricity network in its possession either in part or in whole, it operates in a leased network in that respect. The lease arrangement is dissolved in the regulation methods when the unbundled balance sheet and profit and loss account for the electricity network operations are adjusted.

In accordance with the decree on unbundling, a DSO operating in a leased network must also enter the income and costs directly pertaining to the electricity network

[1] Recommendation by the Energy Market Authority, Sähkö- ja maakaasuliiketoimintojen laskennallinen eriyttäminen (Imputed unbundling of electricity and natural gas business operations) (Reg.No. 549/002/2011), 17 June 2011, the recommendation will be updated before the start of the 4th regulatory period

operations and the asset items and capital items directly in the unbundled financial statements on electricity network operations (1.5).

If the DSO has leased its electricity network or a part thereof, it must provide in the regulatory data information concerning the business operations of the owner of the network. Information must be provided if it concerns the DSO's operations and the network of the area of responsibility determined in the network licence.

A DSO operating in a leased network must deliver, if necessary, an itemisation of the cost items included in the network lease.

1.7 NETWORKS PURCHASED AND SOLD DURING THE REGULATORY PERIOD

The business operations and obligations of networks that merge during the regulatory period are the responsibility of the DSO continuing the business. Similarly, it will gain the rights concerning these networks.

The DSO continuing the network business operations is treated in regulation as an expanded network. This means that the business operation of merged DSOs is treated as a single business.

In a merger that takes place in the middle of the year, the companies form an imputed DSO, which is deemed to carry out activities as a single entity for the entire year in which the merger took place.

CALCULATING THE REPLACEMENT VALUE AND NET PRESENT VALUE

In the adjustment of the value of the buyer's electricity network assets

- the electricity network to be purchased is added to the replacement value and net present value of the buyer's electricity network on the basis of the number of network components and average age data
- the lifetime of the network components to be purchased is determined according to the lifetime that has been previously selected for each network component by the buyer.

In an acquisition where only part of the DSO's electricity network transfers to a new owner, the sold electricity network is deducted from the replacement value and net present value of the seller's electricity network on the basis of the number of network components and average age data.

REGULATORY DATA

The regulatory data takes account of the merger of DSOs from the start of the year of merger, and the data is combined into a single company in the regulation methods.
The DSO continuing the operations is responsible for submitting the regulatory data for the years preceding and following the merger.

DEFICIT AND SURPLUS

The transferee or the receiving DSO is responsible for equalising the surpluses to the customers of the DSO that is transferring or merging the network. This also applies to the equalisation obligation for the part of regulatory period preceding the transfer or merger.

Correspondingly, the transferee or the receiving DSO will gain the right to equalise deficits. This also applies to the equalisation possibility for the part of regulatory period preceding the transfer or merger.

The Energy Authority may, at the request of the DSO disposing of its network business operations or of the transferee, issue a separate decision to confirm the deficit or surplus at the time of transfer.

If only part of the DSO’s network is merged with or separated to another network and both DSOs continue licensed network operations, the deficits and surpluses of the regulatory periods are not combined.

REGULATORY DECISION

The Energy Authority will submit the regulatory decision after the regulatory period only to DSOs that continue network business operations. The regulatory decision takes into account the receiving and merged network business operations for the entire regulatory period.

1.8 INFLATION

The annual change in the monetary value, i.e. the impact of inflation, is taken into account in the calculation of reasonable return and realised adjusted profit as follows.

INFLATION ADJUSTMENT IN THE CALCULATION OF A REASONABLE RETURN

Reasonable rate of return (WACC %) is determined as a nominal value, i.e. the impact of inflation is not removed from it. To avoid taking inflation into account twice in the calculation of reasonable return, the value of unit prices used in the adjustment of electricity network assets is not adjusted during the regulatory period. In terms of other invested adjusted assets, the values according to the unbundled balance sheet for the year in question shall be used.

Reasonable return is obtained by multiplying the adjusted capital invested annually in the electricity network operations and the interest-bearing debt by the nominal reasonable rate of return (WACC %). The nominal reasonable rate of return used in the calculation of the year in question includes the inflation expectation, and therefore the impact of inflation will be taken into account once in the calculation of a reasonable return.

INFLATION ADJUSTMENT IN THE CALCULATION OF REALISED ADJUSTED PROFIT

When calculating realised adjusted profit, inflation adjustment is made on the quality incentive, the efficiency incentive and the investment incentive. The consumer price index is used in the inflation adjustment.

In the quality incentive (6.2) inflation adjustment is made on the unit prices of outages presented in the 2005 value of money (Table 6). The adjustment is made annually in the calculation of the reference level of outage costs and the realised outage costs.

In the efficiency incentive, inflation adjustment is made annually in the calculation of the reference level of efficiency costs.

In the investment incentive, inflation adjustment is made annually in the calculation of straight-line depreciation, which is calculated from the replacement value.

USE OF THE CONSUMER PRICE INDEX IN INFLATION ADJUSTMENT

The change in the total index of the consumer price index (1995=100) is used in the inflation adjustment.

The average of the index points of the consumer price index for April–September of the year in question shall be used as the index for each year. For example, the average of the index points of the consumer price index for April–September 2016 shall be used with respect to year 2016.

The change in the consumer price index is presented in Formula 1.

$$\Delta KHI_t = \frac{KHI_t}{KHI_{t-1}} - 1 \qquad (1)$$

where

ΔKHI_t	=	the change in the consumer price index for year t
t	=	year under review
KHI_t	=	the average of the index points of the consumer price index (1995=100) for April–September in year t
KHI_{t-1}	=	the average of the index points of the consumer price index (1995=100) for April–September in year $t-1$

1.9 CALCULATIONS TO BE MADE DURING THE REGULATORY PERIOD

During the regulatory period, the Energy Authority will calculate the following information for the DSO using the regulatory data system:

- adjusted replacement value of the electricity network assets
- adjusted net present value of the electricity network assets
- adjusted straight-line depreciations of the electricity network assets
- adjusted equity invested in electricity network operations
- adjusted interest-bearing debt invested in electricity network operations
- adjusted non-interest-bearing debt invested in electricity network operations
- adjusted capital invested in electricity network operations
- reasonable return
- realised adjusted profit
- deficit or surplus
- items of a profit-distribution nature.

The Authority will report this information to the DSO through the regulatory data system. In addition, the Authority will make it available to the public, for example, to the DSO’s customers and the media.

The Energy Authority will carry out the calculation of the above-mentioned data applying the regulation methods described in this document and the regulatory data provided by the DSO.

Once the DSO has received the annual calculation for information purposes, the DSO must inspect it and report any errors. If necessary, the Authority will provide a new calculation for information purposes. The annual calculations are not binding on the Energy Authority, and the DSO itself is responsible for providing correct monitoring data.

Even if the DSO did not comment on the annual calculations immediately after receiving them, it does not prevent it from providing a statement at a later date. The last opportunity to comment is with respect to the regulatory decision draft. However, due to the predictability and efficiency of regulation, the Authority recommends that comments are forwarded primarily during the regulatory period immediately after the calculations have been received.

The annual calculations made by the Authority during the regulatory period do not include the obligations concerning the DSO and therefore they are not administrative decisions with a right of appeal. The Energy Authority will confirm the calculations concerning the entire regulatory period after the regulatory period by submitting a regulatory decision (1.10), which is appealable (1.11).

1.10 REGULATORY DECISION MADE AFTER THE REGULATORY PERIOD

After the end of the regulatory period, the Energy Authority will submit the regulatory decision to the DSO by virtue of section 14 of the act on regulation. With this decision, the Authority confirms the amount in euros by which the DSO's realised adjusted profit falls short of or exceeds the amount of reasonable return over the entire course of the regulatory period.

DEFICIT AND SURPLUS

In the regulatory decision, the Authority adds together the realised adjusted profits for different years in the regulatory period using the methods confirmed in the confirmation decision and the regulatory data provided by the DSO and deducts from this the sum of reasonable returns for the corresponding years. The sum total is the deficit or surplus for the entire regulatory period.

If the realised adjusted profits accrued over the entire regulatory period fall short of the amount of reasonable returns for the regulatory period, the DSO will accrue a deficit.

If the realised adjusted profits accrued over the entire regulatory period exceed the amount of reasonable returns, the DSO will accrue a surplus.

INTEREST LIABILITY ON THE SURPLUS

If the realised adjusted profit during the regulatory period has exceeded the amount of reasonable return by at least five per cent, interest shall be payable on the surplus. The interest rate is the average of the reasonable cost of equity (3.2) for the years of the regulatory period in question.

The interest liability on the surplus is taken into account in the regulatory decision when calculating the deficit or surplus transferred to the next regulatory period. The amount to be reduced by virtue of section 14 of the act on regulation for which the interest is calculated is the surplus accrued for the regulatory period that has ended.

DEFICIT OR SURPLUS FOR THE PREVIOUS REGULATORY PERIOD

The regulatory decision takes into account the deficit or surplus accrued for the DSO during the regulatory period preceding the regulatory period in question. The Energy Authority has confirmed the deficit or surplus in the regulatory decision concerning the previous regulatory period.

CALCULATING DEFICIT OR SURPLUS TRANSFERRING FROM THE REGULATORY PERIOD

The calculation of deficit or surplus transferring from the regulatory period to the next regulatory period is presented in Table 1.

Table 1. *Calculation of deficit or surplus*

+	**Sum of realised adjusted profits for all years of the regulatory period**
-	**Sum of reasonable returns for all years of the regulatory period**
=	**Deficit (-) or surplus (+) accrued for the regulatory period**
+	**Possible interest liability on surplus accrued for the regulatory period**
=	**Deficit (-) or surplus (+) accrued for the regulatory period, including interest liability**
+	**Deficit (-) or surplus (+) in accordance with the regulatory decision accrued for the previous regulatory period***
=	**DEFICIT (-) OR SURPLUS (+) TRANSFERRING TO THE NEXT REGULATORY PERIOD**

* *Deficit accrued from the regulatory period preceding the previous regulatory period is no longer taken into account even if the deficit or a part thereof has not been equalised during the previous regulatory period*

EQUALISATION OF DEFICIT OR SURPLUS

If on the basis of the calculation described in Table 1 the DSO has a deficit transferring to the next regulatory period, it cannot be equalised until during the next regulatory period.

If on the basis of the calculation described in Table 1 the DSO has a surplus transferring to the next regulatory period, it must be equalised during the next regulatory period.

However, it is possible to apply for extra time for the equalisation of deficits and surpluses from the Energy Authority on serious grounds.

1.11 APPEALING AGAINST THE CONFIRMATION AND REGULATORY DECISIONS

The confirmation decision issued by the Energy Authority before the start of the regulatory period and the regulatory decision issued by it after the end of the regulatory period are administrative decisions. The DSO may appeal against these decisions in accordance with section 36, paragraph 2 of the act on regulation.

The appeal is lodged with the Market Court. It is possible to appeal against the decision issued by the Market Court by appealing to the Supreme Administrative Court. The Authority may also appeal against the decision of the Market Court by appealing to the Supreme Administrative Court if the Market Court has by its decision amended the confirmation or regulatory decision.

According to section 38 of the act on regulation, the confirmation and regulatory decision must be complied with despite the appeal unless otherwise provided by the Authority in the decision. Furthermore, the court of appeal has the right to give orders on the implementation of the decision as provided in the Administrative Judicial Procedure Act.

2 ADJUSTED ASSETS AND CAPITAL INVESTED IN NETWORK OPERATIONS

ADJUSTMENT OF ASSETS INVESTED IN NETWORK OPERATIONS

The adjustment of assets invested in network operations is based on the assets side of the DSO's unbundled balance sheet, which is adjusted in the ways presented in chapters 2.1, 2.2 and 2.3.

Adjusting the assets side of an unbundled balance sheet gives the value of adjusted assets invested in network operations as the sum total of the adjusted balance sheet.

The adjusted assets invested in network operations consist of the following items:

- adjusted electricity network assets in non-current assets (2.1)
- adjusted other assets in non-current assets (2.2)
- adjusted assets in current assets (2.3).

ADJUSTMENT OF CAPITAL INVESTED IN NETWORK OPERATIONS

The adjustment of capital invested in network operations is based on the liabilities side of the DSO's unbundled balance sheet, which is adjusted in the ways presented in chapter 2.4.

Adjusting the liabilities side of an unbundled balance sheet gives the value of adjusted capital invested in network operations as the sum total of the adjusted balance sheet.

The adjusted capital invested in network operations consists of the following items:

- adjusted equity (2.4.1)
- adjusted interest-bearing debt (2.4.2)
- adjusted non-interest-bearing debt (2.4.2)
- equalisation item (2.4.1).

2.1 ADJUSTMENT OF ELECTRICITY NETWORK ASSETS IN NON-CURRENT ASSETS

Although comprised of several different components, the electricity network forms the greatest individual part of the DSO's assets, i.e. the non-current assets in the unbundled balance sheet.

According to the Electricity Market Act, an electricity network means an interconnected entity intended for the transmission or distribution of electricity, consisting of

- power lines
- substations
- other electric devices, electric equipment, systems and software serving the use of the electricity network and the production of electricity network services.

The value of electricity network assets is adjusted in the regulation methods to correspond with their actual net value. The adjustment is carried out so that the value according to the unbundled balance sheet is not used in the calculation of a reasonable return. Instead, the adjusted net present value of the electricity network (2.1.2) calculated from the adjusted replacement value of the electricity network (2.1.1) shall be used.

UNIT PRICES

Unit prices are used in the calculation of the adjusted replacement value of the electricity network assets.

Average network component-specific unit prices are used in the calculation of the replacement value. The network components and unit prices are presented in Appendix 1.

Unit prices are not index-adjusted for different years because inflation has been taken into account in the reasonable rate of return. Unit prices according to Appendix 1 shall be used in the fourth regulatory period from 2016 to 2019 and in the fifth regulatory period from 2020 to 2023. The unit prices will not be updated with a separate unit price survey for the fifth regulatory period. The purpose of this is to improve continuity and predictability between regulatory periods. Predictability is particularly important in the current situation where the DSOs have to fund more replacement investments than in a normal situation due to the new electricity market act.

Where a component pertaining to the electricity network assets is not included in network components listed in Appendix 1, the component in question can be taken into account in its balance sheet value in the way presented in chapter 2.2. The DSO shall provide a sufficient account of the components in question and their balance sheet values according to the unbundled financial statements in connection with submitting the regulatory data so that they can be taken into account.

LIFETIMES

Lifetimes are used in the calculation of the adjusted net present value of the electricity network assets and the adjusted straight-line depreciations.

The lifetimes for various network components are presented in Appendix 1. No lifetime interval has been specified for substation plots or line area compensations because their adjusted net present value will remain as standard throughout the regulatory period.

The DSO must choose the lifetimes of its network components within the scope of the lifetime replacement intervals to correspond with actual average techno-economical lifetimes. This means the period of time for which the network components are in actual use on average before they are replaced. The DSO's maintenance and investment strategy is taken into account in the chosen lifetimes.

The DSO must include in the structure data of the regulatory data the average techno-economical lifetimes it has chosen for the network components by the end of March 2017. After that, the DSO cannot change the lifetimes it has selected.

AVERAGE AGE DATA

Average age data is used in the calculation of the adjusted net present value of the electricity network assets.

The DSO must report the actual age data for every component in the electricity network at the end of every regulatory year. Based on this age data, the DSO must calculate the average age data for all network components in use and report it in the regulatory data system.

Actual age data means the lifetime of a component, i.e. the age calculated from the first moment of use or year of manufacture. When calculating the average age in terms of every component, the age is always limited to the lifetime selected by the DSO for the network component when the average age is used in the calculation of net present value. This means that a component that is older than the lifetime is regarded to be only as old as the lifetime selected by the DSO. When reporting a new component in the regulatory data for the first time, its age will mainly be the actual age of the component, i.e. the age calculated from the moment it was taken into use. If this is not known, the age of 0.5 years shall be used.

In terms of components whose real age cannot be established by the DSO, the age used in the calculation of the average age of the network component shall be 90% of the lifetime selected by the DSO in the fourth regulatory period and 100% in the fifth regulatory period.

A list of the shares of prices for replacement part components (replacement value of the replaced part/replacement value of the entire component) is presented in Appendix 3 of the report drawn up by Empower Oy[2]. These shares may be used for justifiable reasons to establish the average age data of the network components of substations or the high-voltage network in those partial renovations where the part component of an individual component is replaced with a newer one and the return expectation on the component exceeds that of the original. In other words, it must be an investment that extends the actual lifetime of the above-mentioned network components beyond that of the selected lifetime. The shares of part components cannot be used in the determination of age data if the cost of the replacement of the part has been entered in the DSO's expenses.

ENVIRONMENTAL CONDITION CLASSIFICATION

Environmental condition classification is used when determining the adjusted replacement value of electricity network assets.

In addition to network component structures, the environmental conditions of the DSO's activities are also taken into account with separate environmental condition classification.

With the exception of extremely difficult conditions, environmental condition classification is determined directly on the basis of the latest available CLC material maintained by the town plan areas and the Finnish Environment Institute. The material can be used, for example, as part of the DSO's network data system.

The environmental condition classification is applied in the definition of the following network components:

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[2] Sähköverkkokomponenttien yksikköhintojen määritys (Determining the unit prices of electricity network components) Appendix 3, Empower Oy, 2010

- ditches in the 0.4 kV and 20 kV underground cable network
- ditches in the 110 kV underground cable network

and to support the determination of the following network components, where applicable

- line area compensations for 110 kV overhead lines
- plots of 110 / 20 kV substation land.

In each year of the regulatory period, the DSO must report the environmental condition classes for the network components in Appendix 1 that require an environmental condition definition. If necessary, the DSO must be able to clearly and transparently verify the condition definition to the Energy Authority. If the DSO is unable to verify the conditions to the Energy Authority on the basis of the CLC material, the DSO may be able to use only an easy or ordinary condition in the classification of environmental conditions.

The environmental condition classes are:

- easy condition: other area, i.e. an area outside a town plan area
- ordinary condition: a town plan area
- difficult condition: classes in the CLC material, which the Authority has determined to be classified under difficult conditions in the instructions for the regulatory data system
- extremely difficult condition: the definition is made using verbal definitions and the CLC material in accordance with the instructions of the Authority's regulatory data system.

PRINCIPLES OF DETERMINING THE REPLACEMENT VALUE OF UNDERGROUND CABLE NETWORK

The value of the underground cable network is determined according to the same principles as in the previous regulatory periods. An average unit price per one kilometre of underground cabling, describing the average excavation conditions, is determined for each DSO on the basis of the environmental condition classification. This unit price is added to the unit prices of underground cables in the calculation of the net present value and the replacement value.

Determination of an average excavation condition is based on underground cable ditches in actual use. In other words, the division into different condition classes is carried out on the basis of the underground cable ditches that contain underground cables in actual use. In the first and second regulatory periods, the number of ditches was estimated with the coefficient for the proportion of shared use, provided by the Authority. In the third regulatory period, the number of ditches was determined on the basis of either actual ditch data or the coefficients for the proportion of shared use. In the fourth and fifth regulatory period, the coefficients for the proportion of shared use are no longer used for estimating the number of ditches, and the length of ditches is determined on the basis of actual lengths of ditches only.

The DSO must establish each year, in addition to the actual lengths of ditches, the actual lengths of ditches in different excavation conditions in the situation at the end of the year and report this information to the regulatory data system under the network structure data. It is possible to establish the actual length of ditches on the basis of underground cable location data. According to section 123 of the Electricity Market Act, DSOs have had to digitise the data concerning the location of underground cables by the end of 2014 at the latest. It is possible to establish the length of ditches without site-specific verification by developing the network data systems: for example, cables that are located sufficiently close to one another could be automatically interpreted as a single ditch when using the systems.[3]

For well-justified reasons, the DSO can propose corrections to the area determined on the basis of CLC material using verbal definitions. An error means that the CLC description does not correspond to the actual situation. It is the DSO’s responsibility to verify with the Energy Authority before any correction of errors regarding areas determined by the CLC material that the corrections made are justified.

Error correction requires that the CLC material contains a clear and verifiable error in a wide area. Correction of minor errors is not appropriate as the errors also compensate one another, and errors may be equally to the advantage as well as to the disadvantage of the DSO. The Energy Authority provides more detailed instructions on the correction of errors, if necessary.

COMPONENTS NOT PART OF NETWORK OPERATIONS

Components and assets that are not part of the network operations are not included in adjusted assets invested in network operations. These include land areas that

[3] Maakaapeloinnin kaivuolosuhteiden määritys ja verkkokomponenttien keski-ikätietojen käyttö verkonarvon määrityksessä (Determining the excavation conditions of underground cabling and the use of average age data when determining the network value), Reg.No. 596/401/2009

are not used in actual network operations. No reasonable return is obtained on these items as they are not part of the network operations.

Components are not part of network operations when they are not

- in the DSO's possession but used by the DSO with an arrangement under the law of property, where the possession of the network is not transferred from the owner of the network (so-called participation in another's fixed assets)
- subject to the DSO's development obligation
- DSO's network operations complying with the network licence.

In addition to the above, in a leased network, components that are not included in the lease agreement on the leased network are not part of network operations.

Furthermore, components pertaining to free competition are not included in adjusted assets invested in network operations. These are, for example, components ordered to be built by the customer, which meet the characteristics of a connection line, as well as components classified as extra services, such as reserve power machines serving individual customers.

A network section serving an individual production plant or several plants, which is built after 1 September 2013, is not included in adjusted assets invested in network operations, either, unless the network section also simultaneously serves electricity consumption other than that directly related to production.

An exception concerning a high-voltage distribution network

However, a network section built after 1 September 2013 and serving a production plant can be included in adjusted electricity network assets in a high-voltage distribution network if it is

- funded by the DSO
- owned by and in the possession of the DSO
- originally designed and dimensioned to also serve the DSO's other customer consumption in the region in the near future in addition to production
- techno-economically the most sensible network solution.

The DSO must provide an account of the components of the high-voltage distribution network serving a production plant, which it has included in adjusted electricity network assets, and the reasons why it has done so, in connection with delivering the regulatory data. The Authority will assess the handling of these components on the basis of the account.

COMPONENTS NOT PART OF THE ELECTRICITY NETWORK ASSETS

Components that are not part of the network operations cannot be part of the electricity network assets. In addition, components are not part of the adjusted electricity network assets when they are not

- connected to the network
- in actual use, for example, stored equipment and materials
- entailed acquisition costs to the DSO
- necessary for network operation.

SUBSIDIES RECEIVED FOR THE CONSTRUCTION OF THE NETWORK

The DSO may receive subsidies or other compensation for investing in the network, for example, from the Finnish state or the European Union.

Components funded with the subsidies or compensation received for building the network are not included in adjusted net present value of the electricity network assets, i.e. no reasonable return is obtained on them.

However, components funded with subsidies or compensation are taken into account in the adjusted replacement value of the electricity network assets when calculating adjusted straight-line depreciations of the electricity network assets from it in the investment incentive (6.1.1).

The DSO must provide an account of the amount of subsidies and other compensation it has received in connection with delivering the network structure data. The account must describe the components, for the construction of which they have been used and how they are handled in the DSO's financial statements.

The DSO must annually calculate the net present value for all components built with the subsidies according to the methods and provide the calculation data in the account. The account must state the remaining imputed net present value with respect to all components built with the subsidies. The DSO must calculate this net present value annually and deliver it to the Energy Authority in connection with the structure data until the net present value is zero euros with respect to the components built with the subsidies. The net present value of components built with the subsidies is deducted annually from the net present value of the entire network until the amount of subsidies has been completely eliminated. The Energy Authority provides further instructions with respect to reporting the subsidies, if necessary.

LEASED NETWORKS

Components in a leased network are included in adjusted network assets invested in electricity network operations. The leasing arrangement is dissolved according to the same principles with respect to individual components and a larger entity.

The DSO must be able to itemise all the components that are included in the network lease.

It is possible for the DSO to notify the component it has leased in the regulatory data only if the owner of the component has not notified it in its own network assets in accordance with the network licence.

2.1.1 Adjusted replacement value

The adjusted replacement value of electricity network assets is determined for all years of the regulatory period in the situation on the last day of December in each year.

The adjusted replacement value of a network component is calculated in the fourth and fifth regulatory periods by multiplying the unit price according to Appendix 1 by the number of network components reported by the DSO in the regulatory data. The adjusted replacement value of the entire adjusted electricity network assets is obtained by adding together the network component-specific adjusted replacement values.

The calculation of adjusted replacement value per network component is presented in Formula 2.

$$JHA_i = unit\ price_i \times number_i \qquad (2)$$

The adjusted replacement value of all electricity network assets is calculated as a total of adjusted replacement values of the network components in accordance with Formula 3.

$$JHA = \sum_{i=1}^{n} \left(JHA_i \right) \qquad (3)$$

in formulae 2 and 3

JHA_i = the total adjusted replacement value of all components of network component i

$unit\ price_i$ = unit price of network component i in accordance with Appendix 1

$number_i$ = number of all components in network component i

JHA = adjusted replacement value of the all electricity network assets

2.1.2 Adjusted net present value

The adjusted net present value of the electricity network assets is calculated for all years of the regulatory period as a value corresponding to the situation on the last day of December in each year.

The adjusted net present value of the network component is calculated from its adjusted replacement value on the basis of the lifetime of the network component selected by the DSO and the average age of the network component notified by the DSO in the regulatory data. The adjusted net present value of all adjusted electricity network assets is obtained by adding together the adjusted net present values of each network component.

The calculation of adjusted net present value per network component is presented in Formula 4.

$$NKA_i = \left(1 - \frac{averageage_i}{lifetime_i}\right) \times JHA_i \qquad (4)$$

The adjusted net present value of all electricity network assets is calculated as a sum of adjusted net present values of the network components in accordance with Formula 5.

$$NKA = \sum_{i=1}^{n} \left(NKA_i\right) \qquad (5)$$

in formulae 4 and 5

NKA_i = adjusted net present value of all components in network component i

$lifetime_i$	=	the lifetime of network component i
$average\ age_i$	=	average age of all components in network component i
NKA	=	adjusted net present value of all electricity network assets

2.2 ADJUSTMENT OF OTHER ASSETS IN NON-CURRENT ASSETS

In connection with the adjustment of assets invested in network operations, non-current assets other than electricity network assets in the unbundled balance sheet are basically taken into account in their balance sheet value. These kinds of assets include, e.g. acquisitions in progress. However, in respect of these, goodwill and investments are adjusted by eliminating them.

OTHER ASSETS RECORDED IN ELECTRICITY NETWORK ASSETS

The DSO must notify as notes to the financial statements any items recorded in electricity network assets that are not taken into account in the calculation of adjusted replacement value or net present value. These items are taken into account in adjusted assets invested in network operations in their value according to the unbundled balance sheet. Depreciation according to plan based on the unbundled profit and loss account is permitted for them as a reasonable level of depreciation. These kinds of items are, for example, stored equipment and materials related to electricity network operations.

Components included in these kinds of items are not taken into account in the calculation of adjusted replacement value of the electricity network assets even if these components were included in the list of components in Appendix 1. These components are taken into account in their value according to the unbundled balance sheet. If necessary, the DSO must provide an account of the book value of the components.

ELECTRICITY NETWORK COMPONENTS RECORDED IN OTHER THAN ELECTRICITY NETWORK ASSETS

However, if electricity network components are recorded under items other than the electricity network assets in non-current assets, the balance sheet value of the components is eliminated from these items. Elimination is carried out with respect to components that are referred to in the list of network components in Appendix 1 and are in actual use in the electricity network. These components are taken into account in adjusted assets invested in network operations in their adjusted net present value in accordance with chapter 2.1.2.

GOODWILL

Goodwill in the unbundled balance sheet is eliminated in connection with the adjustment of assets invested in network operations.

Legislative history (HE 20/2013 vp) takes a stand on acquisitions and other arrangements where the sum paid for electricity network assets is higher than its actual net value.

Therefore, the regulation methods must be based on the actual net value of the DSO's electricity network assets and not, for example, on the commercial market value determined on the basis of mergers and acquisitions, which may include valuation or acquisition items not pertaining to electricity network operations.

Electricity network assets in accordance with the unbundled balance sheet are adjusted to the adjusted net present value in the way described in chapter 2.1. This describes the actual net value of the electricity network assets in the regulation methods.

Based on this, the Energy Authority deems that the goodwill of the unbundled balance sheet arisen in connection with an acquisition describes an intangible asset that is not possible to be allocated to other assets.

Merger assets

The share of goodwill of the merger assets created in the merger is treated in the same way as goodwill.

INVESTMENTS

When adjusting assets invested in network operations, investments in non-current assets according to the unbundled balance sheet are eliminated.

Investments in non-current assets include, e.g. investments that seek profits other than those directly connected to network operations or the expansion of business operations. These investments cannot be regarded as necessary in terms of network operations. Therefore, it is not justified to include them in any part in adjusted assets invested in network operations.

2.3 ADJUSTMENT OF ASSETS IN CURRENT ASSETS

FINANCIAL ASSETS

When calculating adjusted assets invested in network operations, financial assets recorded in the unbundled balance sheet are eliminated.

Financial assets to be eliminated include the following items in the assets side of the unbundled balance sheet:

- short- and long-term receivables
- marketable securities
- cash and bank receivables and comparable items.

In accordance with the decision of the Supreme Administrative Court (KHO:2010:86), trade receivables are not eliminated.

The management of financial assets is not actual network operations even in financing theory. Therefore, it is not justified to include it in any part in adjusted assets invested in network operations.

The costs resulting from financial assets necessary to safeguard network operations are taken into account in the calculation of realised adjusted profit in accordance with chapter 5.3.

INVENTORIES

When calculating adjusted assets invested in network operations, the book value according to the unbundled balance sheet shall be used as the value of inventories.

2.4 ADJUSTMENT OF CAPITAL INVESTED IN NETWORK OPERATIONS

The liabilities side of the adjusted balance sheet is determined by dividing adjusted capital invested in network operations into

- adjusted equity
- adjusted interest-bearing debt
- adjusted non-interest-bearing debt.

2.4.1 Adjustment of equity

In the adjusted balance sheet, equity is regarded as the DSO's equity in accordance with the unbundled balance sheet.

In the adjusted balance sheet, voluntary provisions and the depreciation of assets other than electricity network assets, deducted by deferred tax liability, are also regarded as equity.

Group contributions are also taken into account in the adjustment of equity.

Furthermore, an equalisation item is added to equity in the adjusted balance sheet.

GROUP CONTRIBUTION

The DSO is in an equal position regardless of whether or not it operates under a group structure.

Granted group contribution

In the adjustment of capital invested in network operations, the amount of group contribution deducted by the implied amount of tax is returned to equity.

This is done regardless of whether a decision has been made on the closing date to grant the group contribution and which has or has not been paid yet.

Granted group contribution is an item of a profit distribution nature, and in the unbundled balance sheet of a DSO operating without a group structure it would be entered under 'profit for the financial period' in the unbundled balance sheet.

Received group contribution

In the adjustment of capital invested in network operations, the amount of group contribution deducted by the implied amount of tax is deducted from equity. Received group contribution is also an item of a profit distribution nature, and it increases the profit for the financial period.

Receivables are eliminated in the calculation of reasonable return in the way presented in chapter 2.3 of this document. The amount of group contributions received is taken into account in the elimination.

EQUALISATION ITEM

The equalisation item describes the difference in value between the adjusted assets invested in network operations and the assets side of the balance sheet.

The equalisation item is used to balance the assets and liabilities in the adjusted balance sheet. It is recorded under equity in the liabilities side of the adjusted balance sheet.

The value of the equalisation item is calculated as the difference of the assets and liabilities sides of the adjusted balance sheet.

The equalisation item may also be negative if the value of adjusted assets invested in network operations is lower than the assets side of the unbundled balance sheet.

2.4.2 Adjustment of debt

In the adjustment of capital invested in network operations, debt is divided into interest-bearing and non-interest-bearing debt.

ADJUSTED INTEREST-BEARING DEBT

Interest-bearing debt in the unbundled balance sheet is taken into account in adjusted interest-bearing debt as such. However, the equity share in the interest-bearing group contribution debt is eliminated.

Items in interest-bearing debt include bank, pension and other loans in the non-current liabilities in the unbundled balance sheet, as well as the instalments of the above-mentioned loans in the current liabilities of the unbundled balance sheet.

In the adjustment of capital invested in network operations, any capital loans and other interest-bearing loans granted by the owners of the DSO are treated as interest-bearing debt.

ADJUSTED NON-INTEREST-BEARING DEBT

Non-interest-bearing debt in the unbundled balance sheet is taken into account in adjusted non-interest-bearing debt as such. These items include accounts payable, accruals and other short-term debt. However, the equity share in the non-interest-bearing group contribution debt is eliminated.

Mandatory provisions entered in the unbundled balance sheet are treated in full as non-interest-bearing debt. In the depreciation difference of assets other than electricity network assets, the share of deferred tax liability is regarded as non-interest-bearing debt.

CONNECTION FEES

Components funded by connection fees are included in adjusted assets invested in network operations.

The DSO is in an equal position regardless of whether it uses refundable or non-refundable connection fees.

Refundable connection fees

Although refunds are rarely made, even a formal refunding condition gives the connection fee the character of a debt. As distinct from other long-term debts, connection fees involve no interest liabilities, i.e. they are a non-interest-bearing debt by nature. Refundable connection fees cannot be entered under equity in the unbundled balance sheet by virtue of the statement by the Accounting Board.[4]

In the adjustment of capital invested in network operations, refundable connection fees entered in the unbundled balance sheet by the end of 2004 are treated as non-interest-bearing equity.

Refundable connection fees recorded in the unbundled balance sheet after 2004 do not increase non-interest-bearing debt in the adjusted balance sheet.

The net change in connection fees is returned in the calculation of realised adjusted result in accordance with chapter 5.1.

The DSO must itemise as a separate item the annual amount of refundable connection fees entered in the balance sheets of the owner or its other companies as notes to the unbundled financial statements.

Non-refundable connection fees

Non-refundable connection fees are income from network operations in accordance with chapter 5.1.

[4] Kirjanpitolautakunnan lausunto sähköliittymismaksujen kirjaamisesta (Decision of the Accounting Board on the recording of electricity connection fees) (1650/2001)

3 REASONABLE RATE OF RETURN

3.1 THE MODEL FOR WEIGHTED AVERAGE COST OF CAPITAL

The method used when determining a reasonable rate of return approved for adjusted capital invested in network operations is the Weighted Average Cost of Capital, or the WACC model.

The WACC model expresses the average costs of capital used by the enterprise, in which the weightings are the relative values of equity and debt.

The Energy Authority has commissioned a statement[5] from Ernst & Young Oy (EY) for the definition of parameters in the WACC model. This statement is used as the key basis for selecting the levels of parameters in the WACC model, presented in the following.

3.2 REASONABLE COST OF EQUITY

When determining a reasonable rate of return, the reasonable cost of equity is calculated with the CAP model (Capital Asset Pricing Model).

The CAP model describes the dependency between the returns requirement of an investment involving a risk and the risk.

In the model, the reasonable cost of capital is formed by adding to risk-free interest a risk premium, which is obtained by multiplying the market risk premium by the beta coefficient. A premium for lack of liquidity is also added to the risk-free interest.

The calculation of the model is presented in Formula 6.

$$C_E = R_r + \beta_{equity} \times (R_m - R_r) + LP \qquad (6)$$

where

C_E = reasonable cost of equity

R_r = risk-free rate

[5] Ernst & Young Oy, Kohtuullisen tuottoasteen määrittäminen sähkö- ja maakaasuverkkotoimintaan sitoutuneelle pääomalle (Determining a reasonable rate of return on capital invested in electricity and natural gas network operations), 10 October 2014

β_{equity} = equity beta coefficient

R_m = average market returns

$R_m - R_r$ = market risk premium

LP = premium for lack of liquidity

3.2.1 Risk-free rate of equity

When determining a reasonable rate of return, the interest of ten-year Finnish government bonds is used as the risk-free rate of interest, which acts as a basis for a reasonable cost of equity.

Risk-free rate describes the returns requirement of an investment that is as risk-free as possible. In general, bonds by governments with a high credit rating are regarded as this kind of investment.

As the investment horizon for equity must be several years, the selection of maturity is important. Therefore, it is justifiable to use the returns on a long-term bond when defining a risk-free interest.

The value of the risk-free rate is calculated annually in two different ways: R_{r1} and R_{r2}. Of these values calculated in two different ways, the one that gives a higher value for the risk-free rate shall be applied for the next year.

In alternative R_{r1}, the value of risk-free rate is updated each year, using the average of the realised daily value of the ten-year Finnish government bonds for the period of April–September in the previous year. For example, the value for 2016 is determined on the basis of the average of the realised daily values in the period of April–September in 2015.

In alternative R_{r2}, the value of risk-free rate is updated each year, using the average of the realised daily value of the ten-year Finnish government bonds in the ten previous years. For example, the value for 2016 is determined on the basis of the average of the realised daily values in the period of October 2005 – September 2015.

The realised daily values are published by the Bank of Finland.[6]

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[6] The Finnish benchmark government bond yields issued by the Bank of Finland are calculated as averages of the bid rates quoted by primary dealers on the Reuters system daily at 1.00 pm. If the calculation method changes, the daily values issued by the Bank of Finland, calculated with the updated method, will be applied.

The value of the above-described risk-free interest rate is also used as risk-free rate, which acts as a basis of reasonable cost of debt (3.3.1).

3.2.2 Beta coefficient

The value of equity beta is 0.828 when determining a reasonable rate of return.

The beta coefficient describes the risk element of the enterprise under review in relation to the average risk element in all investments.

The beta coefficient depends on the cost structure, debt ratio and growth of the enterprise. In practice, this results in a convergence of the betas of enterprises operating in the same industry.

The regulation methods are based on the fact that the beta coefficient is a sector-specific quantity. It describes the risk level of investments made in enterprises in the electricity network sector in comparison with all investments in the stock market.

According to the Authority's views, there are no differences in sectoral risks between electricity distribution network operations and high-voltage electricity distribution network operations in Finland.

The asset beta describes the risk of business operations without the risk arisen from indebtedness. In the regulation methods, the asset beta has been calculated with the Hamada formula, in which the impact of the tax rate is also eliminated.

The upper limit of 0.54 in the range determined for the electricity distribution network sector in the EY's report is used as the value of the asset beta.

In order to determine the reasonable equity cost, the asset beta is adjusted into equity beta. The calculation of this adjustment where the debt ratio and the rate of corporate tax are taken into account is presented in Formula 7.

$$\beta_{equity} = \beta_{asset} \times \left(1 + (1 - yvk) \times \frac{D}{E}\right) \tag{7}$$

where

β_{equity} = the equity beta coefficient

β_{asset} = the asset beta

yvk = the rate of corporate tax

D/E = the capital structure (interest bearing debt / equity).

3.2.3 Market risk premium

The value of market risk premium is 5% when determining a reasonable rate of return.

The risk premium describes the difference between the risk-free interest rate and the return on equity investment, i.e. the degree to which the shares have yielded a return exceeding the risk-free rate.

When determining the cost of equity, there is an interrelationship between the risk-free interest rate and the market risk premium. Therefore, the selection of risk-free interest rate has an impact on the amount of risk premium.

The value of market risk premium applied in previous regulatory periods has been based on, e.g. studies and statements commissioned by the Authority. The Market Court has also approved the used value in its decision (MAO:635-688/10). According to the EY’s report, this level is justified when the risk-free interest rate has been determined by applying the return on ten-year Finnish government bonds.

3.2.4 Premium for lack of liquidity

The value of the premium for lack of liquidity is 0.6% when determining a reasonable rate of return.

The premium for lack of liquidity describes any illiquidity of an investment.

Factors having a reducing impact on the value of ownership of a company that is unlisted or has a lack of liquidity for another reason may include higher transaction costs and a longer sale period than the ownership of a listed company.

Efforts have been made to use different methods for modelling the premium for lack of liquidity when determining the value of an enterprise. However, it has not been possible to select a single generally accepted method for the calculation. Therefore, practical application of the premium is extremely discretionary.

A moderate level of premium for lack of liquidity is supported by the licence requirements of network operations and the significant acquisitions carried out in the sector even in the past few years.

When assessing the level of the premium for lack of liquidity, it must also be taken into account that the enterprises in the sector are mainly majority-owned. This means that the owners have control in the enterprises and can, therefore, have a direct impact on the business operations of the enterprises.

The value of the premium for lack of liquidity has been dealt with in several statements[5, 7, 8, 9, 10] in addition to the decision of the Market Court (MAO: 271–344/2006). The value of the premium can be determined as an average of the values presented in these statements.

3.2.5 Capital structure

A fixed capital structure where the weighting of interest-bearing debt is 40% and that of equity is 60% is used in the determination of a reasonable rate of return.

The capital structure describes the weightings of the cost of equity and the cost of debt in the WACC model.

The capital structure also has an impact on the determination of the beta coefficient. In order to bring the beta coefficients of various shares into a commensurable form, the impact of the capital structure of the enterprise must be eliminated.

According to the financing theory, the enterprise's optimal capital structure must be used in the calculation of the weighted average cost of capital. In the consultation study[5] EY has derived the DSO's capital structure on the basis of listed reference enterprises that are as similar as possible in terms of their business.. The assumption is that these enterprises have optimised their capital structure in order to maximise the value of the enterprise.

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7 Martikainen Teppo, Lausunto Sähkömarkkinakeskukselle jakeluverkkotoimintaan sitoutuneen pääoman kohtuullisesta tuottoasteesta (Statement to the Electricity Market Centre on the reasonable rate of return on capital invested in distribution network operations), 4 November 1998

8 PricewaterhouseCoopers, Lausunto koskien sähkön jakeluverkkotoiminnan pääoman keskikustannuksista (Statement on the average costs of capital in the electricity distribution network operations), 7 April 2004

9 Deloitte & Touche Oy, Energy Market Authority – Sähköverkkotoiminnan WACC-mallin ja sen parametrien arviointi (Assessment of the WACC model and its parameters in electricity network operations), 6 August 2010

10 Kallunki, Juha-Pekka, Lausunto Energiamarkkinaviraston käyttämästä sähköverkkotoiminnan valvontamallista (Statement on the regulatory model for electricity network operations used by the Energy Market Authority), 29 April 2011

3.3 REASONABLE COST OF DEBT

When determining a reasonable rate of return, the reasonable cost of debt is calculated by adding the debt premium to the risk-free rate.

The calculation of the model describing reasonable cost of debt is presented in Formula 8.

$$C_D = R_r + DP \tag{8}$$

where

C_D = reasonable cost of debt

R_r = risk-free rate

DP = debt premium

3.3.1 Risk-free rate of debt

When determining a reasonable rate of return, the value of a risk-free rate, which is the basis for reasonable cost of debt, is calculated in the same way as with equity (3.2.1).

3.3.2 Debt premium

In the fourth regulatory period (2016–2019), the value of the debt premium is 1.4% when determining a reasonable rate of return.

The debt premium describes the cost of the funding of debt on top of risk-free rate.

EY's study has assessed the level of debt premium in different ways. Based on these methods, the study has assessed the range of the value of debt premium for Finnish DSOs. The value of premium can be determined as the average of this range.

For the fifth regulatory period (2020–2023), the value of the debt premium will be updated by the end of 2019.

The lower limit of the range is formed by the average of the index consisting of returns on ten-year bonds of European utility companies with Bloomberg credit rating A (*Bloomberg fair market yield curve*) for the period from June 2009 to May

2019, deducted by the average monthly quotations of the 10-year German government bond for the period from June 2009 to May 2019.

The upper limit of the range is formed by the average of the index consisting of returns on ten-year bonds of European utility companies with Bloomberg credit rating BBB (*Bloomberg fair market yield curve*) for the period from June 2009 to May 2019, deducted by the average monthly quotations of the 10-year German government bond for the period from June 2009 to May 2019.

Monthly quotation refers to the quotation on the last trading day of the month.

The value of the risk premium consists of the average of the above-mentioned range, and it is applied as such during the fifth regulatory period.

The above-mentioned indices must include several enterprises at the time of updating the risk premium. Otherwise the value of debt premium applied by the Authority in the fifth regulatory period will be 1.4%.

3.4 CALCULATING A REASONABLE RATE OF RETURN

The weighted average costs of adjusted capital invested in network operations is used as the reasonable rate of return (WACC %) in the regulation methods.

The cost of entire capital is calculated with the average weighted costs of equity and interest-bearing debt. The returns requirement of non-interest-bearing debt is zero, and therefore it is not necessary to include it in the calculation of a reasonable rate of return.

A reasonable pre-tax rate of return is used in the regulation methods.

That way, corporate tax is taken into account in the calculation a reasonable return and it is not deducted in the calculation of realised adjusted profit. Application of reasonable pre-tax rate of return clarifies the regulation methods and puts the DSOs in an equal position regardless of their company form or group structure.

A reasonable rate of return is first calculated post-tax in the way presented in Formula 9.

$$\mathrm{WACC}_{post\text{-}tax} = C_E \times \frac{E}{E+D} + C_D \times (1 - yvk) \times \frac{D}{E+D} \qquad (9)$$

where

$WACC_{post\text{-}tax}$ = reasonable rate of return after corporate tax

C_E = reasonable cost of equity

C_D = reasonable cost of interest-bearing debt

E = adjusted equity invested in network operations

D = adjusted interest-bearing debt invested in network operations

yvk = current rate of corporate tax

After that, the above-mentioned post-tax reasonable rate of return will be adjusted with the current rate of corporate tax. This will give the pre-tax reasonable rate of return, the calculation of which is presented in Formula 10.

$$\mathrm{WACC}_{pre-tax} = \frac{WACC_{post-tax}}{(1-yvk)} \quad (10)$$

where

$WACC_{pre\text{-}tax}$ = reasonable rate of return before corporate tax

A fixed capital structure where the weighting of interest-bearing debt is 40% and that of equity is 60% is applied to the DSO. That way, the calculation of pre-tax reasonable rate of return before corporate tax is carried out in accordance with Formula 11.

$$\mathrm{WACC}_{pre-tax} = \frac{C_E \times 0.60}{(1-yvk)} + C_D \times 0.40 \quad (11)$$

4 REASONABLE RETURN

The DSO’s reasonable return is calculated by multiplying the adjusted capital invested in network operations (2.4) by the reasonable rate of return (3.4).

Therefore, the DSO receives a reasonable return on

- adjusted equity invested in network operations
- interest-bearing debt invested in network operations.

No reasonable return is obtained on non-interest-bearing debt invested in network operations as its returns requirement is zero.

The calculation of pre-tax reasonable return before corporate tax is presented in Formula 12.

$$R_{k,\, pre\text{-}tax} = WACC_{pre\text{-}tax} \times (E + D) \tag{12}$$

where

$R_{k,\, pre\text{-}tax}$	=	reasonable return before corporate tax, EUR
$WACC_{pre\text{-}tax}$	=	reasonable rate of return, per cent
E	=	adjusted equity invested in network operations, EUR
D	=	adjusted interest-bearing debt invested in network operations, EUR
$E + D$	=	adjusted capital invested in network operations, EUR

4.1 ADJUSTED ASSETS AND CAPITAL INVESTED IN NETWORK OPERATIONS

ADJUSTED ASSETS INVESTED IN NETWORK OPERATIONS

Adjusted assets invested in network operations consist of adjusted electricity network assets in the unbundled balance sheet (2.1), other non-current assets (2.2) and current assets (2.3).

Electricity network assets in non-current assets of the unbundled balance sheet, which constitute the most important asset item of electricity network operations, are replaced with adjusted electricity network assets (2.1). They consist of adjusted net present value of the electricity network (2.1.2), which is calculated from the adjusted replacement value of the electricity network with the network component-specific lifetimes and average ages (2.1.1). Adjusted replacement value is calculated on the basis of the number and unit prices of network components (Appendix 1).

Other assets invested in electricity network operations are adjusted next (2.2 and 2.3).

The principle of adjusting the assets side of the balance sheet when calculating the DSO's adjusted assets invested in network operations is presented in Table 2 in the form of balance sheet calculation.

Table 2. *The principle of adjusting the assets side of the balance sheet*

ASSETS

UNBUNDLED BALANCE SHEET	**ADJUSTED BALANCE SHEET**
Non-current assets	**Adjusted non-current assets**
Electricity network network	Net present value of the electricity
Goodwill	
Investments	
Other non-current assets	Other non-current assets in the balance sheet value
Current assets	**Adjusted current assets**
Inventories	Inventories in the balance sheet value
Trade receivables	Trade receivables in the balance sheet value
Financial assets	
TOTAL ASSETS	**ADJUSTED BALANCE SHEET TOTAL**

ADJUSTED CAPITAL INVESTED IN NETWORK OPERATIONS

The adjusted capital invested in network operations is obtained by adding together adjusted equity (2.4.1), adjusted interest-bearing debt (2.4.2) and adjusted non-interest-bearing debt (2.4.2). An equalisation item (2.4.1) will also be added to this in order to reconcile the different sides of the balance sheet.

The principle of adjusting the liabilities side of the balance sheet of network operations, to be made when calculating the DSO's adjusted capital invested in network operations, is presented in Table 3 in the form of balance sheet calculation.

Table 3. *The principle of adjusting the liabilities side of the balance sheet*

<u>LIABILITIES</u>

UNBUNDLED BALANCE SHEET	ADJUSTED BALANCE SHEET
Equity	**Adjusted equity**
Equity	Equity in the balance sheet value
	Group contributions granted, deducted by deferred tax liability
	Depreciation difference of assets other than electricity network assets, deducted by deferred tax liability, and voluntary provisions.
	- Group contributions received, deducted by deferred tax liability
	Equalisation item of adjusted balance sheet
Accumulated appropriations	
Depreciation difference and provisions	
Obligatory provisions	
Obligatory provisions	
Debt	**Adjusted debt**
Interest-bearing	**Interest-bearing**
Interest-bearing debt	Interest-bearing debt in the balance sheet value
Capital loans	Capital loans in the balance sheet value
	- Share of equity in interest-bearing group contribution that is granted but not paid
Non-interest-bearing	**Non-interest-bearing**
Non-interest-bearing debt	Non-interest-bearing debt in the balance sheet value
	- Share of equity in non-interest-bearing group contribution that is granted but not paid
	Obligatory provisions in the balance sheet value
	Share of deferred tax liability of the depreciation difference of assets other than those in the electricity network

TOTAL LIABILITIES	ADJUSTED BALANCE SHEET TOTAL

4.2 REASONABLE RATE OF RETURN

A reasonable rate of return is calculated on the basis of the weighted average cost of capital (WACC model).

When the definition of a reasonable rate of return in accordance with Formula 11 is entered in Formula 12, the calculation of a reasonable rate of return after corporate tax on adjusted capital invested in network operations (pre-tax) will comply with Formula 13.

$$R_{k,pre-tax} = \left(\frac{C_E \times 0.60}{(1 - yvk)} + C_D \times 0.40 \right) \times (E + D) \qquad (13)$$

The reasonable cost of adjusted equity invested in network operations in Formula 13 is calculated in accordance with Formula 14.

$$C_E = R_r + \beta_{asset} \times \left(1 + (1 - yvk) \times \frac{40}{60} \right) \times (R_m - R_r) + LP \qquad (14)$$

The reasonable cost of adjusted interest-bearing debt invested in network operations in Formula 13 is calculated in accordance with Formula 15.

$$C_D = R_r + DP \qquad (15)$$

in formulae 13, 14 and 15

$R_{k,\,pre\text{-}tax}$	=	reasonable return before corporate tax
C_E	=	reasonable cost of equity
C_D	=	reasonable cost of interest-bearing debt
yvk	=	the rate of corporate tax
E	=	adjusted equity invested in network operations
D	=	adjusted interest-bearing debt invested in network operations
R_r	=	risk-free rate
β_{asset}	=	asset beta
$R_m - R_r$	=	market risk premium
LP	=	premium for lack of liquidity
DP	=	debt premium

The parameters of a reasonable rate of return applied in the fourth regulatory period are presented in Table 4.

Table 4. *Parameters of a reasonable rate of return in the fourth regulatory period*

PARAMETER	VALUE APPLIED
RISK-FREE RATE	The higher value of the following two values calculated annually R_{r1} = Average daily values of the interest of 10-year Finnish government bonds for previous year's April–September R_{r2} = Average daily values of the interest of 10-year Finnish government bonds for the previous ten years
ASSET BETA	0.54
EQUITY BETA	0.828
MARKET RISK PREMIUM	5.0%

PREMIUM FOR LACK OF LIQUIDITY	0.6%
CAPITAL STRUCTURE (gearing / equity).	40% / 60%
DEBT PREMIUM	1.4%
RATE OF CORPORATE TAX	20.0%

UPDATING THE PARAMETERS OF A REASONABLE RATE OF RETURN

The Energy Authority updates the value of the risk-free rate of interest each year.

The Authority updates annually the rate of corporate tax to correspond with the current value, if necessary.

For the fifth regulatory period, the Authority updates the debt premium for the reasonable rate of return.

The values of the following parameters relating to the reasonable rate of return will remain unchanged throughout the years of the fourth and fifth regulatory periods

- market risk premium
- premium for lack of liquidity
- asset beta
- equity beta
- capital structure.

5 INCOME AND COSTS OF NETWORK OPERATIONS

The basis for calculating realised adjusted profit is the operating profit (loss) in accordance with the unbundled profit and loss account of the network operations, which is adjusted with the profit adjustment items described in this chapter. After that, the impact of incentives will be deducted in the calculation of realised adjusted profit (6).

5.1 INCOME FROM NETWORK OPERATIONS

Income entered before the operating profit (loss) in the unbundled profit and loss account are used as returns on network operations in the calculation of realised adjusted profits.

Income from network operations include

- income from network service fees
- income from other services related to network operations
- non-refundable connection fees
- rental income from common use poles
- income comparable to these.

The following adjustment items are returned in the calculation of realised adjusted profit:

- annual net change in refundable connection fees
- network rents
- planned depreciation and reduction in value of electricity network assets in non-current assets
- planned amortisation of goodwill
- sales loss resulting from the sale of a network section.

The profit from the sale of a network section entered under other operating income is deducted when calculating the realised adjusted profit.

CONNECTION FEES

In the calculation of the realised adjusted profit, the annual net change in refundable connection fees entered in the unbundled balance sheet is returned.

The annual net change in connection fees is obtained by deducting the amount of connection fees in the unbundled balance sheet of the previous accounting period from the amount of connection fees in the unbundled balance sheet in the accounting period.

Non-refundable connection fees are treated as returns on network operations.

The way of treating connection fees in balance sheet adjustment is described in chapter 2.4.2.

Connection fees are not deferred

The Authority has considered an alternative method of treating connection fees in order to defer their high accruals. This matter has also been dealt with in DSO public hearings and in a previously commissioned study, as well as in the court of law based on complaints by DSOs (MAO:13/10 and MAO:427–501/12)

No such alternative method of treating connection fees has been presented that would safeguard equal treatment of DSOs.

Therefore, connection fees are not deferred, but they are treated as returns on network operations in the accounting period during which they have been entered in the unbundled financial statements.

NETWORK RENTS

The rental costs of a leased network must be reported in the regulatory data as network rents.

The network rents paid by the DSO in accordance with the unbundled profit and loss account are returned in full in the calculation of actual adjusted profit.

However, network rents may also include operating or maintenance costs of the leased network. If the DSO wishes that these costs are not returned in the calculation of realised adjusted result, it must provide an account of their share of the network rent in connection with providing the regulatory data. The account must be verifiable on the basis of the DSO's accounts. The Authority will assess the account and decide on the handling of these costs on its basis.

DEPRECIATION OF ELECTRICITY NETWORK ASSETS IN NON-CURRENT ASSETS

In the unbundled profit and loss account, planned depreciations of electricity network assets are returned in the calculation of realised adjusted profit.

Amortisation of electricity network assets recorded in non-current assets in the unbundled financial statements are also added to planned depreciations to be returned.

In terms of a DSO operating in a leased network, depreciations and reductions in value of electricity network assets entered in the DSO's balance sheet are not returned. The depreciation cost of these components is already included in the network rents returned in the calculation of realised adjusted profit.

PLANNED AMORTISATION OF GOODWILL

Planned amortisation of goodwill on the unbundled profit and loss account is returned in the calculation of realised adjusted profit.

SALES PROFIT AND LOSS RESULTING FROM THE SALE OF A NETWORK SECTION

If the profit from the sale of a network section is entered under other operating income in an unbundled profit and loss account, the amount of sales profit is deducted when calculating the realised adjusted profit.

If, on the other hand, a sales loss has been recorded under other operating expenses in the unbundled profit and loss account, the sales loss is returned in the calculation of realised adjusted profit.

LEASED NETWORKS

The network operations of a DSO that has leased an electricity network in its possession in part or in whole include all the same income from network operations as those of a DSO that owns its electricity network.

In addition, for example, returns that a DSO receives on network construction it has carried out on the DSO's electricity network are included in full in the income from network operations.

5.2 COSTS OF NETWORK OPERATIONS

In the calculation of realised adjusted profit, the costs entered in the unbundled profit and loss account are used as the costs of network operations. These are adjusted with the profit adjustment items described in this chapter.

According to section 3, paragraph 6 of the Electricity Market Act, electricity network operations mean placing the electricity network at the disposal of those needing electricity transmission and similar network services in return for consideration. Electricity network operations include

- design, construction, maintenance and operation of the electricity network
- connecting customers' electrical devices to the network
- metering of electricity
- other measures required in the transmission of electricity that are necessary in terms of electricity transmission and other network services.

The costs related to these functions constitute the costs of network operations.

Standard compensations and other compensations on outages paid by the DSO to its customers are also costs of network operations.

In accounting, the costs must be allocated to business operations in accordance with the matching principle.

EQUAL TREATMENT OF INVESTMENTS AND EXPENSES IN ACCOUNTING

The DSO is in an equal position regardless of whether it capitalises its costs pertaining to investment or records them as expenses.

The cost of components is not taken into account twice in the regulation methods.

If the component investment is recorded in full as expenses in operational costs, this component is not accepted in the calculation of network value or in the replacement value and net present value. No separate adjustment is made on the component in the calculation of realised adjusted profit, either. A component entered as expense in full has already been taken into account in the operating profit (operating loss) in the unbundled profit and loss account.

Demolition and general costs recorded as expenses are taken into account in the calculation of realised adjusted profit in the same way as other expenses.

The demolition costs of replacement investments, which have been capitalised in the unbundled balance sheet, can be taken into account in adjusted assets invested in network operations in their value according to the unbundled balance sheet as described in chapter 2.2. In such a case, the DSO must provide a breakdown of the capitalised costs arisen from investments as a separate cost item in the notes to the unbundled financial statements.

COSTS NOT PART OF NETWORK OPERATIONS

In the calculation of actual adjusted profit, only costs for which the DSO receives compensation are accepted as costs of network operations.

Uncompensated costs are treated as items of profit distribution nature and they are returned in the calculation of realised adjusted profit. These uncompensated costs include

- tariff difference compensations
- resource and resource provision compensations
- component placing compensations.

If the DSO wishes that these costs are accepted as costs of network operations, the DSO must provide an account of the matter in connection of delivering the regulatory data. The actual compensation received against the DSO’s costs must be verified in the account. The Authority will assess the account and decide on the handling of these costs on its basis.

STANDARD COMPENSATIONS

Standard compensations and other compensations on outages paid by the DSO to its customers by virtue of section 100 of the Electricity Market Act are costs of network operations. Standard compensations treated as sales adjustment are also costs of network operations.

The DSO must specify the standard compensations and other compensations on outages paid to the customers as their own cost items as notes to the unbundled financial statements to be delivered each year to the Energy Market Authority.

COSTS ARISEN FROM JOINING THE ELECTRICITY NETWORK OF ANOTHER DSO

The treatment of the costs of joining another DSO’s electricity network, including connection fees, depends on whether they are refundable or non-refundable.

Refundable costs

Refundable costs and connection fees for joining the electricity network of another DSO are eliminated because they have to be recorded under 'Other receivables' in investments in non-current assets in the unbundled balance sheet in accordance with the statement by the Accounting Board (1670/2001).[11] The elimination is carried in the same way as investments (2.2).

Non-refundable costs

Non-refundable costs and connection fees of joining the electricity network of another DSO are taken into account in adjusted assets invested in network operations if the DSO has entered them in 'Intangible rights' in non-current assets in the unbundled balance sheet in accordance with the statement by the Accounting Board (1905/2013).[12] They are taken into account in their balance sheet value in the way described in chapter 2.2.

If the DSO has recorded non-refundable costs as an expense, they have already been taken into account in the operating profit (operating loss) in the unbundled profit and loss account.

DEPRECIATION OF OTHER ASSETS IN NON-CURRENT ASSETS

In the calculation of the DSO's realised adjusted profit, depreciation according to plan based on the unbundled profit and loss account with respect to depreciation of non-current assets other than network assets shall be used. These items have already been taken into account in the operating profit (operating loss) in the unbundled profit and loss account. Therefore, no separate adjustment is made on them in the calculation of realised adjusted profit.

However, if there are electricity network components in the unbundled balance sheet in other items than in electricity network assets in non-current assets, depreciations made from these components are eliminated from depreciations made on other assets in non-current assets. This is carried out because electricity network components are taken into account in adjusted straight-line depreciations in accordance with chapter 6.1.1.

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[11] Kirjanpitolautakunnan lausunto sähköliittymismaksujen kirjaamisesta (Decision of the Accounting Board of the recording of electricity connection fees) (1670/2001)

[12] Kirjanpitolautakunnan lausunto kantaverkon liittymismaksujen merkitsemisestä liittyjän tilinpäätökseen (Decision of the Accounting Board of the recording of transmission grid connection fees in the connecting customer's financial statements) (1905/2013)

CONTROLLABLE AND NON-CONTROLLABLE OPERATIONAL COSTS

The costs arisen from electricity network operations incurred to the DSO, entered through profit and loss, are divided in the calculation of actual adjusted profit into controllable and non-controllable operational costs. Controllable operational costs are subject to an efficiency target in accordance with the efficiency incentive (6.3).

The definition of controllable operational costs (KOPEX) is presented in Table 5.

Table 5. *Controllable operational costs*

KOPEX	=	Materials, supplies and goods	
		+	Increase or decrease in stocks
		+	Personnel expenses
		+	Operation and maintenance expenses included in network rents and network leasing fees
		+	Cost of leasing
		+	Other external services
		+	Internal expenses
		+	Other operating expenses
		+	Standard compensations paid (if not included in other costs)
		+	Components recorded as expenses (if not included in other items above)
		–	Loss energy purchasing costs
		–	Production for own use
		–	Cost of building the DSO's own network in a leased network
		–	Costs related to Fingrid's usage right fields

Costs other than those referred to in Table 5 are non-controllable operational costs.

LEASED NETWORKS

The network operations of a DSO that has leased an electricity network in its possession in part or in whole include all the same costs of network operations as those of a DSO that owns its electricity network.

A DSO operating in a leased network must specify the operational costs resulting from investments made in the leased network as their own cost items as notes to the unbundled financial statements. These costs are not included in controllable operational costs.

The margin and unitemised cost increases included in the sale price of network sections built in the network by the system operator and network licence holder of a leased network and sold to the network owner are not deducted from controllable operational costs or from network rents.

5.3 FINANCING COSTS OF NETWORK OPERATIONS

Reasonable costs of financial assets are taken into account as financing costs when calculating the realised adjusted profit.

REASONABLE COSTS OF FINANCIAL ASSETS

Network operations require certain financial assets. They are needed to make regular payments because the payment transactions of the DSO take place at somewhat different times from cash payments. They are also needed to make provisions for unexpected expenses.

For this reason, the reasonable costs arising from financial assets necessary to safeguard network operations are taken into account in the calculation of realised adjusted profit. This is carried out using a method of calculation, on the basis of which the costs of financial assets are not unreasonably small or insufficient from the DSO's point of view by virtue of the decision by the Supreme Administrative Court (KHO:2010:86).

The following are taken into account in the financial assets recorded in the unbundled balance sheet:

- short- and long-term receivables with the exception of trade receivables
- marketable securities
- cash and bank receivables and comparable items.

When calculating realised adjusted profit, the amount taken into account with respect to financial assets shall correspond to a maximum of 10% of the turnover of network operations.

The reasonable costs of financial assets can be calculated by multiplying the maximum amount of financial assets by the reasonable cost of debt used in the calculation of a reasonable rate of return (3.3).

This gives the reasonable costs of financial assets required for safeguarding network operations, and they are deducted when calculating the realised adjusted profit.

6 INCENTIVES

6.1 INVESTMENT INCENTIVE

The purpose of the investment incentive is to encourage the DSO to make its investments cost-effectively on average and to enable replacement investments.

The investment incentive consists of the incentive impact of unit prices and the straight-line depreciation calculated from the adjusted replacement value.

The incentive impact of unit prices directs the DSO to invest more effectively than on average and to find more cost-effective methods of implementation than before. The incentive impact arises from the difference between investments calculated with unit prices and the cost of realised investments. When investing cost-effectively on average, the DSO will get a higher value for its investments than the actual investments (adjusted replacement value).

Together with the net present value, the incentive impact of the straight-line depreciation calculated from the DSO’s adjusted replacement value directs the DSO to maintain its network in accordance with the lifetimes it has selected in actual use as part of the network assets and enables the making of sufficient replacement investments.

The incentive impact arises from the fact that the methods allow for the DSO an annual depreciation level based on average adjusted straight-line depreciation on the basis of the lifetimes selected by the DSO. Imputed straight-line depreciations are always allowed in full as far as the component is in actual use. Therefore, imputed straight-line depreciation is calculated for the component even after the end of the lifetime if the component is still in actual use.

When the lifetime has been correctly selected, the straight-line depreciation of the investment incentive enables and covers on average all necessary replacement investments, also including early replacement investments. In other words, the investment incentive enables full depreciation of the replacement value of network components. Straight-line depreciation is permitted for components that have exceeded their lifetime in the same relation as the depreciated cost of the components that have correspondingly been demolished before reaching the end of their lifetimes. Therefore, the incentive also takes into account early replacement investments that improve the security of supply and enables early replacement investments carried out to achieve the criteria for the security of supply in as far as the DSO has been able to predict these when selecting the lifetimes for the fourth regulatory period.

6.1.1 Adjusted straight-line depreciations

The adjusted straight-line depreciations on the electricity network assets are calculated per network component from the adjusted replacement value of the electricity network assets (2.1.1). Adjusted straight-line depreciations are calculated for all years of the regulatory period in the situation on the last day of December in the year in question. As the unit prices will not be updated for the fifth regulatory period and inflation is not taken into account in the unit prices, the change in inflation is taken into account with the consumer price index in the calculation of straight-line depreciation.

The calculation of adjusted straight-line depreciation of network component i for year k is presented in Formula 16.

$$JHATP_{i,k} = \frac{JHA_i}{lifetime_i} \times \left(\frac{KHI_k}{KHI_{2016}} \right) \tag{16}$$

Adjusted straight-line depreciations for the entire electricity network is calculated as a sum of adjusted straight-line depreciations of the network components in accordance with Formula 17.

$$JHATP_k = \sum_{i=1}^{n} \left(\frac{JHA_i}{lifetime_i} \right) \times \left(\frac{KHI_k}{KHI_{2016}} \right) \tag{17}$$

in formulae 16 and 17

$JHATP_{i,k}$ = adjusted straight-line depreciation of network component i in year k

$JHATP_k$	=	adjusted straight-line depreciations of all electricity network assets in year *k*
JHA_i	=	adjusted replacement value of network component *i*
$lifetime_i$	=	techno-economical lifetime of network component *i*
KHI_k	=	consumer price index in year *k*
KHI_{2016}	=	consumer price index in *2016*

SUBSIDIES RECEIVED FOR THE CONSTRUCTION OF THE NETWORK

The DSO may receive subsidies or other compensation for investment made in the network, for example, from the Finnish state or the European Union. Components funded with subsidies or compensations are taken into account in the adjusted replacement value of the electricity network assets when calculating adjusted straight-line depreciations of the electricity network assets in the investment incentive.

6.1.2 Investment incentive in the calculation of realised adjusted profit

The impact of the investment incentive is deducted when calculating realised adjusted profit. The impact of the investment incentive on the realised adjusted profit is calculated annually in accordance with the formula (17).

6.2 QUALITY INCENTIVE

The purpose of the quality incentive is to encourage the DSO to develop the quality of electricity transmission and distribution.

The DSO is encouraged to achieve at least the level of security of supply required by the Electricity Market Act. The Authority aims to guide the DSO to also develop the quality of electricity transmission and distribution of its own accord to a level higher than the minimum level required by law.

Full regulatory outage costs instead of half of these costs, as previously used, are used in the quality incentive. This increases the speed of impact in improving the security of supply in the incentive.

6.2.1 Regulatory outage costs

Regulatory outage costs, i.e. the disadvantage caused by outages, are calculated on the basis of the number and duration of outages, as well as the unit prices of outages.

OUTAGES

Outages used in the quality incentive consist of the information about the number and duration of outages declared by the DSO in the regulatory data in accordance with the regulation on key figures.

Distribution system operator

In the fourth regulatory period, the following information is taken into account, resulting from the medium-voltage distribution network:

- the number and duration of planned outages
- the number and duration of unexpected outages
- the number of high-speed autoreclosers
- the number of time-delayed autoreclosers.

The Authority has also collected information from the DSOs regarding outages in their high-voltage distribution network since 2013.

In the fifth regulatory period, the following information is taken into account, resulting from the medium-voltage and high-voltage distribution network:

- the number and duration of planned outages
- the number and duration of unexpected outages
- the number of high-speed autoreclosers
- the number of time-delayed autoreclosers.

High-voltage distribution system operator

In the fourth regulatory period, the following information is taken into account, resulting from the high-voltage distribution network:

- the duration of planned outages
- the number and duration of unexpected outages

The Authority has also collected information from the high-voltage distribution system operator about the number of its planned outages, high-speed autoreclosers and time-delayed autoreclosers since 2013.

In the fifth regulatory period, the following information is taken into account, resulting from the high-voltage distribution network:

- the number and duration of planned outages
- the number and duration of unexpected outages
- the number of high-speed autoreclosers
- the number of time-delayed autoreclosers.

UNIT PRICES OF OUTAGES

The values presented in Table 6 are used as the unit prices of outages. These values are based on the study commissioned by the Authority from the Helsinki University of Technology and the Tampere University of Technology.[13]

The outage prices according to the study have been adjusted for the quality incentive so that the disadvantage caused by outages would describe the disadvantage experienced by customers as accurately as possible. The unit prices of outages have been adjusted in the studies commissioned by the Authority from the Lappeenranta University of Technology and the Tampere University of Technology.[14, 15]

The timeliness of the unit prices of outages has been studied with respect to consumers in a study commissioned by Gaia Consulting Oy.[16]

Based on the studies, it is still justified to carry on using the unit prices in accordance with Table 6 in the valuation of the disadvantage caused by outages.

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13 Helsinki University of Technology, Tampere University of Technology / Silvast Antti; Heine Pirjo; Lehtonen Matti; Kivikko Kimmo; Mäkinen Antti; Järventausta Pertti: Sähkönjakelun keskeytyksistä aiheutuva haitta (Disadvantage caused by electricity distribution outages), December 2005

14 Lappeenranta University of Technology / Honkapuro Samuli; Tahvanainen Kaisa; Viljainen Satu; Lassila Jukka; Partanen Jarmo; Kivikko Kimmo; Mäkinen Antti; Järventausta Pertti: DEA-mallilla suoritettavan tehokkuusmittauksen kehittäminen (Further development of the efficiency measurement model based on the DEA method), 8 December 2006

15 Lappeenranta University of Technology, Tampere University of Technology / Honkapuro Samuli; Tahvanainen Kaisa; Viljainen Satu; Partanen Jarmo; Mäkinen Antti; Verho Pekka; Järventausta Pertti: Keskeytystunnuslukujen referenssiarvojen määrittäminen (Determining the reference values for outage key figures), 18 May 2007

16 Gaia Consulting Oy, Karttunen Ville; Vanhanen Juha; Partanen Jarmo; Matschoss Kaisa; Bröckl Marika; Haakana Juha; Hagström Markku; Lassila Jukka; Pesola Aki; and Vehviläinen Iivo: Selvitys laatukannustimen toimivuudesta ja kehitystarpeista vuosille 2016–2023 (Study on the functioning and development needs of the quality incentive for 2016–2023), 27 October 2014

The unit prices in the table are in the 2005 value of money. In the calculation of the reference level of the regulatory outage costs and realised regulatory outage costs, the unit prices are adjusted to the value of money in each year using the consumer price index in accordance with chapter 1.8.

Table 6. *Unit prices of the disadvantage caused by outages*

Unexpected outage		**Planned outage**		**Time-delayed autorecloser**	**High-speed autorecloser**
$h_{E,unexp}$	$h_{W,unexp}$	$h_{E,plann}$	$h_{W,plann}$	h_{AJK}	h_{PJK}
€ / kWh	€ / kWh	€ / kWh	€ / kWh	€ / kWh	€ / kWh
11.0	**1.1**	**6.8**	**0.5**	**1.1**	**0.55**

6.2.2 The reference level of regulatory outage costs in the fourth regulatory period

The determination of the reference level of the quality incentive has been examined in the study commissioned by the Energy Authority from Gaia Consulting Oy.[12] In the study, the matter was examined especially from the viewpoint of the security of supply requirements of the Electricity Market Act. The matter has also been dealt with in a study commissioned by the Authority from the Tampere University of Technology and the Lappeenranta University of Technology.[17] In the study, the matter was examined especially from the viewpoint of the risk of major supply interruptions.

The DSO’s average realised regulatory outage costs for the two previous regulatory periods, i.e. eight years, are used as the reference level of regulatory outage costs. In the fourth regulatory period, the average realised regulatory outage costs for 2008–2015 will be used as the reference level.

When the reference level is calculated, the impacts of major supply interruptions are not removed even though the impact of the quality incentive in the calculation

[17] Tampere University of Technology, Lappeenranta University of Technology / Verho Pekka; Strandén Janne; Nurmi Veli-Pekka; Mäkinen Antti; Järventausta Pertti; Hagqvist Olli; Partanen Jarmo; Lassila Jukka; Kaipia Tero; Honkapuro Samuli: Nykyisen valvontamallin arviointi – suurhäiriöriski (Assessment of the current regulatory model – risk of major disturbance), 24 November 2010

of realised adjusted profits has been made reasonable also in the previous regulatory periods. Major supply interruptions are taken into account in the reference level as this compensates the costs arisen from them to the DSO.

The reference level is adjusted with the annual energy transmitted to the customers in order to make the reference level of regulatory outage costs comparable with the realised regulatory outage costs with respect to the transmitted energy.

DISTRIBUTION SYSTEM OPERATOR

The calculation of the reference level of regulatory outage costs in the medium-voltage distribution network in the fourth regulatory period is presented in Formula 18.

$$KAH_{ref,k} = \frac{\sum_{t=2008}^{2015}\left[KAH_{t,k}^{KJ} \times \left(\frac{W_k}{W_t}\right)\right]}{8} \tag{18}$$

The calculation of realised regulatory outage costs in the medium-voltage distribution network is presented in Formula 19.

$$KAH_{t,k}^{KJ} = \begin{pmatrix} KA_{unexp,t}^{KJ} \times h_{E,unexp} + KM_{unexp,t}^{KJ} \times h_{W,unexp} + \\ KA_{plann,t}^{KJ} \times h_{E,plann} + KM_{plann,t}^{KJ} \times h_{W,plann} + \\ AJK_t^{KJ} \times h_{AJK} + PJK_t^{KJ} \times h_{PJK} \end{pmatrix} \times \left(\frac{W_t}{T_t}\right) \times \left(\frac{KHI_k}{KHI_{2005}}\right) \tag{19}$$

in formulae 18 and 19

$KAH_{ref,k}$	=	reference level of regulatory outage costs for year k, EUR
$KAH^{KJ}_{t,k}$	=	realised regulatory outage costs in the medium-voltage distribution network in year t in the value of money for year k, EUR
W_k	=	volume of transmitted energy in year k, kilowatt-hours
W_t	=	volume of transmitted energy in year t, kilowatt-hours
k	=	year 2016, 2017, 2018 or 2019

t	=	year 2008, 2009, 2010, 2011, 2012, 2013, 2014 or 2015
$KA^{KJ}_{unexp,t}$	=	outage period caused by unexpected outages in the medium-voltage distribution network, weighted by annual energies, hours
$h_{E,unexp}$	=	unit price of disadvantage for the outage period, caused by unexpected outages, EUR/kilowatt-hour
$KM^{KJ}_{unexp,t}$	=	outage period caused by unexpected outages in the medium-voltage distribution network, weighted by annual energies, number
$h_{W,unexp}$	=	unit price of disadvantage for the outage amount, caused by unexpected outages, EUR/kilowatt
$KA^{KJ}_{plann,t}$	=	outage period caused by planned outages in the medium-voltage distribution network, weighted by annual energies, hours
$h_{E,plann}$	=	unit price of disadvantage for the outage period, caused by planned outages, EUR/kilowatt-hour
$KM^{KJ}_{plann,t}$	=	outage amount caused by planned outages in the medium-voltage distribution network, weighted by annual energies, number
$h_{W,plann}$	=	unit price of disadvantage for the outage amount, caused by planned outages, EUR/kilowatt
AJK^{KJ}_{t}	=	outage amount caused by time-delayed autoreclosers in the medium-voltage distribution network, weighted by annual energies, number
h_{AJK}	=	unit price of disadvantage for the outage amount, caused by time-delayed autoreclosers, EUR/kilowatt
PJK^{KJ}_{t}	=	outage amount caused by high-speed autoreclosers in the medium-voltage distribution network, weighted by annual energies, number
h_{PJK}	=	unit price of disadvantage for the outage amount, caused by high-speed autoreclosers, EUR/kilowatt
T_t	=	number of hours in year t
KHI_k	=	consumer price index in year k
KHI_{2005}	=	consumer price index in year 2005

HIGH-VOLTAGE DISTRIBUTION SYSTEM OPERATOR

The calculation of the reference level of regulatory outage costs in the high-voltage distribution network in the fourth regulatory period is presented in Formula 20.

$$KAH_{ref,k} = \frac{\sum_{t=2008}^{2015}\left[KAH_{t,k}^{SJ} \times \left(\frac{W_k}{W_t}\right)\right]}{8} \qquad (20)$$

The calculation of realised regulatory outage costs in the high-voltage distribution network in the fourth regulatory period is presented in Formula 21.

$$KAH_{t,k}^{SJ} = \begin{pmatrix} KA_{unexp,t}^{SJ} \times h_{E,unexp} + \\ KM_{unexp,t}^{SJ} \times h_{W,unexp} + \\ KA_{plann,t}^{SJ} \times h_{E,plann} \end{pmatrix} \times \left(\frac{W_t}{T_t}\right) \times \left(\frac{KHI_k}{KHI_{2005}}\right) \qquad (21)$$

in formulae 20 and 21, the new factors in relation to formulae 18 and 19 are

$KAH^{SJ}_{t,k}$ = realised regulatory outage costs in the high-voltage distribution network in year t in the value of money in year k, EUR

$KA^{SJ}_{unexp,t}$ = average outage time of connection points caused by unexpected outages in the high-voltage distribution network, hours/connection point

$KM^{SJ}_{unexp,t}$ = average outage time of connection points caused by unexpected outages in the high-voltage distribution network, number/connection point

$KA^{SJ}_{plann,t}$ = average outage time of connection points caused by planned outages in the high-voltage distribution network, hours/connection point

6.2.3 The reference level of regulatory outage costs in the fifth regulatory period

DISTRIBUTION SYSTEM OPERATOR

In the fifth regulatory period, the regulatory outage costs is also taken into account in the DSO's high-voltage distribution network in the calculation of the reference level.

The reference level used in the fifth regulatory period is the sum of the average realised regulatory outage costs in the medium-voltage distribution network in 2012–2019 and in the high-voltage distribution network in 2013–2019.

The calculation of the reference level of regulatory outage costs in the distribution network in the fifth regulatory period is presented in Formula 22.

$$KAH_{ref,k} = \frac{\sum_{t=2012}^{2019}\left[KAH_{t,k}^{KJ} \times \left(\frac{W_k}{W_t}\right)\right]}{8} + \frac{\sum_{t=2013}^{2019}\left[KAH_{t,k}^{SJ} \times \left(\frac{W_k}{W_t}\right)\right]}{7} \quad (22)$$

where the differences with formulae 18 and 20 are

k = year 2020, 2021, 2022 or 2023

t = year 2012, 2013, 2014, 2015, 2016, 2017, 2018 or 2019

HIGH-VOLTAGE DISTRIBUTION SYSTEM OPERATOR

In the fifth regulatory period, the number of planned outages, time-delayed autoreclosers and high-speed autoreclosers are also taken into account in the high-voltage distribution network.

In the fifth regulatory period, the average realised regulatory outage costs for 2013–2019 in the high-voltage distribution network will be used as the reference level.

The calculation of the reference level of regulatory outage costs in the high-voltage distribution network in the fifth regulatory period is presented in Formula 23.

$$KAH_{ref,k} = \frac{\sum_{t=2013}^{2019} \left[KAH_{t,k}^{SJ} \times \left(\frac{W_k}{W_t} \right) \right]}{7} \tag{23}$$

The calculation of realised regulatory outage costs in the high-voltage distribution network in the fifth regulatory period is presented in Formula 24.

$$KAH_{t,k}^{SJ} = \begin{pmatrix} KA_{unexp,t}^{SJ} \times h_{E,unexp} + KM_{unexp,t}^{SJ} \times h_{W,unexp} + \\ KA_{plann,t}^{SJ} \times h_{E,plann} + KM_{plann,t}^{SJ} \times h_{W,plann} + \\ AJK_t^{SJ} \times h_{AJK} + PJK_t^{SJ} \times h_{PJK} \end{pmatrix} \times \left(\frac{W_k}{T_t} \right) \times \left(\frac{KHI_k}{KHI_{2005}} \right) \tag{24}$$

where the new factors with respect to formulae 21 and 22 are

$KM^{SJ}{}_{plann,t}$ = the average number of outages in connection points caused by planned outages in the high-voltage distribution network, number/connection point

$AJK^{SJ}{}_t$ = the average number of outages in connection points caused by time-delayed autoreclosers in the high-voltage distribution network, number/connection point

$PJK^{SJ}{}_t$ = the average number of outages in connection points caused by high-speed autoreclosers in the high-voltage distribution network, number/connection point

6.2.4 Realised regulatory outage costs in the fourth regulatory period

The disadvantage caused by outages to the DSO's customers are calculated each year.

DISTRIBUTION SYSTEM OPERATOR

In the fourth regulatory period, the realised regulatory outage costs of the distribution network are calculated on the basis of medium-voltage distribution network outages $KAH^{KJ}{}_t$ in accordance with Formula 19. The difference with Formula 19 is

$t = k$ = the year under review, i.e. year 2016, 2017, 2018 or 2019

HIGH-VOLTAGE DISTRIBUTION SYSTEM OPERATOR

In the fourth regulatory period, the realised regulatory outage costs in the high-voltage distribution network $KAH^{SJ}{}_t$ are calculated according to Formula 21. The difference with Formula 21 is

$t = k$ = the year under review, i.e. year 2016, 2017, 2018 or 2019

6.2.5 Realised regulatory outage costs in the fifth regulatory period

The disadvantage caused by outages to the DSO's customers are calculated each year.

DISTRIBUTION SYSTEM OPERATOR

In the fifth regulatory period, outages in the DSO's high-voltage distribution network are also included in the quality incentive.

In that period, realised regulatory outage costs are composed of the sum of regulatory outage costs in the medium-voltage distribution network and the high-voltage distribution network in accordance with Formula 25.

$$KAH_t = KAH^{KJ}{}_t + KAH^{SJ}{}_t \qquad (25)$$

Realised regulatory outage costs of the medium-voltage distribution network $KAH^{KJ}{}_t$ are calculated in accordance with Formula 19.

The realised regulatory outage costs in the high-voltage distribution network $KAH^{SJ}{}_t$ are calculated according to Formula 24.

The difference with formulae 19 and 24 are

$t = k$ = the year under review, i.e. year 2020, 2021, 2022 or 2023

HIGH-VOLTAGE DISTRIBUTION SYSTEM OPERATOR

In the fifth regulatory period, the number of planned outages, time-delayed autoreclosers and high-speed autoreclosers of the high-voltage distribution network are also taken into account in the quality incentive.

In the fifth regulatory period, the realised regulatory outage costs in the high-voltage distribution network $KAH^{SJ}{}_t$ are calculated according to Formula 24. The difference with Formula 24 is

$t = k$ = the year under review, i.e. year 2020, 2021, 2022 or 2023

6.2.6 Quality incentive in the calculation of realised adjusted profit

The impact of the quality incentive is deducted when calculating realised adjusted profit.

The impact of the quality incentive is calculated so that the realised regulatory outage costs are deducted from the reference level of regulatory outage costs.

The maximum impact of the quality incentive in the calculation of realised adjusted profit is made reasonable. The greatest deviations in annual outage numbers and durations are taken into account by setting limit values, or so-called floor and ceiling levels, for the quality incentive. This means that the difference of the reference level of regulatory outage costs and the realised imputed regulatory outage costs that is higher than the set limit value will have no impact on the calculation of the DSO's realised adjusted profit.

The impact of the quality incentive taken into account in the calculation of realised adjusted profit may not be higher than 15% of the DSO's reasonable return in the year in question. This applies to the quality bonus for improved quality and the quality sanction resulting from a reduction in quality.

The quality incentive must also be symmetric for the DSO whose highest possible quality bonus is less than 15% of the DSO's reasonable return for the year in question. For this reason, the maximum amount of any quality sanction may only be as high as the maximum possible quality bonus.

6.3 EFFICIENCY INCENTIVE

The purpose of the efficiency incentive is to encourage the DSO to operate in a cost-effective way.

The operation of a DSO is cost-effective when the input, or costs, used in its operations are as small as possible in relation to the output of operations.

ON THE CALCULATION OF THE EFFICIENCY INCENTIVE

The calculation of the DSO's efficiency incentive consists of six different factors:

- general efficiency target (6.3.1)
- variables in the measuring of company-specific efficiency (6.3.2)
- company-specific efficiency target (6.3.3)
- reference level of company-specific efficiency costs (6.3.4)
- company-specific realised efficiency costs (6.3.5)
- efficiency incentive in the calculation of realised adjusted profit (6.3.7).

Calculation of the efficiency incentive for a high-voltage distribution system operator is described in chapter 6.3.6. Chapter 6.3.7 also deals with the calculation.

6.3.1 General efficiency target

The purpose of the general efficiency target is to encourage DSOs, including those found to be efficient in the efficiency measurement, to improve the efficiency of their operations in accordance with the general productivity development.

In the regulation of monopoly operations, it is natural to set a general efficiency target for enterprises.

PRODUCTIVITY DEVELOPMENT IN THE NETWORK INDUSTRY

A study[18] commissioned by the Energy Authority has assessed the level of the general efficiency target by examining productivity development in various network activities.

The productivity figures vary depending on the network operations and the period of examination. The study recommends defining the general efficiency target on the basis of long-term productivity development.

[18] Sigma-Hat Economics Oy / Kuosmanen, T.; Saastamoinen, A.; Keshvari, A.; Johnson, A.; & Parmeter, C.: Yleinen tehostamistavoite sähkön ja maakaasun siirto- ja jakeluverkkotoiminnan valvontamalleissa sekä tehostamiskannustimen arviointi: Ehdotus Energiaviraston soveltamien menetelmien kehittämiseksi neljännellä valvontajaksolla 2016 – 2019 (General efficiency target in the regulatory models for electricity and natural gas transmission and distribution network operations and an assessment of the efficiency incentive: a proposal for the development of methods applied by the Energy Authority in the fourth regulatory period 2016–2019), 21 October 2014

Based on this, the study recommends the same annual general efficiency target with a value of two per cent for all network activities.

NEW TASKS AND METHODS OF OPERATION

As a result of changes in legislation, the DSO has been assigned with new tasks, and will probably do so also in the future. Old tasks are still required to be carried out with new kinds of methods of operation. For example, hourly metering and remote reading have been adopted in energy metering.

It is difficult to take into account the extra costs resulting from the new tasks and methods and, on the other hand, the cost savings they bring, in a reliable way in the calculation of realised adjusted profit.

The Authority believes that the clearest and sufficiently appropriate way to take these costs and benefits into account in the calculation of realised adjusted profit is to revise the level of the general efficiency target.

THE LEVEL TO BE APPLIED

The value of the general efficiency target used in the fourth and fifth regulatory period is 0% instead of the two per cent determined on the basis of the long-term productivity development.

This compensates the impacts of extra costs resulting from new tasks and methods of operation to the DSO in the calculation of realised adjusted profit.

6.3.2 Variables in the measurement of company-specific efficiency

The variables in the measurement of company-specific efficiency target consist of the input variables, output variables and the operating environment variable.

INPUT VARIABLES

The following are used as input variables:

- controllable operational costs (KOPEX), EUR
- the replacement value of the electricity network (JHA), EUR.

The controllable operational costs and the replacement value are handled as separate variables and are not added together.

The controllable operational costs are modelled as a variable input, which the efficiency target is aimed at. The replacement value is modelled as a fixed input which has no efficiency target.

The items included in controllable operational costs are presented in Table 5 in chapter 5.2.

OUTPUT VARIABLES

The following are used as output variables:

- volume of transmitted energy, GWh
- total length of the electricity network, km
- metering points, number of
- regulatory outage costs (KAH), EUR.

The amount of transmitted energy takes into account the average load of the electricity network and the resulting costs. The volume of energy is weighted with the average national transmission tariffs for different voltage levels.

The total length of the electricity network and the number of metering points take into account the costs resulting from the extent of the network. These variables and their ratio (total length / number of metering points) also distinguish DSOs operating in population centres and rural areas from one another.

The regulatory outage costs take into account the costs resulting from outages and the costs resulting from avoiding them. Regulatory outage costs are not ordinary output variables. Outputs cannot be increased by increasing regulatory outage costs. They are not necessary in terms of the operations, either, but are only a by-product. Therefore, they are modelled as an unwanted output variable, i.e. a disadvantage.

OPERATING ENVIRONMENT VARIABLE

The ratio of the number of connections and metering points (connections / metering points, L/K ratio) is used as the operating environment variable.

The L/K ratio takes into account higher costs resulting from a less-populated operating environment. The ratio describes the proportion of metering points connected to the network through the same connection. This ratio is also suitable for modelling because it remains fairly stable over time.

The value of ratio is limited between zero and one. It is smallest with DSOs operating in urban conditions. It is close to one with many DSOs operating in sparsely populated areas.

6.3.3 Company-specific efficiency target

The purpose of the company-specific efficiency target is to encourage DSOs found to be inefficient in the efficiency measurement to achieve a level of efficient operations.

The Authority has commissioned a study on efficiency measurement from Sigma-Hat Economics Oy.[19] In the study, the StoNED (Stochastic Non-smooth Envelopment of Data) method applied in the efficiency measurement of DSOs was assessed and developed.

The method has been developed with respect to the model specification and estimation for the efficiency incentive.

MODEL SPECIFICATION FOR THE EFFICIENCY FRONTIER

The efficiency frontier is estimated with the StoNED method. The model specification used in the calculation is presented in Formula 26.

$$ln\ x = ln\ IR(x, y) + \delta' z + u + v \qquad (26)$$

where

x = controllable operational costs

IR = input need function that meets the set conditions of monotony, concave and scale returns

= vector for fixed inputs

y = output vector

δ' = vector describing the marginal impacts of heterogeneity

[19] Sigma-Hat Economics Oy / Kuosmanen, T.; Saastamoinen, A.; Keshvari, A.; Johnson, A.; & Parmeter, C.: Tehostamiskannustin sähkön jakeluverkkoyhtiöiden valvontamallissa: Ehdotus Energiaviraston soveltamien menetelmien kehittämiseksi neljännellä valvontajaksolla 2016 – 2019 (The efficiency incentive in the regulatory model for electricity distribution network companies: a proposal for the development of methods applied by the Energy Authority in the fourth regulatory period 2016–2019), 21 October 2014

z	=	vector for factors describing heterogeneity
u	=	expected value of inefficiency – estimated without distribution assumptions with the nonparametric kernel deconvolution method
v	=	random error

ESTIMATION OF EFFICIENCY FRONTIER

The efficiency frontier, on the basis of which the DSO-specific efficiency incentive is calculated, is estimated with the methods presented in this appendix. The Energy Authority estimates the efficiency frontier and calculates DSO-specific efficiency targets once all the necessary initial data has been inspected by 30 June 2016.

The efficiency frontier is estimated for the fourth regulatory period and it will not be estimated in the other years of the regulatory period. In the estimation, the DSO's regulatory data for 2008–2014 is used as the initial data for variables in accordance with chapter 6.3.1.

The expense items in accordance with the regulatory data for 2008–2014 are used as the controllable operational costs. These are adjusted with the consumer price index to the 2014 level.

The adjusted replacement values of the electricity network assets according to the regulatory data for 2008–2014 are used as the replacement value. These are adjusted with the consumer price index to the 2014 level.

The efficiency frontier is re-estimated for the fifth regulatory period in 2019. Estimation will be carried out in the same way as for the fourth regulatory period. In the estimation, regulatory data for 2012–2018 is used as the initial data for variables in accordance with chapter 6.3.2. These are adjusted with the consumer price index to the 2018 level.

The material used in the estimation of the efficiency frontier is treated as unbalanced panel material.

DSOs that have ceased network operations are treated in the material as separate observation units until they have ceased operations. Merged DSOs are handled as a single observation unit as from the year of merger.

Study for 2014

A study[15] commissioned by the Authority has used the regulatory data for 2005–2012, adjusted with the consumer price index to the 2010 level.

The data includes a total of 89 DSOs. Ten of these have merged with another DSO during or after the period under review.

The study had a total of 690 observation units.

EFFICIENCY FIGURE

The efficiency figure tells the ratio between a reasonable cost level and a realised cost level.

The efficiency figure can be calculated for every year used in the estimation in connection with the estimation of the efficiency frontier. An imputed efficiency figure calculated on the basis of the average of regulatory data for 2011–2014 (input and output data and the operating environment variable) will be used in the definition of the efficiency target in the fourth regulatory period.

Using the average reduces the impact of annual variation in the output variables in the definition of the efficiency target and reasonable controllable operational costs (SKOPEX).

In the fifth regulatory period, the imputed efficiency figure is determined according to the average of regulatory data for 2015–2018 (input and output data and the operating environment variable). In the fifth regulatory period, there is no transition period left and the efficiency target for the transition period is not needed.

EFFICIENCY FIGURE IN THE FOURTH REGULATORY PERIOD

The imputed efficiency figure for 2016–2019 is calculated as a quotient of reasonable and realised controllable operational costs in accordance with Formula 27.

$$TL_{2016\text{-}2019} = \frac{SKOPEX_{2011\text{-}2014}}{KOPEX_{2011\text{-}2014}} \qquad (27)$$

where

$SKOPEX_{2011\text{-}2014}$ = DSO's reasonable controllable operational costs calculated on the basis of the average of regulatory data for 2011–2014.

$KOPEX_{2011\text{-}2014}$ = average of the DSO's controllable operational costs realised in 2011–2014.

$TL_{2016\text{-}2019}$ = DSO's imputed efficiency figure in 2016–2019

EFFICIENCY FIGURE IN THE FIFTH REGULATORY PERIOD

The imputed efficiency figure for 2020–2023 is calculated as a quotient of reasonable and realised controllable operational costs in accordance with Formula 28.

$$TL_{2020\text{-}2023} = \frac{SKOPEX_{2015\text{-}2018}}{KOPEX_{2015\text{-}2018}} \quad (28)$$

where

$SKOPEX_{2015\text{-}2018}$ = DSO's reasonable controllable operational costs calculated on the basis of the average of regulatory data for 2015–2018.

$KOPEX_{2015\text{-}2018}$ = average of the DSO's controllable operational costs realised in 2015–2018.

$TL_{2020\text{-}2023}$ = DSO's imputed efficiency figure in 2020–2023

TRANSITION PERIOD

A transition period is determined for the improvement of efficiency, during which the DSO must reach a cost level according to efficient operations, i.e. the efficiency target will be distributed over several years.

During the transition period, four years, i.e. the fourth regulatory period of 2016–2019, will be used on the basis of the study[15] commissioned by the Authority.

The DSO may opt out of the transition period and start applying the cost level according to the efficiency frontier straight away. In such a case, the term $(1 - X_{2016\text{-}2019})^{t-2020}$ in Formula 32 is assigned a value of 1.

EFFICIENCY TARGET IN THE FOURTH REGULATORY PERIOD (DURING THE TRANSITION PERIOD)

The efficiency target is based on the DSO's observed potential for improvement of efficiency.

The calculation of efficiency improvement potential is based on the DSO's realised controllable operational costs, which the efficiency target is aimed at. These are compared with the reasonable controllable operational costs in accordance with the efficiency frontier. The efficiency frontier has been estimated on the basis of the DSO's all cost and output data.

The calculation of the efficiency target for 2016–2019 is presented in Formula 29.

$$X_{2016\text{-}2019} = 1 - (TL_{2016\text{-}2019})^{1/4} \times (1 - YL) \qquad (29)$$

where

$X_{2016\text{-}2016}$ = efficiency target 2016–2019

YL = general efficiency target

As the general efficiency target in the fourth regulatory period is 0%, the efficiency target then only consists of the company-specific efficiency target in accordance with Formula 30.

$$X_{2016\text{-}2019} = 1 - (TL_{2016\text{-}2019})^{1/4} \qquad (30)$$

EFFICIENCY TARGET IN THE FIFTH REGULATORY PERIOD

The transition period has ended by the start of the fifth regulatory period. In the fifth regulatory period, the DSO's realised controllable operational costs are compared directly with the level of reasonable controllable operational costs in accordance with the efficiency frontier.

REASONABLE COSTS IN ACCORDANCE WITH THE EFFICIENCY FRONTIER

The efficiency frontier is used for determining the DSO's reasonable controllable operational costs at an output level according to efficient operations. These reasonable costs (SKOPEX) are used as the reference level for realised controllable operational costs.

The DSOs' different operating environments and output profiles are taken into account in the estimation of the efficiency frontier with different shadow price profiles.

The efficiency frontier can be presented as shadow price profiles, which are based on marginal costs. The shadow price tells the sum in euros, the change of one unit in the output variable of which has an impact on the calculation of SKOPEX. The replacement value of the electricity network is also estimated in the model in the same way as the output variable, and a shadow price is obtained.

The shadow price profiles of the efficiency frontier differ from one another with respect to the height of the shadow price they allow for different output variables. Some shadow price profiles put more weight, for example, on the amount of transmitted energy, some on the number of customers or the network length.

With the exception of regulatory outage costs, the shadow prices of output variables always have positive values, i.e. they have an increasing impact on SKOPEX. The shadow price of regulatory outage costs may have positive and negative values, i.e. it has an increasing or decreasing impact on SKOPEX. The shadow price of the replacement value of the electricity network is always negative or zero, i.e. it has a decreasing or no impact on SKOPEX.

A shadow price profile that maximises the DSO's SKOPEX is selected automatically.

SKOPEX is calculated as the product of the shadow price profile that maximises it and the outputs, and this product is multiplied with the impact of the operating environment variable and the expected value of inefficiency.

The calculation of reasonable controllable operational costs is presented in Formula 31.

$$SKOPEX = I\hat{R}^{StoNED}(x, y) \times \exp(\hat{\delta}' z) \quad (31)$$

where

$I\hat{R}^{StoNED}(x, y)$	=	the product of outputs and the shadow prices according to the shadow price profile that maximise SKOPEX
$\exp(\hat{\delta}' z)$	=	impact of the operating environment variable and the expected value of inefficiency

6.3.4 Reference level of efficiency costs

The reasonable controllable operations costs (SKOPEX) are used as the reference level of efficiency costs. The reference level is calculated annually.

When the reference level is calculated annually, the changes taking place in the output variables are also taken into account.

Regulatory outage costs and the replacement value of the electricity network have been fixed to the average level of 2011–2014 in the calculation of the reference level in the fourth regulatory period. In the fifth regulatory period, regulatory outage costs and the replacement value of the electricity network have been fixed to the average level of 2015–2018.

Using the average values reduces the impact of annual variation of these variables in the definition of reasonable controllable operational costs.

In the inflation adjustment, the average values of the consumer price index in April–September of the year under review are used in the way presented in chapter 1.8.

REFERENCE LEVEL IN THE FOURTH REGULATORY PERIOD

The calculation of the reference level during the transition period in 2016–2019 is presented in Formula 32.

$$SKOPEX_t = \hat{IR}^{StoNED}(x_t, y_t) \times \exp(\hat{\delta}' z_t) \times (1 - YL)^4 \times (KHI_t / KHI_{2014}) \times (1 - X_{2016\text{-}2019})^{t-2020} \quad (32)$$

where

$SKOPEX_t$	=	the reference level of efficiency costs, i.e. reasonable controllable operational costs
$\hat{IR}^{StoNED}(x_t, y_t)$	=	the product of outputs and the shadow prices according to the shadow price profile that maximise SKOPEX
$\exp(\hat{\delta}' z_t)$	=	impact of the operating environment variable and the expected value of inefficiency
KHI_t	=	consumer price index in year t
KHI_{2014}	=	consumer price index in year 2014

X	=	efficiency target in the transition period in 2016–2019
$(1 - YL)^{4}$	=	technical development in 2016–2019; as the general efficiency target is zero, this factor is assigned a value of 1
$(1 - X_{2016-2019})^{t-2020}$	=	impact of the transition period
t	=	year 2016, 2017, 2018 or 2019

REFERENCE LEVEL IN THE FIFTH REGULATORY PERIOD

In the fifth regulatory period, the transition period has ended.

The calculation of the reference level in 2020–2023 is presented in Formula 33.

$$SKOPEX_t = I\hat{R}^{StoNED}(x_t, y_t) \times \exp(\hat{\delta}' z_t) \times (1 - YL)^{t-2015} \times (KHI_t / KHI_{2018}) \times (1 - X_{2016-2019})^{t-2020} \quad (33)$$

where the differences with Formula 32 are

KHI_{2018}	=	consumer price index in year *2018*
$(1 - YL)^{t-2015}$	=	technical development in 2020–2023; as the general efficiency target is zero, this factor is assigned a value of 1
$(1 - X_{2016-2019})^{t-2020}$	=	impact of the transition period; as the transition period has ended, this factor is assigned a value of 1
t	=	year 2020, 2021, 2022 or 2023

6.3.5 Handling of a merged DSO

When two or more DSOs merge, the reference level of the merged company, i.e. reasonable controllable operational costs (SKOPEX), are determined in relation to the estimated efficiency frontier. The efficiency frontier is estimated in the way described in chapter 6.3.3 separately for each regulatory period.

Handling of a merged DSO in the fourth regulatory period

If there has been mergers of DSOs during 2011–2015, the regulatory data for the merged DSO (input and output data) is added together for the period 2011–2014. The connection / user ratio is also calculated for the merged DSO for the period 2011–2014. After that, the average of the combined regulatory data for 2011–2014 is calculated, to be used in the determination of the imputed efficiency figure, efficiency target and reasonable controllable operational costs (SKOPEX) for the merged DSO in the fourth regulatory period.

If there will be mergers of DSOs during 2016–2019, the regulatory data for the merged DSOs will be combined for 2011–2014 as described above. After that, the average of the combined regulatory data for 2011–2014 is calculated, to be used in the determination of the imputed efficiency figure, efficiency target and reasonable controllable operations costs (SKOPEX) for the merged DSO in the fifth regulatory period starting from the year of the merger.

Handling of a merged DSO in the fifth regulatory period

If there are mergers of DSOs during 2015–2019, the regulatory data for the merged DSOs (input and output data) is added together for the period 2015–2018. The connection / user ratio is also calculated for the merged DSO for the period 2015–2018. After that, the average of the combined regulatory data for 2015–2018 is calculated, to be used in the determination of the imputed efficiency figure and reasonable controllable operations costs (SKOPEX) for the merged DSO in the fifth regulatory period.

If there will be mergers of DSOs during 2020–2023, the regulatory data for the merged DSOs will be combined for 2015–2018 as described above. After that, the average of the combined regulatory data for 2015–2018 is calculated, to be used in the determination of the imputed efficiency figure and reasonable controllable operational costs (SKOPEX) for the merged DSO in the fifth regulatory period starting from the year of the merger.

6.3.6 Realised efficiency costs

Controllable operational costs are used as realised efficiency costs. Realised efficiency costs are calculated annually.

Cost items according to the unbundled profit and loss account for each year are used as controllable operational costs. The items included in controllable operational costs are presented in Table 5 in chapter 5.2.

6.3.7 High-voltage distribution system operator's efficiency

The general efficiency target in the fourth and fifth regulatory periods is 0% (6.3.1). For this reason, a high-voltage distribution system operator's efficiency is measured by only comparing the DSO's cost level with its own previous cost level.

THE REFERENCE LEVEL OF EFFICIENCY COSTS IN THE FOURTH REGULATORY PERIOD

The calculation of the reference level in 2016 is presented in Formula 34.

$$SKOPEX_{2016} = \frac{1}{4}\sum_{t=2012}^{2015}((1 + \Delta KHI_{2016}) \times (1 + \Delta K_{2016}) \times KOPEX_t) \qquad (34)$$

where

$SKOPEX_{2016}$	=	the reference level of efficiency costs, i.e. reasonable controllable operational costs for 2016
ΔK_{2016}	=	change in network volume from year *t* to year 2016
ΔKHI_{2016}	=	change in the consumer price index from year *t* to year 2016
$KOPEXt,$	=	DSO's realised controllable operational costs in year *t*

The calculation of the reference level in the next years of the regulatory period in 2017–2019 is presented in Formula 35.

$$SKOPEX_t = (1 + \Delta KHI_t) \times (1 + \Delta K_t) \times SKOPEX_{t-1} \qquad (35)$$

where

$SKOPEX_t$	=	the reference level of efficiency costs, i.e. reasonable controllable operational costs for year *t*
$SKOPEX_{t-1}$	=	the reference level of efficiency costs, i.e. reasonable controllable operational costs in year *t-1*
ΔK_t	=	change in network volume from year *t-1* to year *t*
ΔKHI_t	=	change in the consumer price index from year *t-1* to year *t*
t	=	year 2017, 2018 or 2019

THE REFERENCE LEVEL OF EFFICIENCY COSTS IN THE FIFTH REGULATORY PERIOD

The calculation of the reference level in 2020 is presented in Formula 36.

$$SKOPEX_{2020} = \frac{1}{4}\sum_{t=2016}^{2019}((1 + \Delta KHI_{2020}) \times (1 + \Delta K_{2020}) \times KOPEX_t) \quad (36)$$

where

$SKOPEX_{2020}$	=	the reference level of efficiency costs, i.e. reasonable controllable operational costs for year 2020
ΔK_{2020}	=	change in network volume from year *t* to year 2020
ΔKHI_{2020}	=	change in the consumer price index from year *t* to year 2020
$KOPEX_t$	=	realised controllable actual operational costs in year *t*

The calculation of the reference level in the next years of the regulatory period in 2021–2023 is presented in Formula 37.

$$SKOPEX_t = (1 + \Delta KHI_t) \times (1 + \Delta K_t) \times SKOPEX_{t-1} \quad (37)$$

where

$SKOPEX_t$	=	the reference level of efficiency costs, i.e. reasonable controllable operational costs for year *t*
$SKOPEX_{t-1}$	=	the reference level of efficiency costs, i.e. reasonable controllable operational costs in year *t-1*
ΔK_t	=	change in network volume from year *t-1* to year *t*
ΔKHI_t	=	change in the consumer price index from year *t-1* to year *t*
t	=	year 2021, 2022 or 2023

NETWORK VOLUME ADJUSTMENT

Changes in the scope of operations by a high-voltage distribution system operator are taken into account in accordance with the model presented in the study[20] commissioned by the Authority from PA Consulting Group Oy.

The network volume of a component is calculated by multiplying the number of components with the coefficient corresponding to each component. These are presented in Table 7. The network volume for the entire network is obtained by adding together the component-specific network volumes.

Table 7. Coefficients describing the extent of the network of a high-voltage distribution system operator

Component	Coefficient
1 km of 110-kV overhead line	4.2
1 km of 110-kV underground cable	2.3
1 customer	0.025

The calculation of the network model is presented in Formula 38.

$$VV = 4{,}2 \times IJ_{sj} + 2{,}3 \times MK_{sj} + 0{,}025 \times AS \qquad (38)$$

where

VV = the extent of the entire network, i.e. network volume

IJ_{sj} = length of a network of 110-kV overhead lines, kilometres

MK_{sj} = length of a network of 110-kV underground cables, kilometres

AS = customers connected to the network, number of

The calculation of a change in network volume for year 2016 is presented in Formula 39.

[20] PA Consulting Group Oy / Kuusela Akke: Sähkön jakeluverkkotoiminnan laajenemisen kustannusvaikutuksiin liittyvä konsulttityö (Consultant project related to the cost impacts of the expansion of electricity distribution network operations), 24 May 2004

$$\Delta K_{2016} = \frac{VV_{2016}}{VV_t} - 1 \qquad (39)$$

where

ΔK_{2016}	=	change in network volume for year 2016
VV_{2016}	=	network volume at the end of 2016
VV_t	=	network volume at the end of year *t*

The calculation of a change in network volume for year 2020 is presented in Formula 40.

$$\Delta K_{2020} = \frac{VV_{2020}}{VV_t} - 1 \qquad (40)$$

where

ΔK_{2020}	=	change in network volume for year 2020
VV_{2020}	=	network volume at the end of 2020
VV_t	=	network volume at the end of year *t*

The calculation of the change in network volume in the other years of the fourth and fifth regulatory period in 2017–2019 and in 2021–2023 is presented in Formula 41.

$$\Delta K_t = \frac{VV_t}{VV_{t-1}} - 1 \qquad (41)$$

where

ΔK_t	=	change in network volume for year *t*
VV_t	=	network volume at the end of year *t*
VV_{t-1}	=	network volume at the end of year $t - 1$
t	=	year 2017, 2018, 2019, 2021, 2022 or 2023

REALISED EFFICIENCY COSTS

Controllable operational costs are used as realised efficiency costs. Realised efficiency costs are calculated annually.

Cost items according to the unbundled profit and loss account for each year are used as controllable operational costs. The items included in controllable operational costs are presented in Table 5 in chapter 5.2.

6.3.8 Efficiency incentive in the calculation of realised adjusted profit

The impact of the efficiency incentive is deducted when calculating realised adjusted profit.

The impact of the efficiency incentive is calculated so that the realised efficiency costs are deducted from the reference level of efficiency costs in the same year.

The maximum impact of the efficiency incentive in the calculation of realised adjusted profit is made reasonable. The greatest deviations in the annual controllable operational costs are taken into account by setting limit values, i.e. floor and ceiling levels, for the efficiency incentive. This means that the difference of the reference level of regulatory efficiency costs and the realised imputed regulatory efficiency costs that is higher than the set limit value will have no impact on the calculation of the realised adjusted profit.

The impact of the efficiency incentive taken into account in the calculation of realised adjusted profit may not be higher than 20% of the DSO’s reasonable return in the year in question. This applies to the efficiency bonus received from the calculation of costs and the efficiency sanction resulting from increased costs.

6.4 INNOVATION INCENTIVE

The purpose of the innovation incentive is to encourage the DSO to develop and use innovative technical and operational solutions in its network operations.

In a study[21] commissioned by the Authority from Gaia Consulting Oy, the functioning of the innovation incentive was assessed and proposals for its development were made.

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[21] Gaia Consulting Oy / Vehviläinen Iivo; Ryynänen Erkka; Hjelt Mari; Descombes Laura; Vanhanen Juha: Energiaviraston valvontamenetelmissä sovellettavan innovaatiokannustimen arviointi (Assessment of the innovation incentive applied in the Energy Authority’s regulation methods), 18 September 2014

6.4.1 Research and development costs

In network operations, the key objectives of research and development activities are the development and introduction of smart grids and other new technologies and methods of operation. As a result, the DSO may incur research and development costs before the new technologies are in full use and utilisable.

The Authority encourages the DSO to make active efforts in research and development by deducting reasonable research and development costs in the calculation of realised adjusted profit.

Acceptable research and development costs must be directly related to the creation of new knowledge, technology, products or methods of operation in network operations for the sector. They may also be related to the planning work in such a project.

The results of projects whose costs have been accepted in the innovation incentive must be public and, for example, they can be utilised by other DSOs in their network operations. However, it is not necessary to publish confidential information concerning customers. Results protected by industrial property rights need not be published, either. The results to be published must be delivered to the Energy Authority, which will publish them on its website.

Acceptable research and development costs must be recorded in the unbundled profit and loss account as expense. Capitalised research and development costs are not accepted to be included in the calculation of the innovation incentive.

The DSO must itemise non-capitalised research and development costs as their own cost items as notes to the unbundled financial statements.

6.4.2 Innovation incentive in the calculation of realised adjusted profit

The impact of the innovation incentive is deducted when calculating realised adjusted profit.

The impact of the innovation incentive is calculated so that a share corresponding to a maximum of 1% of the DSO’s total turnover from network operations in the unbundled profit and loss accounts in the regulatory period are treated as reasonable research and development costs.

Therefore, the amount of acceptable research and development costs in a single year may exceed or fall below the share corresponding to one per cent of the turnover from network operations in the year in question.

6.5 THE SECURITY OF SUPPLY INCENTIVE

The security of supply incentive is used in the methods in the fourth and fifth regulatory periods. With this incentive, the security of supply demands set for the DSOs in the Electricity Market Act (588/2013) are taken into account in an equitable way.

The purpose of the security of supply incentive is to enable meeting the security of supply criteria required by law within the deadline prescribed by law as cost-effectively as possible in view of the achieved benefits. Some DSOs will have to make extremely extensive replacement investments and carry out maintenance measures in order to be able to meet the legal criteria within the specified period.

The DSOs that find it a considerable challenge to meet the legally required criteria for the security of supply within the specified period may have a need for some major unexpected early replacement investments and a substantial increase in the level of maintenance.

The security of supply incentive must be equal and have neutral steering impacts, taking into account the key targets of the special regulation of a natural monopoly.

If the DSO is able to meet the criteria prescribed by law through normal network maintenance tasks and replacement investment, it is not justifiable to use the security of supply incentive.

The security of supply incentive is only applied to electricity distribution system operators, not to high-voltage distribution system operators.

6.5.1 Early replacement investments made in order to meet the security of supply criteria

Write-downs of the security of supply incentive can be applied for justifiable reasons in the fourth and fifth regulatory periods for years 2016–2023.

PURPOSE AND TARGETS OF WRITEDOWNS OF THE SECURITY OF SUPPLY INCENTIVE

The writedowns of the security of supply incentive compensate for the demolition made in connection with replacement investments, which has been compulsory due to the security of supply criteria of the new Electricity Market Act (588/2013), deviating from the previous network strategy, i.e. earlier than normal practice. The incentive is meant for situations where it has been necessary for the DSO, for example, to replace sections of young network in good condition at substation outputs in order to meet the targets stipulated by law.

A DSO that has applied for writedowns of the security of supply incentive must not gain imputed advantage from the methods in relation to a DSO that will not have to carry out significant premature replacement investments due to the new law. The incentive will compensate any losses only as far as the average lifetime selected by the DSO takes equally into account the replacement investments in relation to the DSOs who are not obliged to replace young network and to deviate from the previous practice as a result of the security of supply criteria imposed by the new law.

Situations where the network has been demolished in accordance with the normal network strategy partly before reaching the selected average lifetime are not taken into account with the writedowns of the security of supply incentive.

The operation of the security of supply incentive must not be confused with ordinary replacement investments in network operations where the age of the demolished network component is less than the selected lifetime and in connection of which the security of supply of the network part in question is improved. The writedowns of the security of supply incentive are meant to be used in projects aiming to meet the security of supply requirements prescribed by law and not in network maintenance and development or in projects related to network reinforcement measures.

The write-downs of the security of supply incentive take into account justifiable early replacement investments made in order to meet the security of supply criteria in so far as the investment incentive does not take them into account. In other words, the write-down of the security of supply incentive only compensates the potentially lost part of imputed straight-line depreciation which the DSO has not been able to predict when selecting the average lifetime for the fourth regulatory period.

As the DSO has to choose new average lifetimes for network components at the beginning of the fourth regulatory period, the security of supply incentive takes into account early replacement investments only in as far as the demolition age is under the lower limit of the lifetime replacement interval for network components in Appendix 1.

EARLY REPLACEMENT INVESTMENT MADE DUE TO THE SECURITY OF SUPPLY CRITERIA

It is necessary to make an early replacement investment to improve security of supply significantly earlier than what is normal practice in order to meet the security of supply criteria. In the incentive, improvement of the security of supply means a replacement investment that is necessary to make in order to reach the security of supply targets prescribed by law within the time schedule prescribed by law.

Early replacement investments started for any other reasons than those imposed by the security of supply criteria prescribed by law are not covered by the incentive. For example, reasons to start network renovation include network reinforcement, change in the infrastructure, network maintenance and repairs or electrotechnical reasons, and in these the use of the writedown of the security of supply incentive is not justifiable. Normal replacement investments that come under the development obligation are not covered by the incentive, either, as the network development obligation has been a prerequisite already before the current Electricity Market Act (588/2013) entered into force.

The lifetime selected by the DSO consists of the average lifetime. Therefore, in replacement investments, it can be deemed that a component that has been demolished before reaching the selected lifetime is equally part of normal network maintenance as with components whose demolition age has been longer than the selected lifetime.

Based on the above, a replacement investment project where the age data of demolished components is mainly within the DSO’s ordinary replacement interval and, on average, close to the lifetime selected by the DSO is part of the DSO’s normal development obligations and does not constitute an early replacement investment.

WRITE-DOWNS PERTAINING TO THE SECURITY OF SUPPLY INCENTIVE

In accordance with the above definitions, replacement investments that have been made early in order to meet the security of supply criteria are covered by the incentive.

Early replacement investments made due to the security of supply criteria in order to improve the security of supply refer to replacement investments deviating from the normal lifetime replacement interval of a component where the demolition age of the component to be replaced is under the lower limit of the lifetime replacement interval set for the network component. The Energy Authority has determined the lifetime replacement intervals for every network component in Appendix 1.

The NKA residual value is calculated using the component's adjusted replacement value, age and the lower limit of the lifetime replacement interval of network components in accordance with Appendix 1.

Write-downs are accepted in the incentive only for justifiable reasons. If the level of the DSO's security of supply is already at a good level and meeting the security of supply criteria does not require early replacement investments deviating from the lifetime replacement interval for network components, the use of the security of supply incentive is not justifiable. Write-downs of individual components, such as write-downs of individual distribution substations or short low-voltage line sections, are not accepted in the incentive. The incentive is meant to be used in investment projects where it is necessary to replace larger entities prematurely in order to meet the security of supply criteria.

The NKA residual value is calculated separately for each component. The write-down is carried out only once in the replacement year of each component. If the replaced component is reused elsewhere in the construction of the electricity network, no write-down of the NKA residual value is accepted with respect to this component.

The option for write-down applies to the following network component groups in accordance with Appendix 1:

- 20 kV overhead lines
- disconnectors and switches in the 20 kV overhead line network
- mounted transformer substations in a 20 / 0.4 kV overhead line network
- 0.4 kV overhead lines.

The DSO must provide an account to the Energy Authority of the write-downs it has applied for in connection with supplying the network structure data by the end of March. The account may only apply to the previous year. The Authority will decide on the handling of these costs on its basis of the account.

The account must be compatible with the development plans, and it must state the sections where the network has been demolished early. Furthermore, the DSO must clarify to the Energy Authority that the sites in question pertain only to projects that have been launched early due to the security of supply criteria.

The DSO must provide reasons to the Energy Authority why it cannot to meet the security of supply criteria within the specified period without early investments. The account must also state the number of demolished components and their average age data, as well as the lower limit of the lifetime replacement interval of the network components and the NKA residual value of the network component that has been written down in accordance with Appendix 1, calculated with the above data. The Energy Authority provides more detailed instructions on the contents of the account, if necessary.

6.5.2 Maintenance and contingency measures

Maintenance and contingency measures carried out in order to improve the security of supply in electricity distribution are taken into account in the calculation of the security of supply incentive.

The maintenance and contingency measures carried out to improve the security of supply accepted in the incentive are:

- raising the standard of management and enhanced management measures of a forest, i.e. the near forest zone, which is located in the vicinity of a medium-voltage distribution network

Measures related to the near forest zone of a line area include

- observing hazardous trees in the near forest zone
- analysis of the near forest zone with remote sensing
- management of the near forest zone in the sapling stand or first thinning stage
- removing individual hazardous trees and narrow wooded areas close to the overhead line.

- Measures carried outside the right-of-way to ensure tree security of the overhead line.

Measures carried out in the line area cannot be included in the security of supply incentive.

Costs accepted in the security of supply incentive are not deducted from the controllable operational costs used in the calculation of the reference level and realisation of the efficiency costs in the efficiency incentive.

The costs accepted in the security of supply incentive cannot be included in the innovation incentive.

The DSO must report the costs it has included in the security of supply incentive as notes to the unbundled financial statements. In addition, the DSO must provide a more detailed account of the maintenance and contingency measures it has included in the security of supply incentive, as well as their costs, in connection with delivering the regulatory data. The Authority will assess the account and decide on the handling of these costs on its basis. The Authority may provide more detailed instructions on the contents of the account.

6.5.3 Security of supply incentive in the calculation of realised adjusted profit

The impact of the security of supply incentive is deducted when calculating realised adjusted profit.

The impact of the security of supply incentive is calculated by adding together the write-downs of the NKA residual value resulting from early replacement investments carried out in order to improve the security of supply and the reasonable costs of maintenance and contingency measures.

7 REALISED ADJUSTED PROFIT

The calculation of realised adjusted profit is started from the operating profit (loss) of the unbundled profit and loss account.

When calculating the realised adjusted profit, the annual change in refundable connection fees according to the unbundled balance sheet, as well as network rents according to the unbundled profit and loss account, planned depreciation of electricity network assets and amortisation, amortisation of goodwill, and the loss of sales resulting from the sale of a network section entered under other operating expenses are returned first (5.1). However, the profit from the sale of a network section entered under other operating income is deducted (5.1) when calculating the realised adjusted profit.

After that, reasonable costs of financial assets (5.3) are deducted as profit adjustment items.

The impact of the investment incentive is calculated by deducting the adjusted straight-line depreciation of the electricity network assets.

The impact of the quality incentive is calculated by deducting the realised outage costs from the reference level of outage costs.

The impact of the efficiency incentive is calculated by deducting realised efficiency costs from the reference level of efficiency costs.

The impact of the innovation incentive is calculated from the DSO's reasonable research and development costs.

The impact of the security of supply incentive is calculated by adding together the write-downs of the NKA residual value resulting from early replacement investments carried out in order to improve the security of supply and the reasonable costs of maintenance and contingency measures.

The sum total of the calculations is the realised adjusted profit.

The above-described calculations are presented in Table 8.

Table 8. *The calculation of realised adjusted profit*

OPERATING PROFIT (LOSS) OF THE UNBUNDLED PROFIT AND LOSS ACCOUNT OF NETWORK OPERATIONS

+ Refundable items in the unbundled profit and loss account
  - \+ Net change in refundable connection fees
  - \+ Paid network rents
  - \+ Planned amortisation of goodwill
  - \+ Loss of sales of the network section recorded in other expenses
  - \- Profit on sales of the network section recorded in other income
  - \+ Planned depreciations and value reductions from network assets

\- Profit adjustment items
  - \+ Reasonable costs of financial assets

\- Investment incentive
  - \+ Adjusted straight-line depreciations of the electricity network assets

\- Quality incentive
  - \+ Reference level of outage costs
  - \- Realised outage costs

\- Efficiency incentive
  - \+ Reference level of efficiency costs
  - \- Realised efficiency costs

\- Innovation incentive
  - \+ Reasonable costs of research and development activities

\- Security of supply incentive
  - \+ Write-downs of NKA residual value resulting from early replacement investments
  - \+ Reasonable costs of maintenance and contingency measures

= REALISED ADJUSTED PROFIT

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APPENDIX 1. NETWORK COMPONENTS, UNIT PRICES AND LIFETIME REPLACEMENT INTERVALS

The Energy Authority has determined the unit prices and lifetime replacement intervals in the Appendix on the basis of cost surveys it carried out in 2014 and 2015. Responses to the survey were requested from all distribution system operators and high-voltage distribution system operators on the basis of realised investment costs. The unit prices of the appendix have been updated to better describe the situation at the beginning of the fourth regulatory period by using the average of the consumer price index in April–June 2015. The unit prices in the appendix are used in the fourth and fifth regulatory period.

DETERMINING UNIT PRICES

The unit prices have basically been determined using the average value of the survey results adjusted by standard deviation and weighted by the investment volumes. With some unit prices, it has been necessary to also use other methods due to a low sampling rate. These include the average of the survey results weighted by the investment volumes, the average of the survey results, or the index-adjusted unit price according to the confirmation decision in the third regulatory period.

When forming the unit prices for less common components, cost estimates obtained from DSOs, relative cost structure data and the cost data of other network components in the same group of components have been used in addition to individual cost data. It has been necessary to use the different calculation principles listed above when determining unit prices to ensure that the unit prices of similar network components in a group of components would be in a linear proportion to one another.

UNIT PRICE LIST

The content definitions of network components are mainly found in the unit price survey. More detailed definitions and instructions for all network components will be recorded in the Energy Authority’s regulatory data system. If necessary, the Energy Authority will provide further information for the definitions of network components.

Unit prices in network components of over a thousand euros have been rounded to the nearest hundred euros and those of components of under a thousand euros to the nearest ten euros.

The Authority has determined the lifetime replacement intervals on the basis of responses to the unit price survey carried out in 2014, using the lifetime replacement value created from the average of the techno-economical lifetimes used by the majority of DSOs.

The colour codes of the table are as follows:

- red background colour: network type, i.e. the principal breakdown of network component groups
- yellow background colour: network component group
- grey background colour: definition
- white background: network component and its unit, unit price and lifetime replacement interval.

OVERHEAD LINE NETWORK IN THE DISTRIBUTION NETWORK			
0.4 kV OVERHEAD LINES			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
AMKA 16 -25 mm²	**km**	**16,600**	**35 – 45**
AMKA 35 - 50 mm²	**km**	**17,300**	**35 – 45**
AMKA 70 mm²	**km**	**19,600**	**35 – 45**
AMKA 95 mm²	**km**	**21,500**	**35 – 45**

AMKA 120 mm²	**km**	**23,300**	**35 – 45**
20 kV OVERHEAD LINES			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Sparrow or smaller	**km**	**21,800**	**40 – 50**
Raven	**km**	**25,100**	**40 – 50**
Pigeon	**km**	**29,100**	**40 – 50**
Al 132 mm² or larger	**km**	**30,800**	**40 – 50**
Covered overhead line 35-70 mm²	**km**	**31,300**	**40 – 50**
Covered overhead line 95-120 mm²	**km**	**35,100**	**40 – 50**
Covered overhead line over 120 mm²	**km**	**36,500**	**40 – 50**
Universal cable 70 mm² or smaller	**km**	**45,900**	**40 – 50**
Universal cable 95 mm² or larger	**km**	**52,100**	**40 – 50**
DISTRIBUTION SUBSTATIONS OF 20/0.4 Kv OVERHEAD LINE NETWORK			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
1-pole mounted transformer substation	**each**	**5,100**	**35 – 45**
2-pole mounted transformer substation	**each**	**6,400**	**35 – 45**
4-pole mounted transformer substation	**each**	**7,700**	**35 – 45**

DISCONNECTORS AND SWITCHES IN THE 20 Kv OVERHEAD LINE NETWORK			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Line disconnector: 3-phase maintenance disconnector that can be disconnected	each	1,100	25 – 35
Line disconnector: light	each	3,400	25 – 35
Line disconnector: with circuit breaker chamber	each	6,100	25 – 35
Disconnector station: 1 disconnector with remote control	each	13,200	25 – 35
Disconnector station: 2 disconnectors with remote control	each	22,400	25 – 35
Disconnector station: 3-4 disconnectors with remote control	each	36,400	25 – 35
Pole recloser: remote-controlled	each	26,700	25 – 35

45 kV OVERHEAD LINES			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Timber pole line	each	48,000	45 – 55
Disconnector station: 1 disconnector	each	20,100	40 – 50

UNDERGROUND CABLE NETWORK IN THE DISTRIBUTION NETWORK

0.4 kV UNDERGROUND CABLES

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years
Underground cable 25 mm² or less	km	8,500	35 – 50
Underground cable 35 mm²	km	9,100	35 – 50
Underground cable 50 mm²	km	10,000	35 – 50
Underground cable 70 mm²	km	10,900	35 – 50
Underground cable 95 mm²	km	12,100	35 – 50
Underground cable 120 mm²	km	14,300	35 – 50
Underground cable 150 mm²	km	16,500	35 – 50
Underground cable 185 mm²	km	18,100	35 – 50
Underground cable 240 mm²	km	20,300	35 – 50
Underground cable 300 mm²	km	25,500	35 – 50
Underwater cable 35 mm² or less	km	12,500	35 – 50
Underwater cable 50 – 70 mm²	km	13,700	35 – 50
Underwater cable 95 – 120 mm²	km	22,600	35 – 50
Underwater cable 150 mm² or over	km	28,400	35 – 50

DISTRIBUTION CABINETS AND BRANCHING CABINETS IN THE 0.4 kV UNDERGROUND CABLE NETWORK

	Unit	Unit price, EUR	Lifetime replacement interval, years
0.4 kV house fuse box	each	320	30 – 45
0.4 kV branching cabinet	each	670	30 – 45
0.4 kV cable branching cabinet: max. 400 A	each	1,400	30 – 45
0.4 kV cable branching cabinet: min. 630 A	each	1,800	30 – 45
0.4 kV fuse breaker: max. 160 A	each	300	30 – 45

0.4 kV fuse breaker: 250 - 400 A	**each**	**450**	**30 – 45**
0.4 kV fuse breaker: 630 A	**each**	**670**	**30 – 45**

1.0 kV SPECIAL COMPONENTS			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
1.0 kV protective equipment	**each**	**2,600**	**25 – 35**

20 kV UNDERGROUND CABLES			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Underground cable 70 mm2 or less	**km**	**24,300**	**40 – 50**
Underground cable 95 mm^2	**km**	**28,300**	**40 – 50**
Underground cable 120 mm^2	**km**	**29,600**	**40 – 50**
Underground cable 150 mm^2	**km**	**31,000**	**40 – 50**
Underground cable 185 mm^2	**km**	**36,200**	**40 – 50**
Underground cable 240 mm^2	**km**	**39,000**	**40 – 50**
Underground cable 300 mm^2	**km**	**44,500**	**40 – 50**
Underground cable 400 mm^2	**km**	**52,800**	**40 – 50**
Underground cable 500 mm^2	**km**	**61,100**	**40 – 50**
Underground cable 630 mm^2	**km**	**71,900**	**40 – 50**
Underground cable 800 mm^2	**km**	**86,100**	**40 – 50**
Underwater cable 70 mm^2 or smaller: standard structure	**km**	**26,700**	**40 – 50**
Underwater cable 70 mm^2 or smaller: armoured structure	**km**	**58,600**	**40 – 50**
Underwater cable 95 - 120 mm^2: standard structure	**km**	**31,000**	**40 – 50**
Underwater cable 95 - 120 mm^2: armoured structure	**km**	**68,200**	**40 – 50**
Underwater cable 150 - 240 mm^2: standard structure	**km**	**45,700**	**40 – 50**

Underwater cable 150 - 240 mm^2: armoured structure	**km**	**73,500**	**40 – 50**

20 kV UNDERGROUND CABLE ACCESSORIES			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Cable terminal	each	1,100	35 – 45
Pole terminal	each	2,200	35 – 45
Joint	each	1,700	35 – 45
20 kV branching cabinet	each	3,400	35 – 45

DISTRIBUTION SUBSTATIONS IN 20 / 0.4 kV UNDERGROUND CABLE NETWORK			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Park transformer substation: light	each	8,600	40 – 50
Park transformer substation: externally managed, nominal rated current of low-voltage switchgear max 630 A	each	22,900	40 – 50
Park transformer substation: externally managed, nominal rated current of low-voltage switchgear over 630 A	each	28,700	40 – 50
Park transformer substation: internally managed	each	43,900	40 – 50
Indoor transformer substation	each	58,300	40 – 50
Double transformer substation	each	82,900	40 – 50

DISCONNECTORS AND SWITCHES IN THE 20 kV UNDERGROUND CABLE NETWORK			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Disconnector station: park transformer substation type of structure	each	21,400	40 – 50
Switch: at a transformer substation or disconnector station	each	12,600	30 – 40
Remote control equipment: at a transformer substation or disconnector station	each	3,100	20 – 35

Fault indication equipment: at a transformer substation or a disconnector station without a switch	**each**	**1,200**	**15 – 25**
Data transmission equipment at a transformer substation or disconnector station	**each**	**4,800**	**15 – 30**

45 kV UNDERGROUND CABLES			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
30 - 45 kV underground cable 300 mm² or less, including excavation work	each	59,300	40 – 50

ENVIRONMENTAL CONDITION CLASSIFICATION OF 0.4 AND 20 kV UNDERGROUND CABLES			
Network component	**Unit**	**Unit price, EUR**	
Underground cable ditch – easy conditions	km	10,700	
Underground cable ditch – ordinary conditions	km	24,200	
Underground cable ditch – difficult conditions	km	77,200	
Underground cable ditch – extremely difficult conditions	km	151,200	

TRANSFORMERS IN THE DISTRIBUTION NETWORK

20 / 0,4 kV TRANSFORMERS			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Transformer 16 kVA	each	3,400	35 – 45
Transformer 30 kVA	each	3,600	35 – 45
Transformer 50 kVA	each	3,700	35 – 45
Transformer 100 kVA	each	4,500	35 – 45
Transformer 200 kVA	each	6,100	35 – 45
Transformer 315 kVA	each	7,800	35 – 45
Transformer 400 kVA	each	8,700	35 – 45
Transformer 500 kVA	each	9,600	35 – 45
Transformer 630 kVA	each	11,500	35 – 45
Transformer 800 kVA	each	13,300	35 – 45

Transformer 1,000 kVA	**each**	**16,000**	**35 – 45**
Transformer 1,250 kVA	**each**	**20,500**	**35 – 45**
Transformer 1,600 kVA	**each**	**21,800**	**35 – 45**

SPECIAL TRANSFORMERS AND VOLTAGE CONTROL COMPONENTS IN THE DISTRIBUTION NETWORK			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
3 winding transformer 20 / 1.0 /0.4 kV	each	10,500	35 – 45
Transformer 20 / 10 kV, 45 / 20 kV, 20 / 20 kV	each	159,000	40 – 50
Voltage control station 20 / 20 kV	each	205,800	35 – 50
Voltage booster in the low-voltage network	each	10,600	30 – 40

ENERGY METERING IN THE DISTRIBUTION NETWORK

ENERGY METERING EQUIPMENT			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Energy meter: remotely read max. 63 A	each	200	10 – 20
Energy meter: remotely read over 63 A	each	570	10 – 20
Energy meter: locally read max. 63 A	each	180	10 – 25

OVERHEAD LINE NETWORK IN THE HIGH-VOLTAGE DISTRIBUTION NETWORK

110 kV OVERHEAD LINES

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years
Timber pole line: lightweight	km	128,600	45 – 60
Timber pole line: one circuit, one subconductor	km	155,100	45 – 60
Tubular pole line: one circuit, one subconductor	km	162,200	50 – 60
Tubular pole line: one circuit, two subconductors	km	190,200	50 – 60
Tubular pole line: two circuits, two subconductors	km	252,900	50 – 60
Steel lattice pole line, guyed: one circuit, one subconductor	km	177,300	50 – 60
Steel lattice pole line, guyed: one circuit, two subconductors	km	205,900	50 – 60
Steel lattice pole line, guyed: two circuits, one subconductor	km	247,700	50 – 60
Steel lattice pole line, guyed: two circuits, two subconductors	km	268,600	50 – 60
Steel lattice pole line, free-standing: one circuit, one subconductor	km	317,200	50 – 60
Steel lattice pole line, free-standing: one circuit, two subconductors	km	445,800	50 – 60
Steel lattice pole line, free-standing: two circuits, one subconductor	km	579,600	50 – 60
Steel lattice pole line, free-standing: two circuits, two subconductors	km	627,800	50 – 60

LINE DISCONNECTORS OF A 110 kV OVERHEAD LINE NETWORK

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years

Line disconnector	**each**	**34,200**	**40 – 50**
Line disconnector: remote-controlled	**each**	**49,400**	**40 – 50**

110 kV ENVIRONMENTAL CONDITION CLASSIFICATION OF AN OVERHEAD LINE NETWORK

Network component	Unit	Unit price, EUR	
Easy conditions (areas outside a town plan)	km	21,000	
Ordinary conditions (town plan areas)	km	54,800	
Difficult conditions (areas in major city centres)	km	124,900	

UNDERGROUND CABLE NETWORK IN THE HIGH-VOLTAGE DISTRIBUTION NETWORK

110 kV UNDERGROUND CABLES

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years
Underground cable 800 mm² or less	km	226,700	40 – 60
Underground cable at least 1,000 and under 1,600mm²	km	257,600	40 – 60
Underground cable 1,600 mm² or over	km	351,400	40 – 60

110 kV UNDERGROUND CABLE ACCESSORIES

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years
Cable terminal	km	23,100	40 – 50
Pole terminal	km	31,300	40 – 50
Joint	km	17,100	40 – 50

110 kV ENVIRONMENTAL CONDITION CLASSIFICATION OF AN UNDERGROUND CABLE NETWORK

Network component	Unit	Unit price, EUR	
Underground cable ditch – easy conditions	km	60,800	
Underground cable ditch – ordinary conditions	km	101,400	

Underground cable ditch – difficult conditions	**km**	**308,300**	
Underground cable ditch – extremely difficult conditions	**km**	**605,100**	

SUBSTATIONS OF A HIGH-VOLTAGE DISTRIBUTION NETWORK

110 kV MAIN TRANSFORMERS

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years
Main transformer 6 MVA	each	240,700	40 – 65
Main transformer 10 MVA	each	257,800	40 – 65
Main transformer 16 MVA	each	289,000	40 – 65
Main transformer 20 MVA	each	313,600	40 – 65
Main transformer 25 MVA	each	338,100	40 – 65
Main transformer 31.5 MVA	each	450,200	40 – 65
Main transformer 40 MVA	each	538,400	40 – 65
Main transformer 50 MVA	each	593,000	40 – 65
Main transformer 63 MVA	each	664,000	40 – 65
Main transformer 80 MVA	each	756,900	40 – 65
Main transformer 100 MVA	each	866,300	40 – 65

110 kV AIR-INSULATED SWITCHYARDS

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years
Transformer foundation and connections of an air-insulated switchyard	each	66,500	40 – 65
Air-insulated 1-busbar switchgear: Basic switchgear without incoming and outgoing fields	each	95,800	40 – 50
Outgoing or incoming field of an air-insulated 1-busbar switchgear	each	199,300	40 – 50
Air-insulated 2-busbar switchgear: Basic switchgear without incoming and outgoing fields	each	232,600	40 – 50
Outgoing or incoming field of an air-insulated 2-busbar switchgear	each	292,000	40 – 50

Air-insulated 3-busbar switchgear: basic switchgear without incoming and outgoing fields	**each**	**308,800**	**40 – 50**
Outgoing or incoming field of an air-insulated 3-busbar switchgear	**each**	**349,000**	**40 – 50**
110 kV AIR-INSULATED SWITCHYARDS			
Protection and automation equipment for air-insulated switching substation: station-specific basic part	**each**	**39,200**	**20 – 30**
Protection and automation equipment for air-insulated switchyard: field-specific part	**each**	**19,000**	**20 – 30**

110 kV GAS-INSULATED SWITCHYARDS			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Transformer foundation and connections of a gas-insulated switchyard	**each**	**66,500**	**40 – 65**
Gas-insulated 1-busbar switchgear: basic switchgear without incoming and outgoing fields	**each**	**209,700**	**40 – 50**
Incoming or outgoing field of gas-insulated 1-busbar switchgear	**each**	**267,300**	**40 – 50**
Gas-insulated 2-busbar switchgear: basic switchgear without incoming and outgoing fields	**each**	**343,300**	**40 – 50**
Incoming or outgoing section of gas-insulated 2-busbar switchyard	**each**	**361,300**	**40 – 50**
Gas-insulated 3-busbar switchgear: basic switchgear without incoming and outgoing fields	**each**	**440,500**	**40 – 50**
Incoming or outgoing field of gas-insulated 3-busbar switchgear	**each**	**442,300**	**40 – 50**
Protection and automation equipment for gas-insulated switching substation: station-specific basic field	**each**	**65,900**	**20 – 30**
Protection and automation equipment for gas-insulated switchyard: field-specific part	**each**	**42,900**	**20 – 30**
Differential relay protection of a gas- or air-insulated switching substation: station-specific basic part	**each**	**27,300**	**20 – 30**

Differential relay protection of a gas- or air-insulated switching substation: field-specific part	**each**	**9,600**	**20 – 30**

45 kV SWITCHYARDS			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Transformer foundation and connections	**each**	**60,800**	**40 – 50**
Switchgear: basic switchgear without incoming and outgoing fields	**each**	**91,600**	**40 – 50**
Incoming or outgoing field of a switchgear	**each**	**151,900**	**40 – 50**
Protection and automation equipment: basic part	**each**	**67,600**	**40 – 50**
Protection and automation equipment: field-specific part	**each**	**19,100**	**40 – 50**

20 kV SWITCHGEAR			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Air-insulated 1-busbar switchgear: Basic switchgear without incoming and outgoing fields	**each**	**34,700**	**40 – 50**
Outgoing or incoming section of an air-insulated 1-busbar switchgear	**each**	**16,900**	**40 – 50**
Air-insulated 2-busbar switchgear: Basic switchgear without incoming and outgoing fields	**each**	**82,200**	**40 – 50**
Outgoing or incoming field of an air-insulated 2-busbar switchgear	**each**	**34,600**	**40 – 50**
Gas-insulated 1-busbar switchgear: basic switchgear without incoming and outgoing fields	**each**	**48,400**	**40 – 50**
Incoming or outgoing field of gas-insulated 1-busbar switchgear	**each**	**21,400**	**40 – 50**
Gas-insulated 2-busbar switchgear: basic switchgear without incoming and outgoing fields	**each**	**116,700**	**40 – 50**
Incoming or outgoing field of gas-insulated 2-busbar switchgear	**each**	**41,300**	**40 – 50**

Protection and automation equipment: basic part	**each**	**22,600**	**20 – 30**
Protection and automation equipment: field-specific part	**each**	**7,900**	**20 – 30**

20 kV COMPENSATION EQUIPMENT			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Capacitor less than 3 Mvar	each	38,800	40 – 50
Parallel ballast 1 Mvar	each	61,400	40 – 50
Parallel ballast 2 Mvar	each	79,000	40 – 50
Parallel ballast min. 3 Mvar	each	101,300	40 – 50
Resonant earthed equipment 100 A	each	77,600	40 – 50
Resonant earthed equipment 100 A: with earthing transformer	each	133,100	40 – 50
Resonant earthed equipment 140 A	each	135,800	40 – 50
Resonant earthed equipment 140 A: with earthing transformer	each	154,200	40 – 50
Resonant earthed equipment 200 A	each	142,300	40 – 50
Resonant earthed equipment 200 A: with earthing transformer	each	170,400	40 – 50
Resonant earthed equipment 250 A	each	158,600	40 – 50
Resonant earthed equipment 250 A: with earthing transformer	each	186,600	40 – 50
Resonant earthed equipment 320 A	each	174,800	40 – 50
Resonant earthed equipment 320 A: with earthing transformer	each	202,900	40 – 50
Distributed compensation equipment 10 A or less	each	11,200	40 – 50
Distributed compensation equipment over 10 A	each	19,100	40 – 50

PLOTS OF 110 / 20 kV SUBSTATION LAND			
Network component	**Unit**	**Unit price, EUR**	
Typical substation plot in a built-up or non-built-up area outside the town plan area	each	14,400	
Typical substation plot in an urban or built-up area within a town plan area	each	67,900	

Exceptional substation plots in major city centres: a plot of a large urban substation in a major city centre	**kpl**	**253,400**	

110 / 20 kV SUBSTATION BUILDINGS

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years
Substation type 1 – light substation	**each**	**81,000**	**45 – 55**
Substation type 2 – substation in a non-built-up area	**each**	**141,800**	**45 – 55**
Substation type 3 – substation in a built-up area	**each**	**303,800**	**45 – 55**
Substation type 4 – substation in an urban area	**each**	**506,400**	**45 – 55**
Substation type 5 – large urban substation / cavern substation	**m^2**	**3,500**	**45 55**

SYSTEMS AND COMMUNICATION NETWORKS

NETWORK DATA SYSTEM

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years
Network data system, basic part	**each**	**112,500**	**10**
Section based on the number of customers	**each**	**6.6**	**10**

CUSTOMER DATA SYSTEM

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years
Customer data system, basic part	**each**	**75,500**	**10**
Section based on the number of customers	**each**	**9.5**	**10**

METERING DATA AND BALANCE MANAGEMENT SYSTEM

Network component	Unit	Unit price, EUR	Lifetime replacement interval, years

Metering data and balance management	**each**	**138,000**	**10**
Section based on the number of metering points	**each**	**6.6**	**10**
SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Supervisory control and data acquisition system, basic part	**each**	**301,300**	**10**
Part based on the number of substations	**each**	**9,800**	**10**
Part based on the number of remote-controlled transformers and remote-controlled disconnector stations	**each**	**2,200**	**10**
DISTRIBUTION MANAGEMENT SYSTEM			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Distribution management system, basic part	**each**	**21,900**	**10**
Part based on the number of other systems connected to the distribution management	**each**	**21,900**	**10**
Part based on the number of substations	**each**	**1,100**	**10**
Part based on the number of remote-controlled transformers and remote-controlled disconnector stations	**each**	**550**	**10**
COMMUNICATION NETWORKS IN THE SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM			
Network component	**Unit**	**Unit price, EUR**	**Lifetime replacement interval, years**
Communication networks, basic part	**each**	**89,800**	**20**
Part based on the number of substations	**each**	**5,500**	**20**