

**Ministry of Economic Affairs and
Communications**

**Development Plan of the
Estonian Electricity Sector until
2018**

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Introduction

The Development Plan of the Electricity Sector for 2008-2018 is a development plan of the respective area which shall be approved by the Government of the Republic and which defines the Government's strategy in one of the most important fields of energy policy – power engineering. The development plan of the electricity sector shall be prepared on the basis of the Electricity Market Act.

Great changes have taken place in the Estonian electricity sector after the adoption of the previous development plan of the electricity sector: the submarine cable Estlink has been completed, the new fluidised bed boilers have been successfully put to use in Narva Power Plants, EU emission trading has been started, the production of renewable electricity has started to develop quickly, the security of supply of natural gas and the resulting energy security of states have risen to the agenda. Power losses have decreased significantly and the export of electricity has increased considerably in the Estonian power system as a whole.

Great challenges in the next few years are connected with the development of the electricity markets of Estonia and the Baltic States. The prohibition to use the old units of Narva Power Plants shall be applied as of 2016 and closing of the reactors of Ignalina nuclear power plant in 2009 will require significant investments in the electricity sector. The opening of the electricity market in 2013 at the latest and the application of the new rules of emission trading in 2013 will also have a considerable impact on the development of the electricity market of Estonia. The development of electricity markets requires adequate market regulation in all the three Baltic States.

The purpose of the development plan is to direct the undertakings to make investment decisions which are in the national interests on the electricity market. The objective of the state is to ensure continuous, sustainable power supply at a justified price in Estonia.

Pursuant to subsection 10 (2) of the State Budget Act and in compliance with Regulation No 302 of the Government of the Republic of 13 December 2005 “Types of Strategic Development Plans, the Procedure for Their Preparation, Amendment, Implementation and Evaluation and Reporting Procedure”, the Government of the Republic approved, by Order No 12 of 10 January 2008; the preparation of the development plan of the electricity sector and appointed the Ministry of Economic Affairs and Communications as a ministry responsible for and the Ministry of the Environment, the Ministry of Foreign Affairs, the Ministry of Finance, the Ministry of Social Affairs, the Ministry of Education and Research and the Ministry of Agriculture as the ministries participating in the preparation of the development plan. A working group was formed for the preparation of the development plan of the electricity sector by directive No 6 of the Ministry of Economic Affairs and Communications of 21 January 2008, the objective of which was to prepare a development plan and an implementing plan.

An obligation was imposed on the working group to submit the working version and the final report of the development plan of the electricity sector to the organising committee for power engineering and for the preparation of power engineering development plans formed by directive No 17 of the Ministry of Economic Affairs and Communications (hereinafter „committee”; chairman of the committee: Enari Kisel, Deputy Secretary General for Energy of the Ministry of Economic Affairs and Communications) for review on 22 January 2008.

In order to involve all the interest groups, the Ministry of Economic Affairs and Communications organised a series of public energy forums in order to involve the representatives of all the interest

groups in the process of the preparation of the development plan for making proposals, defining the objectives and courses of action, consulting with each other and for answering or discussing the arisen questions.

Upon the preparation of the development plan of the electricity sector, a strategic environmental assessment of the development plan of the electricity sector was initiated on the basis of clause 33 (1) 1) and subsection 35 (2) of the Environmental Impact Assessment and Environmental Management System Act.

1. Bases for Development Plan

Electricity sector is regulated by the following legislation:

1. Electricity Market Act¹

The Electricity Market Act regulates the generation, transmission, sale, export, import and transit of electricity and the economic and technical management of the power system. The Act prescribes the principles for the operation of the electricity market based on the need to ensure an effective supply of electricity at reasonable prices and meeting environmental requirements and the needs of customers, and balanced, environmentally clean and long-term use of energy sources.

2. Grid Code²

This Regulation regulates the requirements applied to the security of supply of power systems and the technical requirements for electrical installations arising from security of supply. The Regulation prescribes the requirements for the connection of electrical installations to the power network and the rights and obligations of the market participants related to balance responsibility.

3. Quality Requirements for Network Services and Conditions for Decreasing Network Fees in Case of Violation of Quality Requirements³

This Regulation establishes the quality requirements for the network services provided to a customer, producer, line possessor or any other network operator (hereinafter „market participant”) within the service area of a network operator and the conditions for decreasing the network fees in the case of violation of the quality requirements.

In addition to sector-specific regulation, the development of the electricity sector is significantly affected by environmental legislation.

1.1 Definitions

"balance" means the balance between the amount of electricity purchased and/or supplied to the network by a market participant during a trading period and the amount of electricity sold and/or acquired from the network by the market participant during the same trading period

"balance provider" means a person who, pursuant to the procedure provided in the Electricity Market Act and legislation established on the basis thereof, has entered into a balance agreement with a system operator to maintain its balance

"power system" means the technical system for the generation and transmission of electricity, which is comprised of power plants located within the territory of Estonia, the network which connects the power plants to one another as well as customers and the power systems of other countries, and the corresponding control, protection and communication systems

"power network" means an electrical installation or a part thereof intended for the transmission of electricity to the connection point of a customer or producer

¹ Electricity Market Act <https://www.riigiteataja.ee/ert/act.jsp?id=12894671>

² Grid Code <https://www.riigiteataja.ee/ert/act.jsp?id=12831412>

³ Quality Requirements for Network Services <https://www.riigiteataja.ee/ert/act.jsp?id=1039867>

"import of electricity" means the import of electricity from outside the system with the aim of selling or consuming electricity in Estonia

"wind turbine" means a system consisting of a turbine, a drive, a generator, a control system and a tower, which converts kinetic wind energy into electric energy

"reliability of a power system" means the ability of the power system to ensure joint operation of power plants and power networks in the operation of the power system

"power plant" means an operational assembly consisting of one or several generating installations which generates electricity, together with support systems and facilities

"distribution network" means a network which is not a transmission network

"cogeneration" means cogeneration of heat and power upon combustion of fuel

"fluidised bed boiler" means a boiler in which the milling coal is maintained in suspension by a rising current of air during combustion

"household customer" means a consumer who uses electricity in his or her household for purposes not related to his or her business or professional activities

"primary energy" means energy obtained from a natural source and consumed without transformation into other forms of energy. From the fuel produced in Estonia this includes oil shale, peat, firewood, wood waste and biogas and from the imported fuel this includes coal, natural gas, liquid gas, heavy fuel oil, light heating oil, diesel fuel, motor vehicle petrol and aviation kerosene

"transmission network" means the national network with a voltage of at least 110 kV together with alternating current connections with a voltage of over 10 kV with networks of other countries and with other electrical installations, also those operating on medium voltage, necessary to ensure the functioning, administration and development of the system as a whole and with control, protection and communication systems, which form a uniform economic entity

"system operator" means a person obliged to ensure security of supply and balance of the system at any moment in time (system responsibility)

"peak load of a system" means the maximum load value during the period under review (e.g. a twenty-four hour period, a month, a year)

"renewable energy sources" means water, wind, solar, wave, tidal and geothermal energy sources, landfill gas, sewage treatment plant gas, bioenergy

"renewable electricity" means electricity generated from non-fossil energy sources such as wind energy, solar energy, wave energy, hydropower, tidal energy, geothermal energy, bioenergy, landfill gas, sewage treatment plant gas

"operational security" means the capability of a power network to operate under normal conditions without interruption during a specific period of time

"wind farm" means a power plant consisting of several wind turbines and the devices, buildings and structures connecting wind turbines to each other and to the connection point

"efficient cogeneration" - means generation of electricity in a combined power and heat production regime based on the demand for heat energy and ensuring energy conservation in accordance with the requirements for efficient cogeneration

"security of supply" means the capability of a system to ensure the required high-quality electricity supply to customers during a certain period of time

"Grid Code" means legislation which provides for:

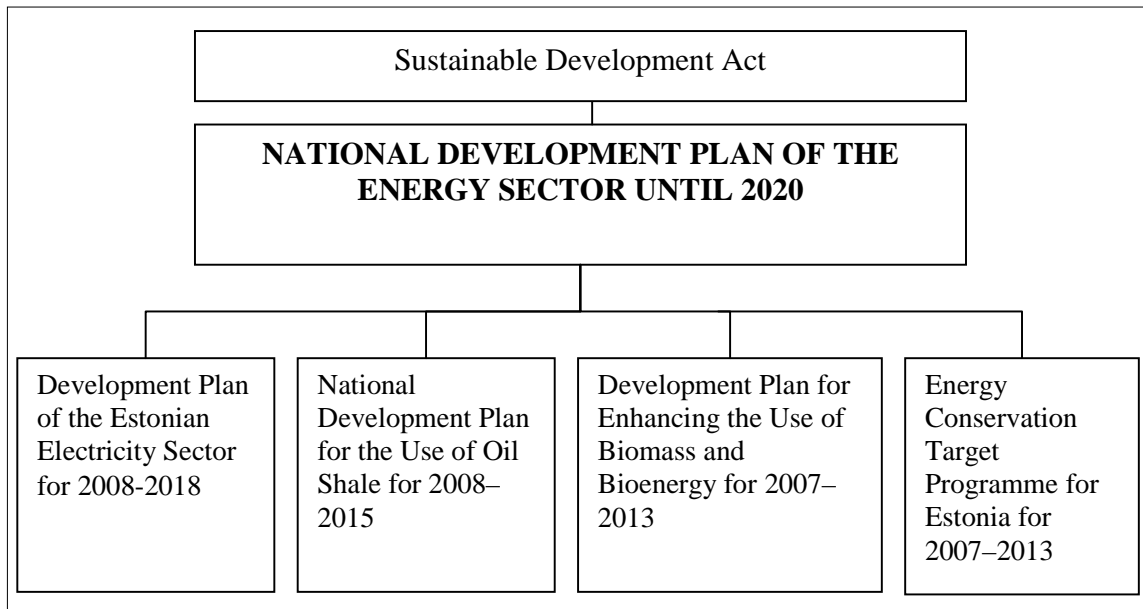
- the requirements for security of supply;
- the technical requirements for electrical installations, arising from security of supply;
- the technical and metrological requirements for measurement and measuring equipment;
- the procedure for connection to the network and for amendment of the consumption or generation conditions and the procedure for calculation of charges payable to the network operator for connection to the network and for amendment of the consumption or generation conditions;
- the conditions for technical co-operation between the transmission network operator and the respective network operators of neighbouring countries;
- other conditions prescribed by law

"network operator" means an undertaking which owns or possesses a power line or network through which electric power or heat is transmitted or distributed

"network losses" means power losses in the distribution network elements

1.2. Relations with Other Strategic Documents

The strategic planning document of the Estonian energy sector is the National Development Plan of the Energy Sector until 2020 which is under preparation and the sub-strategies of which at present are the development plans of the energy sectors:



a. National Development Plan for the Use of Oil Shale for 2008–2015⁴: the strategic objective of the plan is to ensure supply of Estonia with oil shale energy and to guarantee the energetic independence of Estonia. One of the strategic objectives of the development plan is to increase the efficiency of the use and mining of oil shale and to reduce the environmental impact accompanying the use and mining, which supports also the measures and activities of the Development Plan of the Electricity Sector upon the enhancement and development of sustainable ways of electricity production. The National Development Plan for the Use of Oil Shale for 2008–2015 was approved by the resolution of the Riigikogu of 21 October 2008.

b. Development Plan for Enhancing the Use of Biomass and Bioenergy for 2007–2013⁵: the objective of the plan is to create favourable conditions for the development of the production of domestic biomass and bioenergy in order to decrease the dependence of Estonia from imported resources and fossil fuels and to reduce pressure on the natural environment by using the earth resources effectively and sustainably. The abovementioned objectives support the objectives of the Development Plan of the Electricity Sector to enhance sustainable ways of electricity production and to reduce the environmental impact accompanying electricity production.

c. Energy Conservation Target Programme for 2007- 2013⁶ defines the targets for saving fuel and energy in Estonia for 2007-2013 and establishes the measures required for achieving the targets. The objective of the programme is to ensure more efficient use of fuels and energy in Estonia, which is of significant importance for the achievement of the objectives of the

⁴ National Development Plan for the Use of Oil Shale for 2008–2015 <http://www.envir.ee/232764>

⁵ Development Plan for Enhancing the Use of Biomass and Bio energy for 2007–2013 <http://www.agri.ee/index.php?id=11014>

⁶ Energy Conservation Target Programme for 2007- 2013 <http://www.mkm.ee/index.php?id=221420>

Development Plan of the Electricity Sector upon enhancement of sustainable electricity production and consumption.

The Development Plan of the Electricity Sector for the new period is related to several strategic documents which have already been approved:

d. Estonian National Strategy on Sustainable Development "Sustainable Estonia 21"⁷ supports in general the increase of the production of energy based on renewable natural resources. Estonian energy sector shall be reorganised by developing preferentially and supporting activities which promote energy conservation. Based on the objectives of the strategy, measures have been planned in the Development Plan of the Electricity Sector for supporting the ways of sustainable energy production.

e. National Strategic Reference Framework for the EU Structural Funds for 2007-2013⁸ establishes an objective to use energy more efficiently which would enable to prevent potential shortage of energy in future and thus provide international competitive and security advantages for the state in the longer run. More attention should be paid to the control of the increase of energy consumption and the increase of the efficiency of energy consumption and energy conservation by the end consumer. Based on the objectives of the strategy, measures have been planned in the Development Plan of the Electricity Sector for increasing more economical electricity supply and consumption.

f. Estonian Environmental Strategy until 2030⁹ provides for the objective of the energy sector to produce electricity in an amount, which satisfies the consumption needs in Estonia, and to develop versatile, sustainable production technologies based on different energy sources and with little environmental load, which enable to produce electricity also for export. The Development Plan of the Electricity Sector helps to implement the objectives set out in the Estonian Environmental Strategy by application of concrete measures and activities.

g. Estonian Environmental Activity Plan for 2007-2013¹⁰: the objective is to slow down and stabilise the increase of energy consumption by ensuring at the same time satisfaction of the needs of the people, i.e. by ensuring preservation of the amount of primary energy upon increase of consumption. The measures and activities for ensuring continuous electricity supply have been planned in the Development Plan of the Electricity Sector.

h. Estonian Housing Development Plan for 2007- 2013¹¹ provides measures for the improvement of energy conservation in apartment buildings and for raising awareness in order to improve the housing fund which supports the objective to increase the economy of electricity consumption provided for in the Development Plan of the Electricity Sector.

⁷ Estonian National Strategy on Sustainable Development "Sustainable Estonia 21" <https://www.riigiteataja.ee/ert/act.jsp?id=940717>

⁸ National Strategic Reference Framework for the EU Structural Funds for 2007-2013 <http://www.fin.ee/sf2007>

⁹ Estonian Environmental Strategy until 2030 <http://www.envir.ee/1045989>

¹⁰ Estonian Environmental Activity Plan for 2007-2013 <http://www.envir.ee/1045989>

¹¹ Estonian Housing Development Plan for 2007- 2013 <http://www.mkm.ee/index.php?id=1733>

i. Estonian Energy Technology Programme for 2007-2013¹² determines the main priorities upon the development of energy technologies in Estonia. The priorities are the development of new energy technologies based mainly on renewable energy resources and the development of oil shale technologies, both of which have a direct impact on the development of the electricity sector and support the objectives, measures and activities of the Development Plan of the Electricity Sector.

j. Estonian Action Plan for Economic Growth and Employment for 2008- 2011¹³ establishes the objective of the energy sector to ensure security of supply of energy, to develop environment-friendly power engineering and to increase energy efficiency. For Estonia the key issues are oil shale power industry, increase of ecological compatibility, increase of the share of renewable energy and improvement of energy efficiency. The increase of energy efficiency contributes to environment-friendly power engineering (more efficient energy consumption – smaller environmental impact) and the increase of security of supply (smaller energy consumption – smaller need for imported energy), which coincide with the objectives of the Development Plan of the Electricity Sector upon the increase of energy efficiency.

¹² Estonian Energy Technology Programme <http://www.hm.ee/index.php?03242>

¹³ Estonian Action Plan for Economic Growth and Employment for 2008- 2011 <http://www.riigikantselei.ee/?id=5864>

1.3. Implementation of Development Plan of Electricity Sector for 2005- 2015

The "Development Plan of the Estonian Electricity Sector for 2005-2015" (hereinafter "development plan of the electricity sector of the previous period") was approved by the Government of the Republic Order No 5 of 3 January 2006. The strategic objective of the development plan of the electricity sector of the previous period is to ensure optimum functioning and development of the Estonian power system under market economy conditions and supplying of the consumers with electricity in conformity with the requirements at as low prices as possible in the long term.

An overview is given below on the objectives established in the development plan of the electricity sector of the previous period for 2005-2015 and on the achievement thereof.

Table 1. Overview of the performance of the tasks provided for in the development plan of the electricity sector of the previous period

Objective	Achievement	Achieved target value or objective, as at 2007 ¹⁴
Ensuring the operational security and immunity of the Estonian power system and the security of consumer supply at least at the level of 2005	<u>Achieved:</u> The operational security and immunity of the Estonian power system has improved constantly over the years. In order to achieve the objective, OÜ Põhivõrk has made significant investments in the construction of new substations and lines and in the maintenance of old substations and lines over the past few years.	In 2005 there were 246 trippings, including 40 trippings with interruptions; in 2006 there were 169 trippings, including 23 trippings with interruptions.
Ensuring complete modernisation of the power network in approximately every thirty years in the transmission network and in approximately every forty years in the distribution network	<u>Achieved:</u> The methods for the calculation of the prices for network services take into account the need to modernise the transmission network in every thirty years and the distribution network in every forty years. During the years 2000 – 2006 five substations were renovated each year on an average.	
Reduction of transmission and distribution losses	<u>Achieved:</u> During the years 2001-2005 transmission losses decreased by 13.2 % and distribution losses decreased by 15 %.	
Ensuring the existence of local generating power to cover the domestic electricity consumption needs	<u>Achieved:</u> Estonia has been continuously able to cover its electricity consumption needs and has also exported electricity.	The available net installed capacity of the power plants is 2760 MW. In 2007, 7180 GWh of electric energy was consumed domestically, there were 1354 GWh network losses (thus 8534 GWh for gross consumption) and 2765 GWh of electricity was exported (1001 GWh in 2006).
Establishment of new interconnections with the power systems of the neighbouring states and enhancement of international cooperation	<u>Achieved:</u> In 2007, the submarine cable Estlink was put into operation between Estonia and Finland which has considerably increased power trading between the states of the region.	

¹⁴ Upon pointing out the trend (increase/decrease), the year 2000 has been taken as the reference level (unless indicated otherwise) for the purpose of comparing with the levels indicated in the development plan of the previous period.

Objective	Achievement	Achieved target value or objective, as at 2007 ¹⁴
Ensuring that by 2010 renewable electricity forms 5.1 % of the gross consumption	<u>Trend towards achievement of the objective:</u> By 2006 the share of renewable electricity had increased; the estimated output of the new projects of renewable electricity production which will be completed by 2010 exceeds the established objective.	In 2007 renewable electricity formed 1.75 % of the gross consumption.
Ensuring that by 2020 the electricity produced in cogeneration stations forms 20 % of the gross consumption	<u>Trend towards achievement of the objective:</u> The cogeneration support schemes implemented in 2007 have facilitated the construction of new cogeneration stations; the share of cogeneration is increasing.	10.2 % of the gross consumption of electric energy and 27 % of thermal energy was produced in cogeneration regime. 18 cogeneration stations were in operation.
Development of the technologies which use energy resources more efficiently	<u>Achieved:</u> In order to improve the efficiency of energy production of Narva Power Plants, new power units based on fluidised bed technology were installed in 2005, as a result of which the use of oil shale and the amount of atmospheric emissions have decreased to a considerable extent.	The efficiency of the old boilers was 30 %, the efficiency of the new boilers amounts to 36 %.
Keeping the rate of increase of electricity consumption at least twice as low as GDP growth	<u>Achieved:</u> the rate of the increase of electricity consumption has been constantly more than twice as low as the rate of real GDP growth; it exceeded the established objective only in 2006.	In 2005: GDP growth 9.2 %, increase of final consumption of electricity 2.2 % 2006: GDP growth 10.4 %, increase of final consumption of electricity 7.5 % 2007: GDP growth 6.3 %, increase of final consumption of electricity 3.8 %
Ensuring that know-how is available in the field of power engineering, ensuring efficient technology development and transfer of technology, research and innovation in the state.	The field of power engineering has become more popular at the universities, new specialities and areas of specialisation have been opened. The new areas of specialisation are distributed generation of electricity, use of alternative energy sources, optimisation of larger systems and energy trading.	

While the development plan of the electricity sector of the previous period indicated that the most feasible trend economically would be to increase the share of natural gas in electricity production, the problems concerning gas supplies in 2005 and the price increase which was significantly higher than expected have considerably decreased the attractiveness of this variant. The construction of power plants operating only on natural gas in Estonia is justified only if there is a clear alternative fuel or if these are used only for covering the peak load.

As an experience from the implementation of the development plan of the electricity sector of the previous period it shall be noted that implementation of the electricity market requires that the state give very clear signals for investment to energy undertakings in order to ensure the desired structure of electricity production. It is important that there is a variety of different producers in the electricity market: it shall be possible to produce electricity from several different energy sources by as many different producers as possible as cheaply as possible and in an environmentally-friendly way without market concentration.

1.4. Electricity Market Statistics

Estonia has been continuously able to cover its domestic electricity consumption needs and has also exported electricity. According to the system operator, the available net capacity of the power plants was approximately 1800 MW by the beginning of 2008; the actual potential net production during peak consumption in winter was 2076 MW (as a result of the repairs of the generating installations, breakdowns and the possibility of production depending on the existence water and wind resources). In 2007, 7180 GWh of electric energy was consumed domestically, there were 1354 GWh network losses (thus 8534 GWh for gross consumption) and 2765 GWh of electricity was exported. In 2007, the gross production of electricity was 12,188 GWh (including autoproduction of the power plants).

According to the statistical survey "Energy balance 2007" prepared by the Statistical Office (hereinafter "Energy balance 2007", available on the website www.stat.ee), 11,402 GWh of electricity was produced on the basis of oil shale, 350 GWh on the basis of natural gas, 235 GWh on the basis of shale gas, 22 GWh on the basis of hydro power, 91 GWh on the basis of wind power, 36 GWh on the basis of other renewable energy sources and 22 GWh on the basis of peat (see Figure 1). In 2007, 93.6 % of electricity was produced from oil shale.

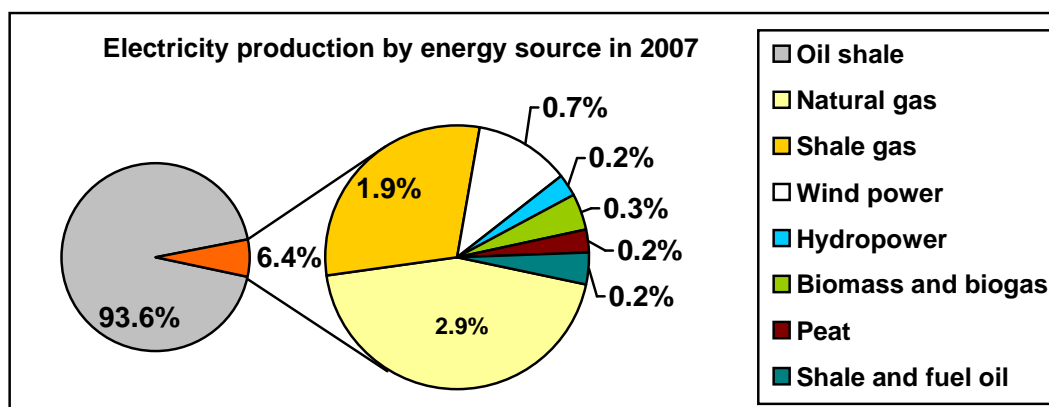


Figure 1. 12 188 GWh of electricity was produced in 2007¹⁵

As compared to 2006, electricity production increased by approximately one fourth in 2007. The production increase resulted from the increased export of electricity. While in 2006 electricity was exported in the amount of 1001 GWh, in 2007, 2765 GWh of electricity was exported. Nearly fifty per cent of it was transmitted to the Nordic countries through the submarine cable Estlink and export to Latvia increased 1.5 times.

Production of electricity from renewable energy sources has increased constantly. 22 hydroelectric power plants and 12 wind farms operated in Estonia in 2007. In 2007, the share of the production of renewable electricity was 1.75 % of the gross consumption. The estimated output of the new projects of renewable electricity production which will be completed by 2010 exceeds significantly the established objective – to ensure that by 2010 the share of renewable electricity would be 5.1

¹⁵ Data of 2007 of the Statistical Office, „Energy balance 2007”

%). The use of renewable energy for electricity production is facilitated by the amendments to the Electricity Market Act which entered into force at the beginning of 2007 and which, inter alia, establish new legal basis for supporting entry of renewable energy producers and cogeneration producers into the market.

18 cogeneration stations operated in Estonia in 2007. According to "Energy balance 2007", 10.2 % of the gross consumption of electricity (electricity consumption and network losses) was produced in cogeneration regime. The cogeneration support schemes implemented in 2007 have also facilitated the construction of new cogeneration stations, as a result of which the share of cogeneration is increasing.

In order to improve the efficiency of oil shale energy production, new power units based on fluidised bed technology were introduced in Narva Power Plants, which have reduced the environmental impact to a considerable extent – as compared to 2004, the total amount of SO₂ emissions decreased by 20 %, the amount of CO₂ emissions from combustion of fuels by 6.9%.

1.5. Current State of and Forecast for Estonian Electricity Market

This Development Plan is based on the research and analysis carried out in the past few years. The main conclusions of the most important research and analysis are given below.

1.5.1. Assessment of and forecast for Estonian electricity market

According to the report on the security of supply of the Estonian power system prepared by OÜ Põhivõrk¹⁶, problems concerning coverage of peak demand may arise in Estonia already from the year 2012. These problems will become more severe in 2016 in connection with the requirement not to use the old units of Narva Power Plants in the present form. From the electricity production capacity used at present it will be possible to keep in operation the two new fluidised bed combustion units of Narva Power Plants, the second power unit of Iru Power Plant and small stations from 2016. The capacity of wind turbines cannot be taken into account in the capacity balance.

OÜ Põhivõrk has predicted that the peak load will increase 1.6 % to 3.8 % a year, the increase of 2.3 % of peak demand is predicted as a base scenario. At the same time the peak demand depends considerably on the temperature, in the presented forecasts the average degree level is presumed.

¹⁶ OÜ Põhivõrk, <http://www.pohivork.ee/>

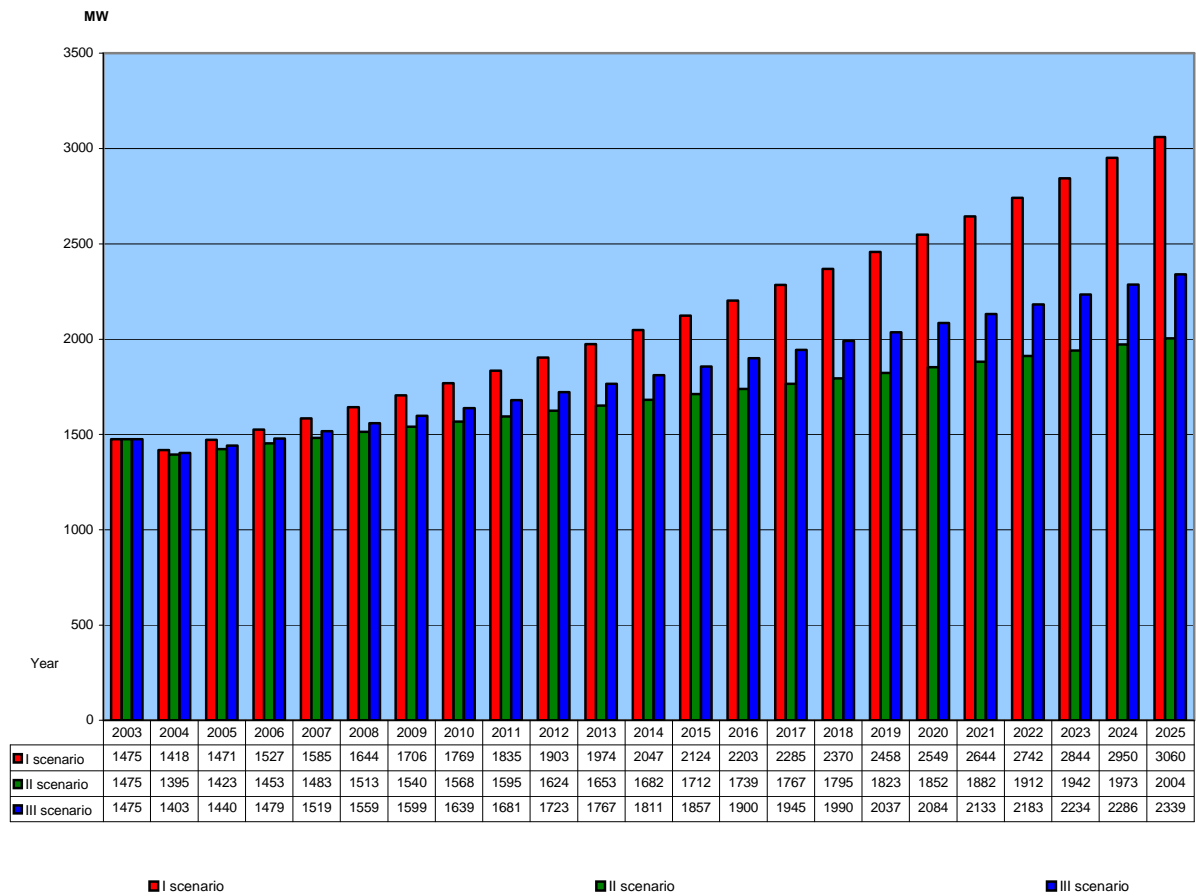


Figure 2. Peak load forecasts of OÜ Põhivõrk for 2004-2025

Considering that the peak load of the system in 2015 will be approximately 1800 MW, there will be capacity shortage of approximately 1228 MW. According to OÜ Põhivõrk, the potential new projects in the next years are: 2x225 up to 2x300 MW_{el} oil shale units based on fluidised bed technology in the years 2011-2012, 110 MW_{el} emergency reserve in Iru power plant by 2011, 140 MW_{el} regulation reserve in Iru power plant by 2011, 23 MW_{el} cogeneration station operating on biofuel in Ahtme power plant by 2009. In order to cover the peak loads in winter, it is also possible to use old oil shale units if desulphurisation and denitrification systems are installed. The wind turbines constructed in parallel shall have also adequate power reserve.

At the end of 2008 Vão cogeneration station was completed near Tallinn, the electrical and thermal capacities of which are 25MW and 50MW respectively. The planned electricity production is up to 190 GWh and the planned heat production 500 GWh a year.

It has been planned to complete the new cogeneration unit of Iru power plant based on the recovery of waste and operating in the group of Eesti Energia by the end of 2011. The planned electrical capacity of the new cogeneration unit is 17 MW and the planned thermal capacity is 50MW.

According to OÜ Põhivõrk, electricity consumption will increase 1.8-3.5 % a year, 2.3 % a year as the most probable scenario. Annual economic growth of 3-7 % is presumed in the forecast.

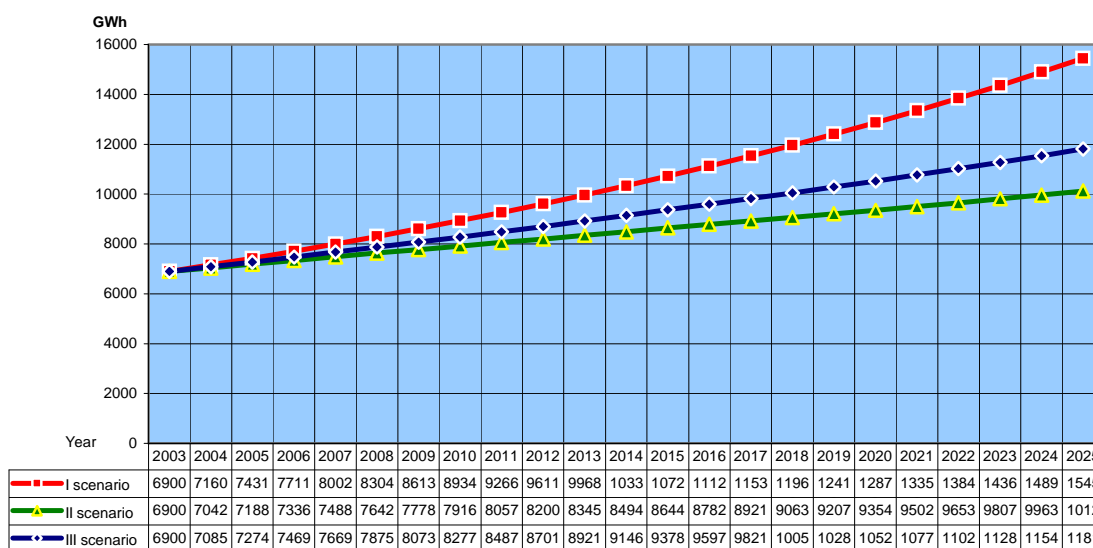


Figure 3. Forecasts of total electricity consumption from the transmission network for 2004-2025

1.5.2. Current state of Estonian electricity market

The report on the current state of the electricity and gas market in Estonia prepared in 2008 by the Estonian Competition Authority¹⁷ gives an overview of the development of the electricity market in Estonia. According to the Estonian Competition Authority, the electricity production and sales market in Estonia is very concentrated and orientated at one type of fuel – approximately 94 % of all the electricity is produced from oil shale. In 2007, Eesti Energia AS produced 95.3 % of the total amount of electricity. In addition to 95 % of the production market, OÜ Jaotusvõrk with the market share of 86 % belongs also to the group of Eesti Energia AS. As compared to other states, Estonia is in a good state as for electricity market legislation, the rights and obligations of the electricity market regulator have been regulated by the Electricity Market Act.

In its report the Estonian Competition Authority has assessed also the independence of OÜ Põhivõrk as the system operator and has given a positive assessment thereto. The functions of the management board and the supervisory board of the undertaking are well-defined; the supervisory board cannot affect the decisions of the management board with respect to other market participants; no cases of discrimination of market participants by OÜ Põhivõrk have been detected, goods and services are purchased on an equal basis from both, the undertakings belonging to the group and undertakings not belonging to the group; the website of the undertaking is one of the best ones among the energy undertakings.

In order to differentiate the activities better, the Estonian Competition Authority has recommended as a proposal to establish a sales company as a separate legal person in the group of Eesti Energia AS which would avoid the potential conflict of interests between a sales company and OÜ Põhivõrk. It is also recommended to define more precisely the criteria for removal of members of the management board.

¹⁷ Estonian Competition Authority, Estonian Electricity and Gas Market Report 2008
<http://www.konkurentsiamet.ee/?id=10836>

In the open electricity market it is important to ensure independence of the activities of the system operator, regulator and network operators. In the relevant comparisons prepared by the European Commission Estonian electricity market regulation stands out for its transparency and proper organisation, there are also no examples of the discrimination of undertakings on the electricity market.

In the debates on the draft electricity market Directive introduction of the requirement of separation of the transmission network from vertically integrated electricity groups has been proposed. In principle, Estonia has supported the proposal on condition that it is applied in a non-discriminative way and it does not include the obligation to privatise the transmission network enterprise (i.e. both of the enterprises may belong to the state).

SWOT analysis has been used below for assessing the Estonian electricity sector.

Table 2. SWOT analysis of the Estonian electricity sector

<p>Strengths:</p> <ol style="list-style-type: none"> 1. Strong electrical interconnections with Latvia, Russia and Finland; 2. Strong and well-developed transmission network; 3. The present level of production capacities ensures electricity supply at any moment in time; 4. Efficient cooperation between the Baltic States and the Finnish transmission network operators; 5. Transparent and proper market regulation. 	<p>Weaknesses:</p> <ol style="list-style-type: none"> 1. Small electricity market with few suppliers; 2. Old age of the power plants; 3. Concentration of electricity production in one region ; 4. Extensive environmental impact of oil shale fired power plants; very high share of oil shale in electricity production; 5. Insufficient technical quality of distribution networks; 6. Inadequately justified level of aid for renewable and cogeneration electricity; 7. Weak and non-transparent price signals for investments into the capacities of the new generation; 8. Insufficient electrical interconnections between the Baltic region and the rest of the Member States of the European Union.
<p>Opportunities:</p> <ol style="list-style-type: none"> 1. Interest of the market participants to develop and make investments in the electricity market; 2. To establish a versatile and balanced power system within a relatively short period of time; 3. To increase the use of renewable energy sources to a justified extent; 4. To increase the production of cogeneration electricity; 5. To construct plants intended for covering the peak load based on domestic fuel. 	<p>Threats:</p> <ol style="list-style-type: none"> 1. Potential shortage of production capacity since 2016; 2. Potential dominant position of electricity with dumping elements from Russia; 3. Negative effect of emission trading on the energy balance; 4. Potential steep increase of electricity prices upon opening of the electricity market; 5. Possibility of extensive network failures and/or power-cuts; 6. Overloading in the Russian transmission system may affect the functioning of the electricity market and the power systems.

1.5.3. Potential for heat and power cogeneration in Estonia¹⁸

Estonia has set a national aim to cover 20 % of the gross consumption of electricity in 2020 on the basis of cogeneration. As at 2007, there were 18 cogeneration stations in Estonia, three of which complied with the criteria of efficient cogeneration¹⁹ and produced 10.2 % of the gross consumption of electricity. According to the surveys undertaken, the potential of cogeneration is relatively big in Estonia, there are economic and technical conditions for that - a functioning district heating network, energy-intensive local industry, the existence of gaseous fuel and a developed gas network, the availability of biofuels, the increase of electricity consumption, the need for innovations of technology, increased requirements for the environment. The restricting factor is the absence of constant thermal input.

The new cogeneration stations would operate mainly on biofuels. Peat, firewood, logging and wood waste are local fuels having significant energetic potential which could be used sustainably in small cogeneration stations.

1.5.4. Potential of renewable energy sources

According to the survey of the Tallinn University of Technology²⁰, the potential of Estonian renewable energy primarily means combined heat and power production based on biofuel and wind power; at the same time small-scale hydropower industry is developed. In order to achieve the 5.1 % objective set for 2010, 300-360 GWh of electricity should be produced on the basis thereof. The following solutions were proposed in the survey:

- increasing of the capacities of hydroelectric power plants up to 10 MW which would enable to produce 45...55 GWh of electricity with an average annual quantity of water;
- making use of the technologically practical potential of replacing firewood boilers of boiler plants by combined heat and power appliances by installing 31 MW of electrical capacity which would enable to produce additionally up to 830 GWh of heat and 164 GWh of power from firewood on the basis of cogeneration. Electricity produced from biogas – approximately 3 MW – and electricity produced on the basis of black liquor (the production depends on the profitability of the production in Estonia) will be added thereto;
- increasing of the capacity of wind farms up to 50 MW with the annual production of 123 GWh.

In 2007, renewable electricity formed 1.75 % of gross consumption. Since the estimated electricity production of the cogeneration stations and wind turbines under construction may exceed

¹⁸ Tallinn University of Technology "Potential for Efficient Heat and Power Cogeneration in Estonia" 2007, "Reference Values of Efficient Cogeneration and Potential for Heat and Power Cogeneration in Estonia" 2005, <http://www.mkm.ee/index.php?id=8098>

¹⁹ Regulation No 30 of the Minister of Economic Affairs and Communications of 3 May 2007 "Requirements for Efficient Cogeneration", <https://www.riigiteataja.ee/ert/act.jsp?id=12825847>

²⁰ Tallinn University of Technology "Possibilities for Increasing the Share of Renewable Energy Sources in Electricity generation in Estonia" 2003, Reports "Promotion of Use of Electricity Produced from Renewable Energy Sources" 2005, 2007, <http://www.mkm.ee/index.php?id=8098>

800 GWh, the share of renewable energy may exceed 10 % of gross consumption in 2010. Thus, the results of the survey are out-of-date and a new survey needs to be conducted.

1.5.5. Balancing of power system

The balance between electricity production and consumption is one of the most important conditions for functioning of a power system. The absence of balance brings about frequency variation and may cause blackout of the whole system. Balance of a power system means that the amount of electricity produced and imported into the system shall be equal to the amounts of electricity consumed and exported from the system at any moment in time.

The absence of balance (imbalance) is usually caused by the following:

- as a result of unexpected changes in consumption, usually in connection with rapid temperature variations;
- in case of changes in wind speed;
- as a result of emergency switching off of the power plants or transmission equipment;
- increase of consumption in connection to an especially cold winter and other extraordinary unforeseeable cases.

All the described cases affect the power system during a relatively short period of time (from a couple of hours up to one day) in each specific case.

The balance of the power system is achieved through the system of balance providers. Each market participant shall belong to the balance area of one balance provider. Balance providers are responsible for the balance of their balance area at any moment in time. In case of the occurrence of imbalance, they shall promptly take measures for achieving balance.

The system operator shall be responsible for the elimination of imbalance:

- a. for a short period of time i.e. during the current and the following hour. It is usually not possible for the balance providers to balance their balance area during the current or the following trading period (hour), since pursuant to the market rules additional supplies may be provided only as of the second following hour. It shall be possible for a system operator to balance the Estonian power system quickly (within a quarter of an hour) and to keep the balance up to the end of the following hour. Since a real-time regulating market cannot be established in our region due to the small number of hydroelectric power plants, the only possibility for a system operator (OÜ Põhivõrk) is to construct a relevant power plant which would enable to balance the system in a short period of time;
- b. in extraordinary unforeseeable cases which is especially likely during winter peak load. For this purpose, the system operator shall have spare production capacity available which could be activated if necessary. Since such events are not frequent and they last a short period of time, it is not economically reasonable to make market based investments into such a power plant. The system operator may solve the balancing of the system in case of such events either through the regulation plant operated thereby, through the existing power plants on the basis of the relevant contracts or in combination of the both;
- c. as a result of emergency switching off of the power plants or transmission equipment. For this purpose, the transmission networks of the states belonging to the unified power system have concluded a contract pursuant to which each transmission network shall increase production in its power system within fifteen minutes in accordance with the agreed formula and keep the level for twelve hours. For this purpose, the system

operator shall construct the relevant so-called emergency power plant. This plant shall not be used for balancing an imbalance caused by other reasons, since in the latter case the system operator would not be able to perform the contractual obligations thereof upon the occurrence of an emergency.

Since in both, variant a) and variant b) the power plant (so-called regulation plant of the system operator) and in variant c) the emergency power plant are activated relatively seldom for a relatively short periods of time, the power plants to be constructed should have as low investment expenses as possible, the cost of energy production is not important. The investment into the emergency power plant shall be financed from the tariff of OÜ Põhivõrk.

A balance provider shall always be financially responsible for the imbalance of the balance area thereof in accordance with the terms and conditions of the balance agreement concluded with the system operator. In addition to that, a balance provider shall promptly take measures for restoring balance upon the occurrence of imbalance and at the request of the system operator. These measures mean primarily procurement of additional supplies from other market participants. However, it is not possible to eliminate imbalance by additional supplies momentarily, since agreement with the counterparty and the system operator takes a certain amount of time and, as a rule, entry into force thereof is possible as of the second following trading period.

Although wind turbines must have also concluded open supply contracts (usually) with a balance provider, wind turbines have their own specifics which bring about their additional obligations upon balancing the system. Since wind speed may change quickly and it is relatively hard to foresee it, the imbalance caused by wind turbines affects the balance of the power system in a very negative way. The seriousness of the problem is directly connected with the total capacity of the wind turbines. So far the maximum production of wind turbines has remained below 30MW which is in the same range as the imbalance permitted to the Estonian power system by the contract concluded between the transmission networks of other states belonging to the unified power system and thus, it has not caused any problems. However, the Development Plan includes scenarios where the planned total capacity of wind turbines is from a couple of hundred to 1200 MW. Regulation power plants are required for balancing the production of these wind turbines.

1.6. Regulations Affecting EU Electricity Market

1.6.1. EU energy policy

In March 2007, the European Council adopted the EU's Action Plan for Energy Policy 2007-2009 (hereinafter EU energy policy), the objectives of which are:

- increasing security of supply;
- ensuring the competitiveness of European economies and the availability of affordable energy;
- promoting environmental sustainability and combating climate change.

In order to achieve the objectives established in the action plan for energy policy, the European Union has fixed highly ambitious quantified targets on energy efficiency, the use of renewable energy sources and biofuels, including environmentally safe carbon capture and storage by 2020:

- achieving at least a 20 % reduction of greenhouse gas emissions compared to the base year 1990 (by 2005 the greenhouse gas emissions had been reduced by 6 %);

- increasing the share of renewable energy to 20 % of the final consumption of primary energy (in 2005 the average share in EU was 8.5 %);
- achieving 20 % more efficient use of energy in the final consumption of primary energy;
- increasing the share of biofuels up to 10 % in transport fuels provided that economically expedient second-generation biofuels are developed.

1.6.2. Third internal natural gas and electricity market package²¹

The planned amendments to the electricity market have a direct impact on the structure of the Estonian electricity market. In this context, Estonia is open to justified requirements on the electricity market, including separation of transmission networks from the vertically integrated energy group provided that this is required from analogous groups in the whole European Union and this does not include the requirement of privatisation of the transmission network. At the same time such a separation of undertakings shall not deteriorate the financial capability of the energy undertakings.

The functioning of the Estonian electricity market is affected also by the organisation of the offsetting mechanism of international electricity transit by the European Union which is discriminating Estonia at present. Therefore work must be continued for the development of the system so that it would be suitable for all the Member States.

On the opening electricity market of the European Union it is very important for Estonia to regulate the terms and conditions of the import of electricity from third countries, since at present significant competitive advantages have been provided for these producers as compared to EU producers (in the EU there are more strict requirements for the environment and nuclear safety, fuel price differences, emission trading). Since the Baltic States have very strong interconnections with the Russian power system, there are no technical restrictions for the import of electricity. Thus, regulative restrictions shall ensure equal treatment of producers on the electricity market.

1.6.3. Climate and energy package

The so-called "Climate and Energy Package"²² published by the European Commission 23 January 2008 plays an important role in the options of Estonian electricity production; the most important parts of it for Estonia are the draft amendment to the Greenhouse Gas Emissions Trading Directive, the draft Renewable Energy Directive and the draft Carbon Capture and Storage Directive. The Climate and Energy Package was confirmed by the European Council on 11-12 December 2008 and approved by the European Parliament on 17 December 2008.

The emissions of greenhouse gases (GHG) shall be reduced in two parts – within the framework of the trading scheme of permissible GHG emissions (hereinafter "ETS" - emission trading scheme) and through state obligations in the sectors not included in the scheme.

The reduction of emissions within the framework of ETS is achieved by the scheme of allocation of allowances (quotas). As of 2013 the permissible quantity of total annual emission allowances shall decrease by a linear factor of 1.74 % in order to reduce the emissions covered by the scheme by 21 % by 2020 compared to the level in 2005. Member States may exclude small installations

²¹ http://ec.europa.eu/energy/gas_electricity/third_legislative_package_en.htm

²² Climate package http://ec.europa.eu/climateaction/key_documents/index_en.htm

with annual emission of less than 25,000 tonnes of carbon dioxide and a rated thermal input below 35 MW from ETS.

It is planned to replace the national allocation plans by auctioning or free allocation of permissible emissions through single EU-wide rules. In the scheme of allocation of emissions, organisation of auctions, which should increase the price of an allowance and thus motivate the undertakings to apply cleaner technologies, becomes most important. 88 % of the total quantity of allowances to be auctioned will be distributed among Member States according to their share of the verified Community scheme emissions either a) as of 2005 or b) the average for the period 2005-2007, whichever is higher. In case of Estonia the average verified emissions for the period 2005-2007 is higher (13.4 million tons). The rest of the 10% and 2% of the total quantity of allowances to be auctioned shall be allocated according to the principle of solidarity, economic growth and early reduction. The European Commission will publish the estimated number of allowances to be auctioned by the end of 2010.

The electricity production sector – representing a large part of emissions – would be subject to auctioning from the start of the new ETS in 2013. However, Member States may grant transitional free allocations for small installations which were engaged in the production of electricity on 31 December 2008 or for small installations for which an investment process had been initiated for the same date if one of the following conditions is met:

- the national electricity network was not, in 2007, directly or indirectly connected to the network interconnected system (central European power system) operated by the Union for the Coordination of the Transmission of Electricity (UCTE); or
 - where the national electricity network was, in 2007, only directly or indirectly connected to the network operated by the Union for the Coordination of the transmission of electricity (UCTE) through a single line with a capacity of less than 400 MW; or
 - where, in 2006, more than 30 percent of electricity was produced from a single fossil fuel, and, where in 2006 the gross domestic product per capita at market prices did not exceed 50 % of the average gross domestic product per capita of the EU.
- Free allowances shall be allocated on the basis of an investment plan. Transitional free allocations shall be deducted from the quantity of allowances the Member State would otherwise auction. Free allowances shall be allocated for a specified term and limited in quantity: in 2013, the total transitional free allocation shall not exceed 70 % of the annual average verified emissions in 2005-2007 from such generators for the amount corresponding to gross final national consumption pursuant to verified emissions in 2005-2007 of the Member State concerned and shall gradually decrease thereafter, resulting in no free allocation in 2020. Free allowances shall be allocated to electricity production on the basis of the relevant activity plan of the Member State, an application shall also be submitted to the European Commission.

Proceeding from the abovementioned conditions, the option to allocate free allowances in the transitional period for modernisation of electricity production applies also to Estonia. Partial allocation of free allowance may turn out to be necessary upon the development of new electricity production capacities in Narva Power Plants.

- Free allowances shall be allocated for the production of heat in district heating boiler plants through high efficiency cogeneration the quantity of which shall decrease by a linear factor of 1.74% a year starting in 2013. Other industrial sectors with no risk of carbon leakage will step up to auctioning gradually; in the period 2013-2020 the share of allowances will increase from 20% to 70% of the European Community reference and the system of auctioning will be fully implemented by 2027.

Auctions shall be organised by Member States and the revenues would be received by Member States. The auctions shall be based on the principles of openness, transparency, harmonised approach and non-discrimination. For example, each operator operating in the European Union may buy allowances in any Member State. By 30 June 2010 at the latest, the European Commission shall adopt a Regulation which regulates the timing, organisation and other aspects of auctions.

- The auctioning process will generate significant revenues for Member States, which will help towards the process of adjustment to a low carbon economy, supporting research and development and innovation in areas like renewables and carbon capture and storage, helping developing countries, and helping the less well-off to invest in energy efficiency. Member States shall use at least 50% of their auctioning income for that purpose. Member States shall notify the European Commission of the use of auctioning income.
- In the climate package specific attention has been paid to industrial sectors exposed to the risk of carbon leakage, the international competitiveness of which may deteriorate significantly as a result of the implementation of the prerequisite for the climate package. The European Commission shall prepare analysis of such sectors (mainly energy-intensive industries) by the end of 2009 and the relevant list of industries shall be approved by the European Council. The European Commission shall present proposals for the required further action with respect to these sectors at the European Union level not later than by 30 June 2010. Installations in industrial sectors or sub-sectors which are exposed to a significant risk of carbon leakage will be allocated, in the period 2013-2020, 100% of allowances free of charge at the level of the benchmark of the best technology available.
- It is important to point out that in its impact assessment of the negotiations on an international climate change agreement and upon the presentation of further action, the European Commission shall take account of the impact of carbon leakage on Member States' energy security, where there are cross-border electricity connections with third countries and where the electricity connections with the internal market of the rest of the European Union are insufficient. Taking into account, for example, the nature of the cross-border electricity connections of Estonia and depending on the results of the international climate change agreement, this may mean a possibility to establish common measures at the European Union level for the regulation of the import of electricity produced in third countries, e.g. by including import in the emission trading system.

The reduction of GHG emissions in the sectors outside the ETS will be achieved through national obligations to reduce GHG. In the sectors not covered by the EU ETS such as buildings, transport, agriculture, waste and industrial installations the emissions of which are lower from the quantities prescribed for accession to the ETS, the obligations to reduce emission are shared between Member States according to GDP per capita. In case of the abovementioned sectors, EU aims to reduce emissions by 10% compared to 2005. For Estonia it is permitted to increase emissions in the abovementioned sectors by up to 11% by 2020.

For the purposes of organisation of the distribution and use of the income received within the framework of the emission trading scheme, a concept of the relevant organisational structure shall be adopted in Estonia in 2010. When the concept is agreed upon and approved, principles shall be adopted for the implementation of the updated emission trading scheme in Estonia, including the principles for the organisation of allowance auctions and for the distribution and use of the income received from the allowance auctions.

The objective of the Renewable Energy Directive is to establish a common framework for the promotion of the use of energy from renewable sources. One of the most important elements in the Directive is national renewable energy targets, which determine the percentage of the consumption

of renewable energy to be achieved by each Member State by 2020 with an aim to increase the overall EU share of renewable energy to 20% by 2020. Thereby indicative interim targets have been established which are calculated as an average for a two-year period. By 2020 the share of energy from renewable sources shall form 25% of the total final consumption in Estonia. The share of energy from renewable sources is calculated as the ratio of consumption of energy from renewable sources over total final consumption. According to the Directive, final consumption includes energy consumption of different economic sectors and energy consumption in the energy sector together with losses.

It is up to Member States to decide on which possibilities of renewable energy production to focus. Also, more attention shall be paid on the reduction of greenhouse gas emissions and the increase of security of power supply in the transport sector.

The objective of the Carbon Capture and Storage Directive is to ensure that carbon capture and storage is used as a means of mitigating climate change and that this is carried out in a secure and responsible way.

Carbon dioxide capture and storage (hereinafter "CCS") is a means of mitigating climate change. It consists of the capture of carbon dioxide from industrial installations, its transport to a storage site and its injection into a suitable geological formation for the purposes of permanent storage. The purpose of geological storage is permanent containment of CO₂ in such a way as to prevent or reduce negative effects on the environment and any resulting risk to human health.

Although no separate free allowances have been prescribed for carbon dioxide capture and storage (except up to 300 million tons up to the end of 2015 set aside in the new entrants reserve for supporting EU demonstration projects), the Emissions Trading Directive enables Member States to use in the years 2013-2016 the income received from the auction of allowances for the promotion of the construction of highly efficient power plants, including the construction of new power plants enabling carbon dioxide capture and storage. In case of new installations with the efficiency exceeding the efficiency values provided for power plants in Annex 1 to the Commission decision 2007/74/EC (e.g. the reference value for separate production of electricity from oil shale is 39.0%), Member States may bear up to 15% of the total cost of the investments related to the new installations enabling carbon dioxide capture and storage.

1.6.4 Prices and market liberalisation on EU electricity market

The electricity markets of the Member States of the European Union were opened to commercial consumers on 1 July 2004 and to all the consumers on 1 July 2007. Pursuant to the accession treaty between Estonia and the European Union, Estonia shall open 35% of its electricity market by 2009 at the latest and 100% by 2013 at the latest. In connection with the opening of the electricity markets, electricity undertakings of other states will enter the market beside Estonian undertakings. The entry into market of new undertakings will increase competitiveness on the electricity market, but also uncertainty with respect to the structure of production capacities and the location thereof. Because of this it is important to make preparations for ensuring adequate functioning of the open electricity market.

At present the electricity prices on the electricity markets of the EU states surrounding Estonia are somewhat higher. The electricity price will increase considerably in the region in the next few years after closing of the Ignalina nuclear power plant and the construction of new production

capacities in Estonia and Latvia. The application of the new EU emission trading rules and the environmental investments in power plants also increase pressure on the price in Estonia. The price of electricity in Estonia will be determined to a considerable extent by the price quotations of the Nordic power exchange Nord Pool. Thus a significant increase of electricity prices may be expected in Estonia after the construction of new power plants and opening of the electricity market. The price of the production of electricity may increase 2-3 times depending on the price of the allowances, which means that the average electricity price for the final consumer, including connection charges and supports, increases 1.5 to 2 times.

On an open market, electricity prices are not insomuch based on the costs as on the relation between supply and demand and market sharing (efficiency). In this context, it shall be ensured that the undertakings dominating the market do not abuse their position and that the market would be shared evenly between the competing undertakings. Power exchange should send the best price signals to the electricity market; however, even here there may be a risk, as in the example of the Nordic countries, that the undertakings with significant market power manipulate with the exchange. In the context of Estonia, the issues concerning the terms and conditions of import of the electricity from third countries should definitely be settled in case of the establishment of power exchange, otherwise incorrect signals may be sent to market participants as a result of the functioning of the power exchange.

1.7. Strategic Choices in Electricity Production

The need to reorganise electricity production in Estonia derives from several circumstances:

1. the need to reduce emissions from electricity production to the environment;
2. the obligations assumed by the EU accession treaty to reduce SO₂ emissions of Narva Power Plants in 2012 and 2016;
3. the need for more sustainable use of oil shale resources;
4. the need to make electricity price in Estonia more competitive arising from the impact of emission trading.

In the following, 5 different scenarios are given describing the ways Estonia could structure electricity production in Estonia. The economic and CO₂ intensity assessments in the given analysis have been conducted by Eesti Energia AS.

It is presumed in the calculations that Estonia shall be able to cover its peak demand, approximately 1800 MW as of 2016. It is presumed in all the scenarios that after 2016 the electricity short shall be produced by the old oil shale units whereto SO₂ capture equipment shall be installed. It is also presumed that after the improvement of the hydraulic transport of oil shale ash depositing of oil shale ash will not be deemed to be depositing of liquid waste after 15 July 2009.

The analysis has been made with a vision for the year 2018. It is obvious that it is not possible to realise all the visions (e.g. the construction of a nuclear power plant) by 2018, but all these scenarios may be achieved gradually. In case of all the scenarios, the existing fluidised bed combustion units would operate and approximately 200 MW cogeneration stations would operate on different fuels in 2018. The following options of generation of electricity are discussed below:

- electricity from on-shore and off-shore wind turbines,
- import of nuclear energy from Lithuania, Finland or the production of nuclear energy in Estonia,
- electricity from additional oil shale fluidised bed combustion units;
- electricity from pulverised combustion units with oil shale purification equipment;
- electricity from gas turbines based on different fuels (natural gas, light heating oil, shale oil and shale gas, liquid gas or liquefied gas, liquid biofuels) with an aim to balance the instability of wind energy production, cover the peaks and maintain the reserves;
- from coal fired combined cycle power plants.

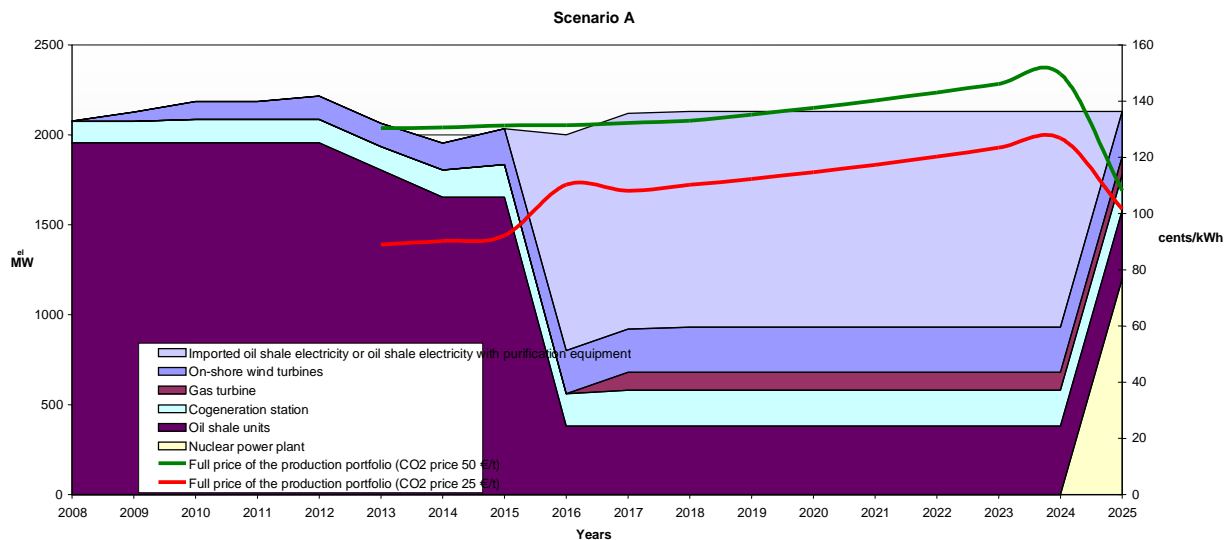
The CO₂ allowance prices of 25 EUR and 50 EUR and the cost of investments and fuels in 2007 have been used as a presumption.

1.7.1 Scenario A: 400 oil shale, 1200 nuclear energy, 250 wind turbines

According to this scenario, a gas turbine of approximately 100 MW and wind turbines approximately of 250 MW would be constructed in Estonia in addition to the existing fluidised bed combustion units and cogeneration stations of approximately 200 MW based on different fuels. In addition, Estonian electricity demand would be covered by the participation of the nuclear power plants in Lithuania and/or Finland and/or a small nuclear power plant to be constructed in Estonia (in the total amount of 1200 MW)

Main estimates of this scenario:

Price of electricity in 2025 (CO ₂ at the price of 25 EUR/t)	Price of electricity in 2025 (CO ₂ at the price of 50 EUR/t)	Amount of investments	CO ₂ emission from electricity production
100 cents/kWh	110 cents/kWh	4.3 billion EUR= 67.3 billion EEK	0.17 t/MWh



SWOT analysis:

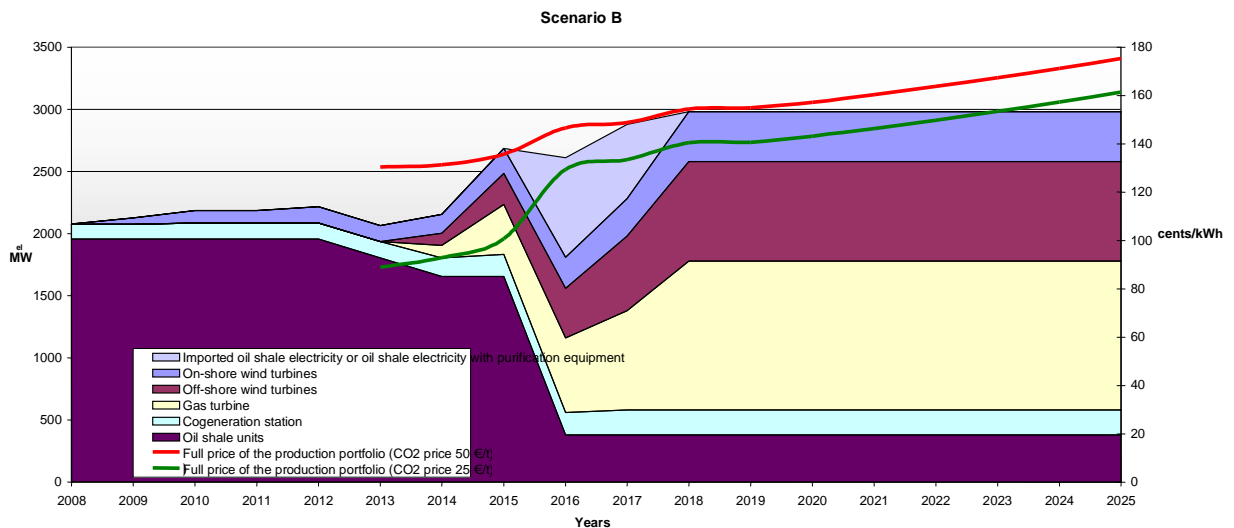
Strengths	Weaknesses
<ol style="list-style-type: none"> 1. Low CO₂ emission from electricity production, little dependency on CO₂ allowance price 2. Low estimated price of electricity 	<ol style="list-style-type: none"> 1. Significant dependence on the import of electricity 2. Insufficient flexibility: not enough peak load capacities and balance capacities 3. Very big amount of investments 4. Long period of implementation, what would be an interim solution? 5. The need of reserve capacity for a nuclear power plant 6. CO₂ emissions from electricity production are very high until the completion of the nuclear power plant 7. No know-how and legislation in the nuclear energy sector in Estonia
Opportunities	Threats
<ol style="list-style-type: none"> 1. Opportunity to become one of the states with the most clean energy production in the world 2. Little dependency on the world market prices of fossil energy carriers 3. Potential large-scale export of electricity 	<ol style="list-style-type: none"> 1. The elimination of big production units may have a significant impact on electricity supply in Estonia 2. Dependency on imported electricity makes it easy to influence electricity supply and prices, domestic income therefrom is minimum 3. Potential too high concentration of the market

1.7.2 Scenario B: 400 oil shale, 1200 wind turbines and gas turbines

According to this scenario, on-shore and off-shore wind turbines of 1200 MW would be installed in addition to the existing fluidised bed combustion units and cogeneration stations of approximately 200 MW based on different fuels. The variation of the production of the wind turbines would be balanced by gas turbines, where shale oil and shale gas, liquid gas or liquefied gas, light heating oil and liquid biofuels would be used in addition to natural gas in different plants.

Main estimates of this scenario:

Price of electricity in 2018 (CO ₂ at the price of 25 EUR/t)	Price of electricity in 2018 (CO ₂ at the price of 50 EUR/t)	Amount of investments	CO ₂ emission from electricity production
140 cents/kWh	155 cents/kWh	3.5 billion EUR= 54.8 billion EEK	0.36 t/MWh



SWOT analysis:

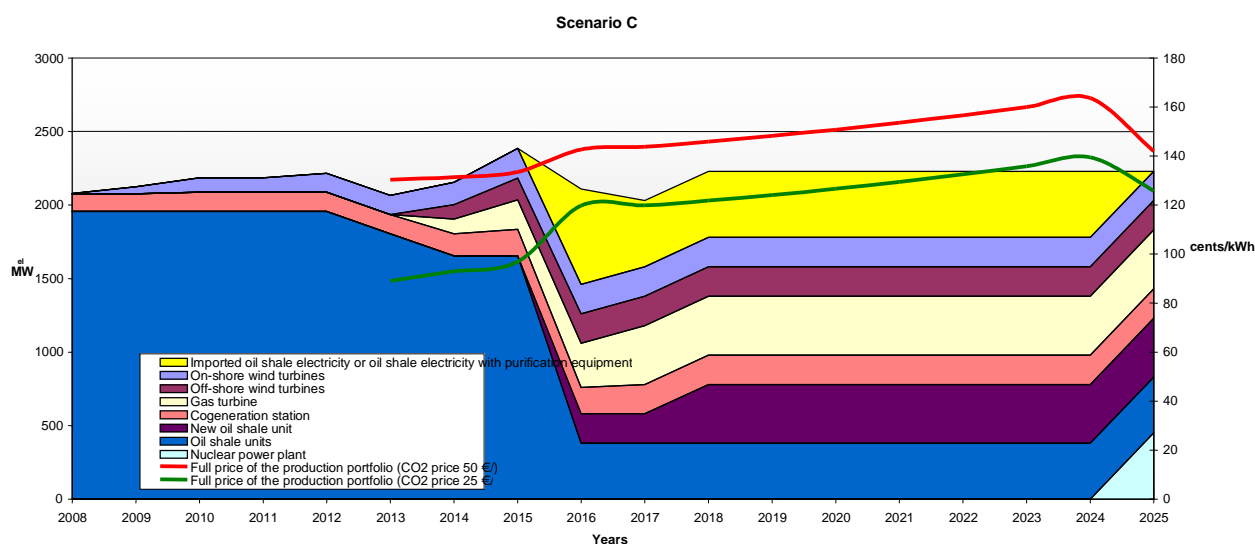
<p>Strengths</p> <ol style="list-style-type: none"> 1. Relatively low CO₂ emission from electricity production, little dependency on CO₂ allowance price 2. Distributed electricity production 	<p>Weaknesses</p> <ol style="list-style-type: none"> 1. High estimated electricity price as compared to other scenarios 2. Big investments in infrastructure 3. Significant dependence on the world market prices of energy carriers
<p>Opportunities</p> <ol style="list-style-type: none"> 1. Opportunity to become a state with the biggest share of wind power in the world 2. By using shale oil in the gas turbines the state could make a profit on the increase of the world market prices of energy carriers. 	<p>Threats</p> <ol style="list-style-type: none"> 1. Vulnerability in case of difficulties of supply of natural gas and liquid fuel markets 2. Presumes application of very good regulating automatics 3. Possibilities arise for external manipulation of the price of electricity 4. It has not been proven yet whether shale oil can be used in a gas turbine

1.7.3 Scenario C: 800 oil shale, 400 wind turbines and gas turbines, 400 nuclear energy

According to this scenario, supplementary fluidised combustion units (2x300 MW) would be installed, wind turbines of approximately 400 MW and gas turbines of 400 MW based on different fuels would be constructed in addition to the existing fluidised bed combustion units and cogeneration stations of approximately 200 MW based on different fuels and purification equipment would be installed in old oil shale units by 2015. The latter would be replaced by a nuclear power plant with the best possible technology and with the capacity of 400 MW in Estonia or a holding in the Finnish and/or Lithuanian nuclear power plant by 2025.

Main estimates of this scenario:

Price of electricity in 2025 (CO ₂ at the price of 25 EUR/t)	Price of electricity in 2025 (CO ₂ at the price of 50 EUR/t)	Amount of investments	CO ₂ emission from electricity production
125 cents/kWh	140 cents/kWh	3.5 billion EUR= 54.8 billion EEK	0,41 t/MWh



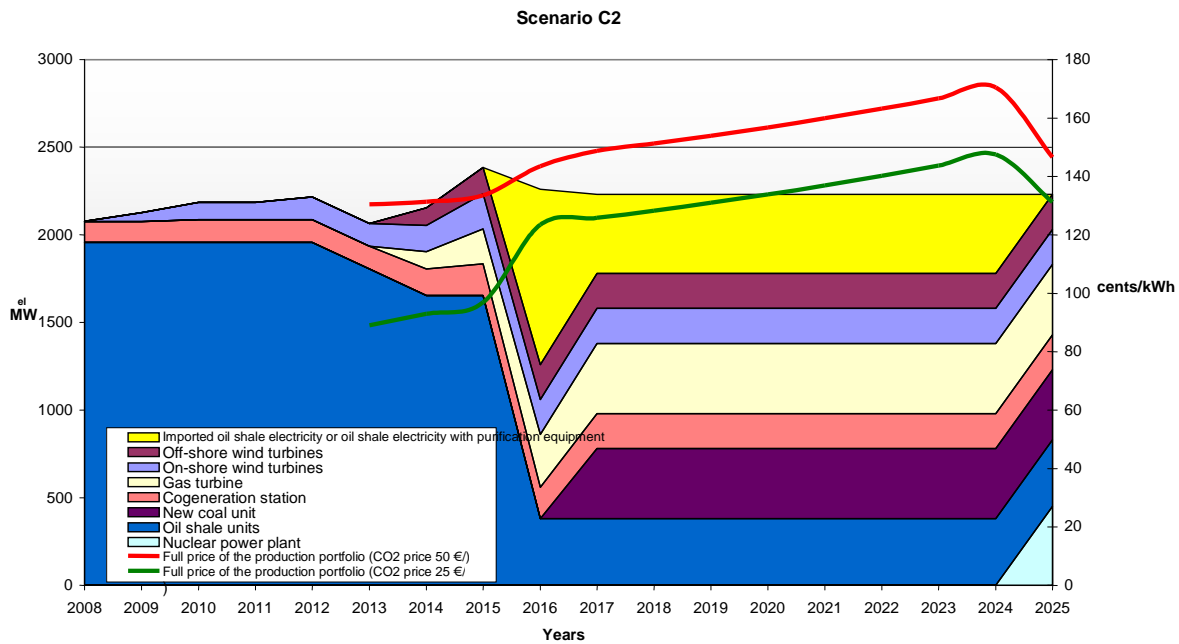
SWOT analysis:

Strengths	Weaknesses
<ol style="list-style-type: none"> The varied energy portfolio supports the development of competition on the market Little dependency on the imported energy sources 	<ol style="list-style-type: none"> CO₂ emissions from electricity production are very high until the completion of the nuclear power plant No know-how and legislation in the nuclear energy sector in Estonia
Opportunities	Threats
<ol style="list-style-type: none"> By using shale oil in the gas turbines the state could make a profit on the increase of the world market prices of energy carriers. 	<ol style="list-style-type: none"> It has not been proven yet whether shale oil can be used in a gas turbine Potential need to grant state aid to oil shale plants until the completion of the nuclear power plant

One potential scenario which can be analysed here is the construction of a coal fired power plant instead of an oil shale fired power plant. The good availability of coal on international markets at a

reasonable price speaks in favour of the use of coal. High CO₂ content should be pointed out as a negative aspect, but due to extensive use it is likely that the technologies for carbon capture will be first developed for coal fired power plants.

Price of electricity in 2025 (CO ₂ at the price of 25 EUR/t)	Price of electricity in 2025 (CO ₂ at the price of 50 EUR/t)	Amount of investments	CO ₂ emission from electricity production
130 cents/kWh	148 cents/kWh	3.5 billion EUR= 54.8 billion EEK	0,39 t/MWh



SWOT analysis:

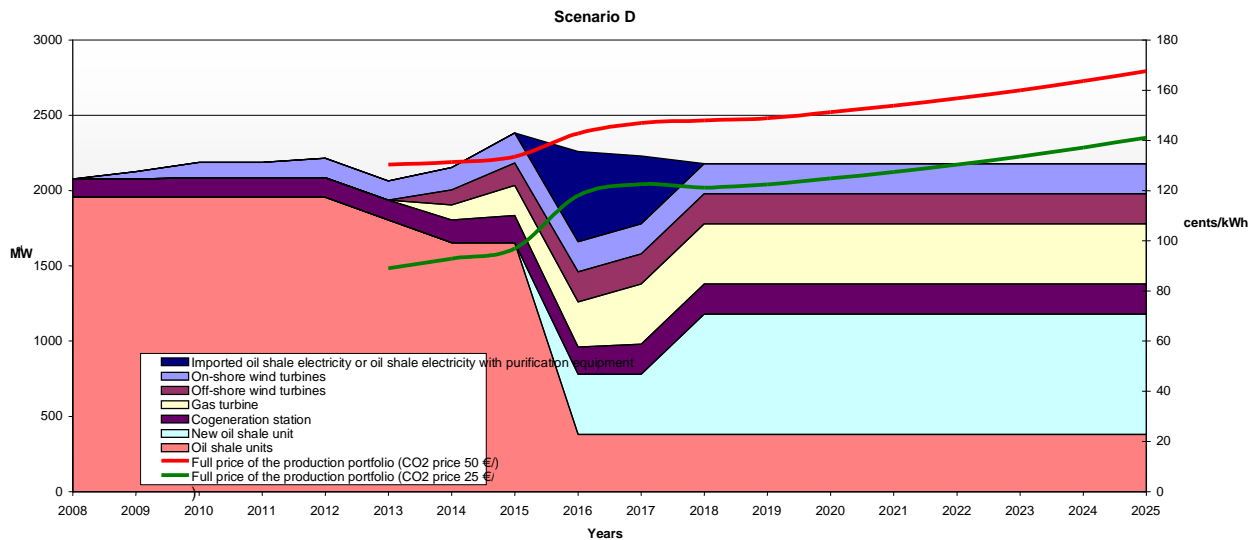
Strengths	Weaknesses
<ol style="list-style-type: none"> 1. Varied energy portfolio (supports the development of competition on the market) 2. Little dependency on the imported energy sources 	<ol style="list-style-type: none"> 1. CO₂ emissions from electricity production are very high until the completion of the nuclear power plant 2. The dependency of coal price on the world market prices
Opportunities	Threats
<ol style="list-style-type: none"> 1. By using shale oil in the gas turbines the state could make a profit on the increase of the world market prices of energy carriers. 2. It is likely that carbon capture technologies will be first applied to coal 	<ol style="list-style-type: none"> 1. It has not been proven yet whether shale oil can be used in a gas turbine

1.7.4 Scenario D: 1200 oil shale, 400 wind turbines and gas turbines

According to this scenario, wind turbines of 400 MW and gas turbines of 400 MW on different fuels shall be installed and new oil shale units of approximately 800 MW shall be installed in Narva Power Plants in addition to the existing fluidised bed combustion units and cogeneration stations of approximately 200 MW based on different fuels.

Main estimates of this scenario:

Price of electricity in 2018 (CO ₂ at the price of 25 EUR/t)	Price of electricity in 2018 (CO ₂ at the price of 50 EUR/t)	Amount of investments	CO ₂ emission from electricity production
120 cents/kWh	148 cents/kWh	EUR 3 billion = EEK 46.9 billion	0.67 t/MWh



SWOT analysis:

<p>Strengths</p> <ol style="list-style-type: none"> 1. The smallest amount of required investments 2. Little dependency on the world market prices of energy carriers 3. Very good security of supply 	<p>Weaknesses</p> <ol style="list-style-type: none"> 1. Very high CO₂ emissions from electricity production, significant dependency of the price on the CO₂ allowance price 2. Continuing electricity production in one geographical area 3. Very high environmental impact
<p>Opportunities</p> <ol style="list-style-type: none"> 1. Be the biggest producer of electricity from oil shale 2. The state may gain considerable profit from the increase of electricity prices in this region. 	<p>Threats</p> <ol style="list-style-type: none"> 1. The significant increase of the CO₂ allowance price makes electricity price considerably higher than forecasted 2. Significant dependence on the development and cost of CO₂ sequestration technologies 3. Potential need to grant state aid to the oil shale sector 4. It has not been proven yet whether shale oil can be used in a gas turbine.

1.8. Technological Trends Affecting Strategic Choices in Electricity Production

The strategic choices of Estonia may be affected by several technological developments. The most important ones of these are described below:

- Electrical energy storage technologies

Equipment which would enable to store the energy generated by wind turbines during windy periods and generate electricity during windless periods would promote significantly more extensive use of wind power. At present the main problem of such accumulators is storage losses, but this possibility shall definitely be taken into account upon the development of the technology.

- CO₂ sequestration technologies

The main challenge of the use of fuels rich in CO₂ is to develop technologies for post-combustion capture (or pre-combustion chemical separation), transport and storage of CO₂. Such technologies are currently under development; the main challenge is their high cost and power consumption. In the context of Estonia, it is important to find a technology suitable for oil shale which might be very different from the technologies applied to coal.

- Nuclear technologies

At present generation III and III+ reactors are built in the world. Reactors which would also use reactive waste in the electricity production process are deemed to be generation IV nuclear reactors. The development of such reactors would mitigate the problems of the radioactive waste from nuclear power plants. The best existing technology shall be taken into account when constructing a nuclear power plant in Estonia.

- Use of shale oil in gas turbines

Oil shale is not suitable for use in gas turbines in the present form due to its abrasivity. In order to solve these problems, a way has to be found for purifying shale oil from abrasive particles either in purification equipment or for obtaining purer fractions by supplementary refining.

- Use of supercritical parameters upon combustion of fuels

The use of supercritical parameters enables to increase the efficiency of electricity production, reduce emissions and the consumption of fuel to a considerable extent. Upon the development of the technology it is not known at present how the materials used will sustain the supercritical parameters in a long run and at present the price of these boilers is considerably higher than the one of traditional boilers.

- Coal fired power plant

The application of technology of coal combustion – the construction of a combined cycle power plant with pre-gasification - the efficiency of which has already been proved should also be assessed as one alternative. The use of coal may be practical due to good availability and big resources of the fuel on condition that an efficient solution can be applied for CO₂ capture. Since at present technologies for CO₂ capture from coal plants are under development, the technological solution may be found for coal earlier than for other fuels.

- Use of wood in oil shale fired fluidised bed boilers

One possibility upon the use of fluidised bed boilers is the use of wood chips together with the main fuel. This would result in the agreed reduction of CO₂ emissions. The application of this option would also affect the competitiveness of oil shale to a considerable extent.

1.9. Export of Electricity

One of the strategic choices of Estonia is also whether to be a state exporting electricity or not. The scenarios described above are based mainly on covering the domestic needs of Estonia. In 2007 2765 GWh of electricity was exported from Estonia to Finland, Latvia and Lithuania, which forms approximately 30% of the domestic electricity consumption of Estonia. According to this indicator, Estonia is a state with the biggest share of export in the European Union.

By analysing the relation between the supply and demand of electricity in the neighbouring states, it can be seen that there will be a significant shortage of electricity in the Baltic region (mainly in Latvia) after closing of the Ignalina nuclear power plant which is planned to be covered by import of electricity from Russia. However, Russia does not have not enough electricity for export during peak consumption. The situation may be alleviated by the completion of the nuclear power plant in Lithuania, but the time for the completion of the plant is uncertain.

The construction of production capacities for export of electricity is not prescribed in the investment plans for electricity production in Estonia, thus, after 2015, Estonia should focus mainly on covering the needs of the domestic market. At the same time it is clear that upon opening of electricity markets the undertakings are interested in maximising their profit and selling electricity to the consumers who pay more, without giving preference to any states. Therefore it shall be ensured by regulation that the first priority of the producers located in Estonia would be covering of the needs of Estonian electricity consumers and that only the surplus amount of electricity may be sold for export.

Upon export of oil shale electricity, the damage caused to the environment shall be compensated and the investments required for the reduction and prevention of the adverse environmental impacts thereof shall be covered. In order to exploit the potential of the export of wind electricity, a clear scheme shall be prescribed in the new Renewable Energy Directive indicating how to trade the so-called green energy allowances. It is in the interests of Estonia to implement a scheme which would enable trading renewable energy on the basis of the guarantee of origin at a justified price in the whole European Union.

2. Development Plan

2.1. Vision and Mission

Vision:

The Estonian power system is a system with varied and sustainable electricity production which is very well interconnected with the neighbouring countries and which ensures power supply to consumers at a justified electricity price at any moment in time.

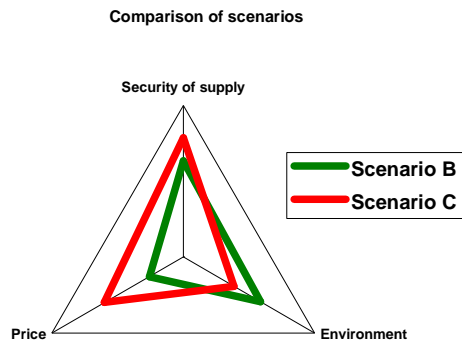
Mission:

The mission of the Estonian electricity sector is to ensure **continuous, sustainable electricity supply at a justified price** for the inhabitants of Estonia:

1. In order to ensure continuous electricity supply, regulations shall be adopted which would give rise to the construction of power plants with the structure of energy sources prescribed in this Development Plan and to guaranteeing of high-quality electricity supply.
2. In order to ensure sustainable electricity supply and consumption, regulations shall be adopted which would ensure the interest of electricity consumers, producers and transporters in saving electricity and the use of more environment-friendly solutions. At the same time these trends should not bring about unjustified increase of the import of energy sources. Work should also be continued for the development of technologies for carbon-free combustion of fossil fuels. Upon the development of sustainable electricity supply, awareness of the public of the possible solutions and technologies shall be increased and implementation of new solutions shall be promoted.
3. For the purpose of supply of electricity at a justified price, the state shall adopt regulations which would ensure adequate electricity prices on the electricity market to be opened, avoid market distortions and abuse of the market position by undertakings. The development of nuclear energy is important for the purpose of ensuring competitive price of electricity.

2.1.1. Trends in electricity production

By assessing the abovementioned scenarios on the basis of the strategic environmental impact assessment statement the preferred solution for Estonia would be scenario C proceeding from the economic or security considerations and scenario B proceeding from the environmental considerations.



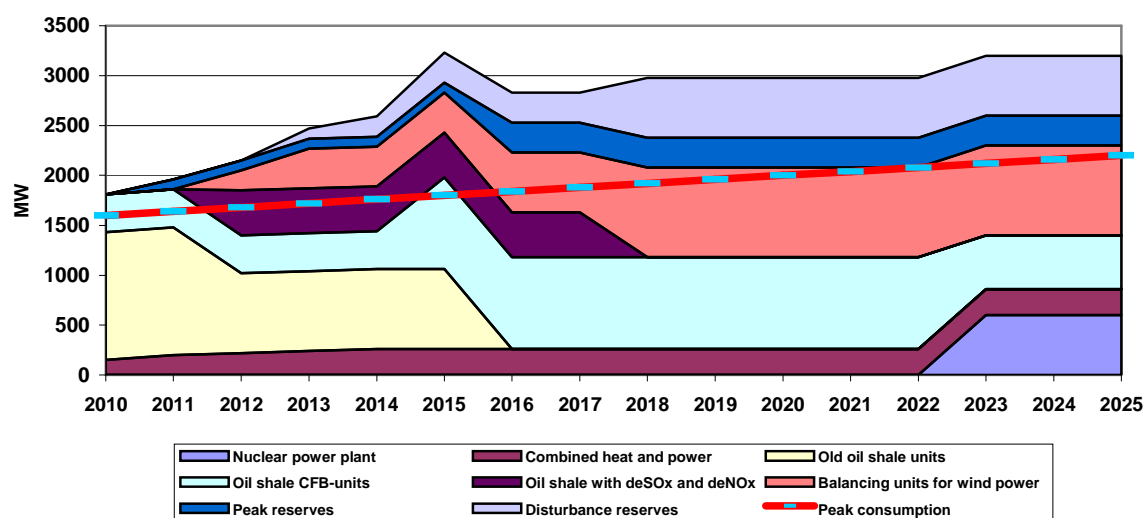
Reference: Calculations of the Ministry of Economic Affairs and Communications on the basis of the strategic environmental impact assessment statement

The positive aspects of these scenarios shall be combined in order to achieve the most optimal result. For that purpose, the capacity of wind turbines and gas turbines shall be increased and the capacity of oil shale power plants shall be reduced in scenario C. It shall also be taken into account that the use of gas turbines with refined shale oil depends on the completion of the refinery and testing of the relevant gas turbines. Until the completion of such plants the peak demand in Estonia shall be covered by old oil shale units in some of which desulphurisation and denitrification systems shall be installed.

In parallel preparations for the construction of a nuclear power plant shall continue and a decision concerning the expediency of the construction of the plant shall be made not later than by 2013. The construction of an additional fluidised bed combustion unit or increasing of the capacity of wind turbines and gas turbines may be considered as an alternative.

By combining the scenarios B and C, the development of the net capacities and new connections in the Estonian electricity production would be as follows:

Development of net capacity in Estonian power system 2010-2025



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cogeneration plants	150	200	220	240	260	260	260	260	260	260	260	260	260	260	260	260
Oil shale plants	1660	1660	1630	1630	1630	2170	1520	1520	920	920	920	920	920	920	920	920
- old	1280	1280	640	640	640	640										
- fluidised bed	380	380	380	380	380	920	920	920	920	920	920	920	920	920	920	920
- with purification equipment			600	600	600	600	600	600								
On-shore wind farms*	150	200	200	400	400	400	400	400	400	400	400	400	400	400	400	400
Off-shore wind farms*							200	200	500	500	500	500	500	500	500	500
Balancing units for wind power			200	400	400	400	600	600	900	900	900	900	900	900	900	900
- including gas turbines based on shale oil							200	200	500	500	500	500	500	500	500	500
Peak reserves**		100	100	100	100	100	300	300	300	300	300	300	300	300	300	300
Disturbance reserves**				100	200	300	300	300	600	600	600	600	600	600	600	600
Nuclear power plant														600	600	600
Total guaranteed production capacity	1810	1960	2150	2470	2590	3230	2980	2980	2980	2980	2980	2980	2980	3580	3580	3580
Taking account of criterion n-1	1620	1800	1990	2310	2430	3070	2710	2710	2710	2710	2710	2710	2710	2980	2980	2980
Taking account of criterion n-2	1430	1580	1830	2150	2270	2910	2440	2440	2440	2440	2440	2440	2440	2710	2710	2710

* - The capacities are not taken into account in the total guaranteed production capacity.

** - Unit capacities of up to 100 MW

Thus, the capacity of cogeneration plants shall be increased to 300 MW (with the net capacity of 260 MW at the peak time) by 2014, oil shale fluidised bed combustion units of 2x300 MW (net capacity of 270 MW) shall be constructed by the end of 2015, desulphurisation and denitrification systems (net capacity of 4x150 MW) shall be installed in four of the existing old oil shale units of 200 MW by 2012, the capacity of on-shore wind turbines shall be increased to 400 MW by 2013. The decisions concerning the investments in all these capacities shall be made before the end of 2010.

It is practical to increase the capacity of wind farms off shore. Production capacities shall be constructed in the range of the capacity of the wind turbines which would balance the instability of the production of the wind turbines and also cover the consumption peaks. Partial closure of the units with purification equipment of Narva Power Plants may be considered after putting shale oil fired gas turbines into service presumably in 2018. The need for increasing the capacity of emergency power plants in 2016 is due to the completion of the submarine cable Estlink 2 (with the estimated capacity of 600 MW). The capacity of these plants can also be used for ensuring the nuclear power plant capacity reserve. All the gas turbine stations shall be able to use at least 2 types of fuels, preferably domestic resources.

The production of each power plant depends on the market situation in the relevant year, which is why it is almost impossible to forecast the structure of electricity production thereof. The regulation on electricity market shall ensure that the structure of production capacities is diversified in Estonia and that we have enough production capacities in case it is not possible to buy electricity at a lower price from anywhere else.

In order to implement the scenario, the construction of these plants shall be ensured by national regulations, support schemes, state aid, fiscal policy and legislative measures. The relevant amendments in legislation shall be prepared by 2012 as a preliminary work for the construction of a nuclear power plant.

The environmental impact caused by the implementation of the scenarios of electricity production has been assessed in the strategic environmental impact assessment statement of the draft development plan. The abovementioned statement is attached in the Annex to the draft development plan.

2.1.2. Development of transmission network

The main task of OÜ Põhivõrk as a system operator is to ensure long-term smooth operation of the Estonian power system. In connection with the establishment of the new structure of production capacities, the transmission network operator shall ensure that the new production capacities will be connected to the network. At the same time it is obvious that it is not practical, based on the market, to construct all the peak and reserve capacities in Estonia and the transmission network operator shall organise the required competitions for that purpose and ensure the availability and operation of the justified capacity of these plants in case of system disturbances.

According to the preferred scenario of production capacities, OÜ Põhivõrk shall organise competitions for securing the required emergency and peak load capacities of up to 600 MW. The investment and maintenance costs of these plants would be covered from the transmission network tariffs, the costs of use, however, would be covered on the bases of the market prices. In addition, increase of the share capital of OÜ Põhivõrk could be considered in case of significant increase of investment obligations. For the purpose of the construction of regulating capacities, the Electricity Market Act shall be amended in order to create conditions for the construction of such plants proceeding from the strategic interests of Estonia.

Further integration of the power system of Estonia and also of the Baltic States with the power system of the European Union is of determinative importance in the light of ensuring the operation of the EU electricity market and increasing of security of supply. In this context it is necessary to

continue cooperation with the Latvian and Lithuanian transmission network operators for the connection of Estlink 2, the Baltic-Swedish and the Baltic-Polish power networks and for the synchronisation of the power networks of the Baltic States with the Central-European power network UCTE. The latter would not mean total separation from the Russian power system, but the construction of converter stations for all or some of the existing connections.

2.1.3. Development of distribution networks

There are 40 distribution network enterprises in Estonia as at 1 January 2008. Upon opening of the electricity market, an additional important function of the distribution networks will be communication of information to the market participants. Thereby the distribution network operators must not discriminate any market participants.

The technical level of distribution networks has improved from year to year; however, the quality of the network services does not comply with the contemporary requirements in smaller places yet. The quality requirements for network services introduced in 2005 together with contractual penalties have given a good signal for network undertakings for the improvement of the quality of their services and for setting investment priorities. In the places where it is expensive to connect residential buildings to the distribution network a programme for supporting their connection is under implementation in cooperation with the local governments.

The distribution network tariff rate is sufficient at present to invest in the development of the networks; the flexible longer-period price regulation applied has also had positive results. Distribution losses have decreased constantly (7.8% in 2007).

2.2. Structure of Objectives and Measures

Arising from the problems concerning the Estonian electricity sector and proceeding from the mission and vision of the policy of the electricity sector, the objectives and measures of this Development Plan are as follows:

1. Objective: Continuous supply of electricity is ensured for consumers located in Estonia

Measures:

- 1.1. Construction of peak and emergency reserve capacities following a competition organised by the system operator
- 1.2. Promotion of the construction of power production capacities in Estonia conforming to the trends of the Development Plan, granting of state aid for that purpose, if necessary
- 1.3. Creation of preconditions for the construction of new international connections
- 1.4. Analysis and development of the quality requirements for network services, improvement of the quality of network services
- 1.5. Ensuring electricity supply for all interested persons

2. Objective: Power supply and consumption of the consumers located in Estonia has become more sustainable

Measures:

- 2.1. Supporting sustainable methods of electricity production
- 2.2. Updating of legislation with an aim to enhance the efficiency of electricity undertakings
- 2.3. Implementation of innovative power network solutions
- 2.4. Raising of awareness of saving electricity

3. Objective: Power supply at a justified price has been ensured for consumers located in Estonia

Measures:

- 3.1. Opening of the electricity market, establishment of power exchange
- 3.2. Development of honest competition rules and ensuring that the competition rules are complied with
- 3.3. Taking external costs gradually into account in the price of electricity in the framework of the ecological tax reform
- 3.4. Analysis of the efficiency of support schemes for renewable and cogeneration electricity, correction thereof, if necessary
- 3.5. Drawing up and entry into force of legislation concerning nuclear power plants

A draft implementing plan for 2009-2012 and an estimate of the cost up to 2018 has been prepared for the implementation of the development plan. The draft implementing plan is available on the homepage of the Ministry of Economic Affairs and Communications at <http://www.mkm.ee/index.php?id=321328>.

The cost of the activities planned in the framework of the abovementioned measures shall be indicated by year in the implementing plan which shall be submitted to the Government of the Republic within three months after approval of the National Development Plan of the Energy

Sector until 2020 by the Riigikogu. It is planned to finance the activities in the framework of the Development Plan of the Electricity Sector in the total amount of 17.5 billion kroons until 2018, including the cost of the measures in the total amount of 16,850,000 kroons in 2009, the total amount of 45,850,000 in 2010, the total amount of 763,800,000 kroons in 2011, the total amount of 964,100,000 in 2012 and the total amount of 15,668,600,000 kroons in the period from 2013 to 2018.

2.3 Activities and Measures

2.3.1. Measures for ensuring continuous electricity supply

Objective 1	Continuous supply of electricity is ensured for consumers located in Estonia	Baseline	Target
Indicator 1	The ratio between the available net capacity of power plants and the maximum net consumption of electricity during a winter period (October-March) exceeds 110%, but does not exceed 140%.	approximately 136% (2007) ²³	>110% (2018)
Indicator 2	The annual average duration of the power cuts caused by the failures at the place of consumption indicates a decreasing trend.	Transmission network 7.468 min Distribution network 201.280 min (2007) ²⁴	Decreasing trend
Indicator 3	By 2018 the total capacity of the power connections between the Baltic States and the European Union will form at least 80% of the connection capacities between the Baltic States and third countries	Approximately 11.7% (2007)	At least 80% (2018)

MEASURE 1.1

BACKGROUND OF THE MEASURE

PERFORMANCE INDICATORS MOST IMPORTANT ACTIVITIES

Construction of peak and emergency reserve capacities following a competition organised by the system operator	
The experience of the world electricity markets shows that electricity markets do not give signals for the construction of peak load and quickly responding emergency capacities. Therefore the system operators shall have power plants for peak and emergency reserves, the cost of the construction of which shall be covered by the tariffs of the network services, the operation costs thereof, however, shall be covered by electricity sellers. Production capacity balancing plants or energy storage units (e.g. pumped storage power stations) are often used for such purpose. In order not to increase significantly the dependence of Estonia on natural gas, the balancing production capacities based on different fuels (e.g. light heating oil, shale oil and shale gas, biofuels) shall be constructed.	
1. Balancing production capacities based on different fuels have been constructed	2015
<ul style="list-style-type: none"> - The system operator shall determine the number, capacity, fuel and location of the plants - Organisation of competition in compliance with the Electricity Market Act - Construction of the required power plants 	

²³ Reference: Estonian Competition Authority

²⁴ Reference: Estonian Competition Authority

	Results and indicators	Target value for 2018 or deadline
OUTPUT INDICATORS	1. The terms and conditions of procurement have been prepared by OÜ Põhivõrk and approved by the Estonian Competition Authority	July 2009
	2. The competition has been organised and the constructors have been selected	July 2010
	3. The new peak and emergency reserve power plants have been constructed	December 2015
RESPONSIBLE	OÜ Põhivõrk, Estonian Competition Authority	

MEASURE 1.2

BACKGROUND OF THE MEASURE

Promotion of the construction of power production capacities in Estonia conforming to the trends of the Development Plan, granting of state aid for that purpose, if necessary

As a rule, power plants are constructed according to the market demand. However, not a single new power plant has been constructed on open electricity markets without state support (either in the form of investment support, state or market guarantee, fixed buying-in price or aid, etc.). In order to ensure the establishment of the structure of the production capacities provided for in the Development Plan, state support schemes shall be prepared for the construction of the required power plants.

In order to continue production of electricity from oil shale, 2 new units with the unit capacity of 300 MW shall be constructed in addition and desulphurisation systems shall be installed in up to four old units. The need for the use of state aid shall be prescribed for the construction of new capacities. The construction of different regulating power plants shall be supported analogously.

The sales revenue received by the state from the emission trading auctions of emission allowances starting from 2013 and planned to be directed into a fund, which will be established on the basis of the relevant Act and with an aim to ensure energy security and the improvement of energy efficiency, shall be used for granting state aid. Depending of the sales price of the allowance on the auction, the annual revenue of the state may amount to 12 billion kroons. An organisational structure²⁵ which is planned to be established and the concept of which is planned to be developed by the end of 2009 will be the manager of the fund.

The use of the finances of the fund will be as follows:

- [at least 30%] of the fund's resources will be used for the investments in energy saving, the development of carbon capture technologies and solving the potential social problems;
- [at least 20%] will be used for environmental investments related to power engineering and for co-financing of new connections;
- up to [50%] will be used for supporting the preparatory work in the field of nuclear energy and for granting undertakings state aid related to energy

²⁵ The establishment of the organisational structure is under discussion and no final decision has been made concerning the establishment of the structure.

	<p>security, if necessary.</p> <p>The state aid scheme shall ensure justified rate of return to the persons making investments in energy security (persons renovating oil shale power plants) in open market conditions in case the market price does not ensure an adequate rate of return to them.</p> <p>According to the document "The Bases of the Security Policy of the Republic of Estonia", the electricity market regulation and the development of the relevant infrastructure shall ensure to consumers the level of security of supply of electricity which does not put the performance of the important functions of the state at danger²⁶.</p>	
PERFORMANCE INDICATORS	1. The structure of the production capacities proceeding from energy security has been ensured	2015
MOST IMPORTANT ACTIVITIES	<ul style="list-style-type: none"> - Analysis of the requirement for support and defining of the principles of the support scheme - Submission of the notice of state aid by the European Commission - Development of a legislative support scheme for the construction of new production capacities, if necessary - Implementation of the support scheme as required - Construction of 2x 300 MW units in Narva Power Plants - Supplying 4 old units with desulphurisation systems 	
	Results and indicators	Target value for 2018 or deadline
OUTPUT INDICATORS	1. The analysis of the need to support and the principles of the investments in power plants has been conducted	July 2009
	2. The notice of state aid has been submitted by the European Commission	September 2009
	3. Legislation has been drawn up and has entered into force for the purpose of granting aid to electricity producers ensuring energy security, if necessary	July 2010
	4. The supply scheme has been implemented, if necessary	January 2013
	5. 2x 300 MW units have been constructed in Narva Power Plants	2015
	6. Desulphurisation systems have been installed to 4 old units	2012
RESPONSIBLE	Ministry of Economic Affairs and Communications, Ministry of Finance, Estonian Competition Authority, OÜ Põhivõrk	

MEASURE 1.3	Creation of preconditions for the construction of new international connections
BACKGROUND OF THE MEASURE	The interconnections of the Baltic States with the other EU countries are so far limited to the 350 MW submarine cable Estlink (the maximum consumption of the Baltic States exceeds 4500 MW). The construction of

²⁶ The Bases of the Security Policy of the Republic of Estonia <http://www.kmin.ee/?op=body&id=119>

	Estlink 2, the interconnections between Lithuania-Poland and Baltic States-Sweden are projects necessary for the Estonian power system for increasing security of supply which require also political support. It is recommended to construct the interconnection between Lithuania and Poland as a synchronous connection by replacing the connections in the directions of Russia and Byelorussia by asynchronous connections. Both of the new connections should be constructed by transmission network operators in order to ensure better operation of the electricity market.	
PERFORMANCE INDICATORS	<ol style="list-style-type: none"> 1. Estlink 2 has been put into service 2. Readiness for synchronous operation with the Central-European and asynchronous operation with the Russian power system has been ensured 3. Unrestricted access to Estlink 1 has been ensured to all the parties 	<p>2014 January 2018</p> <p>2013</p>
MOST IMPORTANT ACTIVITIES	<ul style="list-style-type: none"> - Negotiations on the conditions of the construction of new interconnections with the relevant transmission network operators and state institutions - Participation in drawing up of the activity plan of the Baltic interconnections - Performance of the required research, environmental assessment and procurements 	
	Results and indicators	Target value for 2018 or deadline
OUTPUT INDICATORS	<ol style="list-style-type: none"> 1. The conditions for the construction of new interconnections have been negotiated with the transmission network operators and state institutions 2. The development plan of the Baltic interconnections has been completed; the readiness of the EU has been achieved for co-financing the projects important to Estonia (e.g. Estlink 2) 3. Construction contracts have been concluded with the suppliers with respect to Estlink 2 	<p>2010</p> <p>July2009</p> <p>2010</p>
RESPONSIBLE	OÜ Põhivõrk, Estonian Competition Authority, Ministry of Economic Affairs and Communications, Ministry of Foreign Affairs	

MEASURE 1.4

BACKGROUND OF THE MEASURE

PERFORMANCE

Analysis and development of the quality requirements for network services, improvement of the quality of network services	
Quality requirements for network services (the permissible number of power supply interruptions, voltage deviations, requirements for service, contractual penalties, etc.) have been established by Regulation No 104 of the Minister of Economic Affairs and Communications. The quality of network services has improved significantly in the last few years, which is why the trends for further improvement of the quality shall also be reviewed.	
1. The quality of Estonian network services	2010

INDICATORS MOST IMPORTANT ACTIVITIES	complies with the new quality requirements.	
	<ul style="list-style-type: none"> - Conducting of the analysis of compliance with the quality requirements and potential - Amendment of the Regulation of the Minister of Economic Affairs and Communications 	
OUTPUT INDICATORS	Results and indicators	Target value for 2018 or deadline
	<ol style="list-style-type: none"> 1. Analysis completed 2. The required amendments to the Regulation have been enforced 	September 2009 July 2010
RESPONSIBLE	Ministry of Economic Affairs and Communications, network operators, Estonian Competition Authority	

MEASURE 1.5	Ensuring electricity supply for all interested persons	
BACKGROUND OF THE MEASURE	<p>Electricity supply shall be ensured for residential buildings used throughout the year at the expense of the person requesting electricity supply. The problem mostly lies in the connection fee which is especially high in case of the residential buildings located far from the lines. The bases for the calculation of the network charges provided for in the Electricity Market Act in force do not allow supporting of natural persons in payment of the connection fees taking into consideration the purposes of regional policy. The Ministry of the Interior prepared a motion to amend the Electricity Market Act, which was adopted on 19 December 2008. The Ministry of the Interior drew up the corresponding programme of connection supports based on the purposes of regional policy. Enterprise Estonia is the coordinator of the programme.</p>	
PERFORMANCE INDICATORS	<ol style="list-style-type: none"> 1. Connection to the power network has been ensured for the entitled subjects of the support schemes (2007: 0%). 	100% December 2011
MOST IMPORTANT ACTIVITIES	<ul style="list-style-type: none"> - Development of national support schemes, planning of finances from the state budget 	
OUTPUT INDICATORS	Results and indicators	Target value for 2018 or deadline
	<ol style="list-style-type: none"> 1. The support schemes have been drawn up and implemented. 	July 2009
RESPONSIBLE	Ministry of the Interior, distribution network operators	

2.3.2. Measures for ensuring more sustainable power supply and consumption

Objective 2	Power supply and consumption of the consumers located in Estonia has become more sustainable	Baseline	Target
Indicator 1	The share of renewable electricity in gross consumption is increasing and will reach at least 5.1% by 2010 and at least 15% by 2015.	1.75% (2007) ²⁷	5.1% (2010) 15% (2015)
Indicator 2	The share of cogeneration electricity will be least 20% of the gross consumption in 2020	10.2% (2007) ²⁸	20% (2020)
Indicator 3	The level of power transmission losses below 3%, the share of distribution losses below 7%, below 6% from 2015	3% of transmission losses 7.8% of distribution losses (2007) ²⁹	<3% of transmission losses <6% of distribution losses (from 2015)
Indicator 4	Electricity consumption per capita in households does not exceed the average level in the European Union	1320 kWh (2007) ³⁰	EL ₂₇ (2018)
Indicator 5	The amount of atmospheric emissions of CO ₂ will not exceed 5 million tons in 2020.	15.7 mill. t (2007) ³¹	5 mill. t (2018)
Indicator 6	Decrease of the share of oil shale electricity in the gross production of electricity	93.6% (2007) ³²	<70% (2018)

MEASURE 2.1

Supporting sustainable methods of electricity production

BACKGROUND OF THE MEASURE

Sustainable methods of electricity production are more expensive in the present international legal environment and not competitive without state support. Therefore different states have supported the production of electricity by various measures. In Estonia, support has been granted partially to the production of renewable electricity and cogeneration electricity. However, not all the potential producers of renewable electricity receive support.

PERFORMANCE INDICATORS

1. Increase of the share of renewable and cogeneration electricity (2007: renewable electricity 1.75%, cogeneration electricity 10.2%)	5.1% of renewable electricity (2010)
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MOST

- Analysis of the need for supporting and the extent of electricity

²⁷ Reference: Statistics Estonia

²⁸ Reference: Statistics Estonia

²⁹ Reference: Statistics Estonia

³⁰ Reference: Eurostat

³¹ Reference: Ministry of the Environment, Statistics Estonia

³² Reference: Statistics Estonia

IMPORTANT ACTIVITIES	production methods - Preparation of motions to amend to the relevant legislation, if necessary	
	Results and indicators	Target value for 2018 or deadline
OUTPUT INDICATORS	1. Analysis has been completed 2. The motions to amend the legislation have been submitted to the Government of the Republic	2011 2012
RESPONSIBLE	Ministry of Economic Affairs and Communications, Ministry of the Finance, Ministry of the Environment, Estonian Competition Authority	

MEASURE 2.2	Updating of legislation with an aim to enhance the efficiency of electricity undertakings	
BACKGROUND OF THE MEASURE	The existing legislation provides for a definite framework for undertakings, but situations occur on the market, where electricity undertakings are not motivated to make investments for the improvement of sustainability or to act sustainably, since they cannot increase their profit due to the principles of price regulations. The situation could be improved, e.g. by the application of a longer regulation period.	
PERFORMANCE INDICATORS	1. Increase of the amount of investments in the increase of the efficiency of electricity undertakings (2007: 1.5 billion ³³).	Increasing trend
MOST IMPORTANT ACTIVITIES	- Analysis of the investment behaviour of electricity undertakings - Preparation of motions to amend legislation as required	
OUTPUT INDICATORS	Results and indicators	Target value for 2018 or deadline
	1. Analysis has been completed 2. The motions to amend legislation have been submitted to the Government of the Republic, if necessary	2011 2012
RESPONSIBLE	Estonian Competition Authority, Ministry of Economic Affairs and Communications	

MEASURE 2.3	Implementation of innovative power network solutions	
BACKGROUND OF THE MEASURE	In case of distributed electricity production and addition of unstable electricity producers, better solutions shall be found for the integration of these producers into the network. The power measurement systems based on innovative infotechnological solutions allow the consumers to receive more exact information on the consumption structure and current prices and allow the consumers and network operators to control electricity demand, if necessary. Network operators shall have economic motivation for the application of such solutions.	
PERFORMANCE	1. 1/3 of electricity consumers have innovative	2010

³³ Estonian Competition Authority <http://www.konkurentsiamet.ee/>

INDICATORS	measurement systems	
	2. All the electricity consumers have innovative measurement systems	2013
MOST IMPORTANT ACTIVITIES	- Amendment of the Grid Code as required	
	Results and indicators	Target value for 2018 or deadline
OUTPUT INDICATORS VASTUTAJAD	1. Grid Code has been amended	2010
	Ministry of Economic Affairs and Communications, network operators, Estonian Competition Authority	

MEASURE 2.4	Raising of awareness of saving electricity	
BACKGROUND OF THE MEASURE	In order to increase the efficiency of electricity consumption and production, the availability of the relevant information shall be ensured for the industries, the public sector and the households. The development of the activity of energy auditors, performed by KREDEX in Estonia, is also related to raising awareness of saving electricity. A suitable solution shall be found for the performance of the abovementioned functions by establishing the corresponding organisational structure.	
PERFORMANCE INDICATORS MOST IMPORTANT ACTIVITIES	1. The domestic final consumption does not exceed the level of 2007 (2007: 7180 GWh)	until 2015
	- Analysis of energy audits and development of the activity of energy auditors - Organisation of electricity saving campaigns	
OUTPUT INDICATORS	Results and indicators	Target value for 2018 or deadline
	1. Analysis of energy audits has been completed and implemented in the development of the activity of energy auditors 2. One electricity saving campaign has been conducted each year	periodical annually until 2018
RESPONSIBLE	Ministry of Economic Affairs and Communications, energy auditors, Kredex Foundation	

2.3.3. Measures for ensuring justified price of electricity

Objective 3	Power supply at a justified price has been ensured for consumers located in Estonia	Baseline	Target
Indicator 1	35% of the electricity market opened in 2009, fully opened in 2013 ³⁴ at the latest	13% (2007)	35% (2009) 100% (2013)
Indicator 2	The market share of one electricity seller in the common market area does not exceed 40% in 2018.	95% Eesti Energia (2007) ³⁵	40% (2018)

MEASURE 3.1

BACKGROUND OF THE MEASURE

PERFORMANCE INDICATORS MOST IMPORTANT ACTIVITIES

OUTPUT INDICATORS

RESPONSIBLE

Opening of the electricity market, establishment of power exchange	
The Estonian electricity market will open 35% in 2009, it will be fully open in 2013 at the latest. Alongside with the opening of the electricity market the Baltic region of the Nordic power exchange can be launched, which would continuously give price signals to the electricity market.	
1. Launching of the Baltic region of the Nordic power exchange	2013
<ul style="list-style-type: none"> - Deregulation of the electricity price - Preparation for launching the Baltic region of the Nordic power exchange - Full opening of the Estonian electricity market - Preparation of market participants for free market 	
Results and indicators	Target value for 2018 or deadline
1. Electricity price has been deregulated	2013
2. The preparation for the Baltic region of the Nordic power exchange has been completed	2011
3. Estonian electricity market is fully open	2013
4. At least 1000 market participants have been trained	2013
OÜ Põhivõrk, Estonian Competition Authority, Ministry of Economic Affairs and Communications	

MEASURE 3.2

BACKGROUND OF THE MEASURE

Development of honest competition rules and ensuring that the competition rules are complied with
Honest competition between undertakings shall be ensured on an opening market in order to avoid unjustified preference of equivalent producers. The same competition conditions shall apply to all the market participants. In order to avoid market distortions, cooperation with other EU countries is necessary for drawing up similar regulations.

³⁴ Reference: Estonian Competition Authority

³⁵ Reference: Estonian Competition Authority

PERFORMANCE INDICATORS MOST IMPORTANT ACTIVITIES	In order to avoid influencing of the transmission network operator by other participants, independence of the transmission network operator from the commercial interests of other undertakings shall be ensured. Proceeding from the principles of the new Electricity Market Directive, it is rational to separate OÜ Põhivõrk from Eesti Energia AS.	
	1. Equal competition conditions have been provided for all the market participants.	2010
	<ul style="list-style-type: none"> - Analysis of the potential of the import of electricity - Analysis of the market distortions and deviations of the electricity market - Regulation of market distortions which occur as a result of unjustified price advantages of electricity originating from third countries - Separation of OÜ Põhivõrk from Eesti Energia AS and 100% into the direct state ownership 	
OUTPUT INDICATORS	Results and indicators	Target value for 2018 or deadline
	1. Analysis of the potential of import of electricity has been completed	2009
	2. Analysis of market distortions and deviations of the electricity market has been completed	2010
	3. Market distortions have been regulated	2011
	4. OÜ Põhivõrk has been brought 100% into the direct ownership of the state	2010
RESPONSIBLE	OÜ Põhivõrk, Estonian Competition Authority, Ministry of Economic Affairs and Communications	

MEASURE 3.3

BACKGROUND OF THE MEASURE

Taking external costs gradually into account in the price of electricity in the framework of the ecological tax reform

The environmental impact of the use of fossil fuels shall be reduced constantly and the corresponding amendments shall be made in legislation by giving the electricity producers signals by the gradual application of either tax rates or duties. Upon the development of taxes, the development of other taxes and rules of emission trading shall also be taken into account. Gradual application of tax rates or duties may cause considerable increase of the electricity price. It is planned to apply for financial resources from the Fund of Wise Decisions for carrying out the analysis.

PERFORMANCE INDICATORS

1. The rates of environmental taxes complying with the rules of emission trading ensure constant reduction of environmental impacts	
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MOST IMPORTANT ACTIVITIES

- Analysis of the effect of environmental taxes and excise duties
- Making changes in tax and excise duty rates, if necessary

OUTPUT INDICATORS

Results and indicators	Target value for 2018 or deadline
1. Analysis has been completed	2012
2. Tax and excise duty rates have been changed, if necessary	

RESPONSIBLE	Ministry of Economic Affairs and Communications, Ministry of Finance, Ministry of the Environment
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MEASURE 3.4	Analysis of the efficiency of support schemes for renewable and cogeneration electricity, correction thereof, if necessary	
BACKGROUND OF THE MEASURE	The Electricity Market Act provides for the supports for renewable and cogeneration electricity, the purposefulness/efficiency of which shall be assessed on an ongoing basis. A decision concerning the justification of these supports can be made on the basis of the actual costs of the new plants put into operation, especially in a situation, where the price of the competing electricity producers is going to increase considerably due to the price of fuels and CO2 allowances. Too big supports would enable unjustified profitability and increase of the price for the consumers of electricity.	
PERFORMANCE INDICATORS	1. Increase of the share of renewable and cogeneration electricity (renewable electricity 2007:1.75%) ³⁶	5.1% (2010) 15% (2015)
MOST IMPORTANT ACTIVITIES	<ul style="list-style-type: none"> - Analysis of the efficiency of the level of support for renewable and cogeneration electricity - Making amendments to legislation, if necessary 	
	Results and indicators	Target value for 2018 or deadline
OUTPUT INDICATORS	1. Analysis has been completed 2. Amendments have been made to legislation	July 2010 January 2011
RESPONSIBLE	Estonian Competition Authority, Ministry of Economic Affairs and Communications	

MEASURE 3.5	Drawing up and entry into force of legislation concerning nuclear power plants	
BACKGROUND OF THE MEASURE	The construction of a nuclear power plant in Estonia as an economically justified alternative in a longer run presumes long-term preliminary work. In order to ensure the technical and economic viability of the construction of a nuclear power plant, the corresponding legislation shall be prepared. A nuclear energy agency shall be established in connection with nuclear safety.	
PERFORMANCE INDICATORS	1. The legal basis concerning nuclear power plants has been established	2012
MOST IMPORTANT ACTIVITIES	<ul style="list-style-type: none"> - Drawing up legislation concerning nuclear power plants and submission thereof to the Government of the Republic - Establishment and functioning of the institutions related to nuclear safety 	
	Results and indicators	Target value for 2018 or deadline
OUTPUT INDICATORS	1. The draft legislation on nuclear power plants have been submitted to the Government of the Republic 2. The institutions related to nuclear safety	December 2010 2012

³⁶ Reference: Statistics Estonia

RESPONSIBLE

have been established and are functioning	
Ministry of the Environment, Ministry of Economic Affairs and Communications, Ministry of Social Affairs, Ministry of Defence, Ministry of the Interior, Ministry of Foreign Affairs, Ministry of Education and Research	

3. Monitoring and Management of Implementation of Development Plan

The description of the management structure of the Development Plan of the Electricity Sector has been prepared pursuant to Regulation No 302 of the Government of the Republic of 13 December 2005 “Types of Strategic Development Plans, the Procedure for Their Preparation, Amendment, Implementation and Evaluation and Reporting Procedure”.

This Development Plan shall be implemented through the activities of the Ministry of Economic Affairs and Communications, the Ministry of the Environment, the Ministry of Education and Research, the Ministry of Social Affairs, the Ministry of Finance, the Ministry of the Interior, the Ministry of Foreign Affairs and the Estonian Competition Authority and in cooperation with energy undertakings and network operators.

Every three years, the Ministry of Economic Affairs and Communications shall prepare a development plan for the electricity sector and submit it to the Government of the Republic for approval pursuant to the requirement provided for in subsection 2 (1) of the Electricity Market Act. The development plan for the electricity sector shall include an implementing plan for 2009-2012 and an estimate of the cost up to 2018 which shall be submitted by the Ministry of Economic Affairs and Communications to the Government of the Republic together with the development plan for the electricity sector.

The development plan shall be implemented on the basis of the implementing plan of the development plan, which shall set out the specifics, the extent and organisational arrangements of the measures to be implemented. The Ministry of Economic Affairs and Communications shall be responsible for direct implementation of the development plan and assess the efficiency of the activities on ongoing basis in accordance with the output indicators set out in the development plan.

The supervision of implementation is based on regular assessment of the efficiency of the measures and subactivities contained in the development plan, on the basis of which the Ministry of Economic Affairs and Communications shall report to the Government of the Republic on the achievement of the established objectives and make propositions for the amendment or termination of the development plan, if necessary. The report on the development plan shall be submitted as part of the report on the development plan of the energy sector.

Pursuant to the provisions of §2 of the Electricity Market Act, the development plan shall be amended in 2012.

Annexes

Annex 1 Summary of SWOT analyses

The Estonian power system has been constructed as part of the unified northwestern system of the former Soviet Union. Estonia belongs to a unified synchronised system together with Russia, Byelorussia, Latvia and Lithuania.

The Estonian electricity market is small and characterised by concentration on and orientation at one type of fuel. In 2006, 90.2% of electricity was generated from oil shale, 5.6% from natural gas and the rest of the energy from other energy sources. Thus, Estonia is independent from the import of fuel upon the production of electricity; if necessary, the whole electricity supply can be covered by domestic fuels and energy sources. However, the production of electricity is controlled by the biggest energy undertaking Eesti Energia, which owns 96% of the constructed capacities and which produced 95.3% of electricity in 2006.

As a positive aspect of the electricity sector it should be mentioned that there is a very strong power transmission infrastructure in all of the three Baltic States, which is the only region in the European Union where there is no shortage of interconnection capacities, i.e. there are no so-called bottlenecks. Estonia has power interconnections with Russia and Latvia and since the end of 2006 also a direct current link (submarine cable) with Finland.

The market share of OÜ Jaotusvõrk forms approximately 85% of the service market. According to the report of the Energy Market Inspectorate, the Estonian distribution networks have the highest potential for saving losses. OÜ Jaotusvõrk has set an objective in its strategy to make 7% reduction in electricity losses by 2010.

Oil shale fired power plants have an extensive environmental impact. In 2005 the quantity of waste in the energy sector amounted to 67.1% of the quantity of waste produced in the whole Estonia. Since the oil shale mines and undertakings using oil shale are located mainly in the Ida-Virumaa and Lääne-Virumaa, the emissions accompanying oil shale processing and the use of natural resources have an adverse effect right on the environment of these counties and on the health of the people living there.

The electricity market is characterised by efficient cooperation between the transmission network operators of the Baltic States and Finland. Estlink 1 has been constructed and put into operation as a result of the cooperation. In 2007, the transmission network operators of Finland, Estonia and Latvia signed a contract for starting the establishment of a unified electricity market of the Nordic countries and the Baltic States. As the first task of the project, the parties agreed to establish a separate price area in the southern end of the Estonian-Finnish submarine cable Estlink. This enables more efficient market-oriented use of the submarine cable Estlink.

The year 2016, when all the electricity production shall be harmonised with the EU requirements, as a result of which there will be a shortage of production capacities in the amount of approximately 1580 MW, will be of critical importance from the point of view of the Estonian electricity sector. Upon the development of the electricity sector in the next years, the use of renewable energy sources and the production of cogeneration electricity shall be increased to a rational extent by taking all the environmental impacts and socio-economical factors of a life cycle into account in the use of energy sources. Peat, waste and biofuel have a significant energetic potential for the operation of small sustainable cogeneration stations.

Annex 2 Analysis of employment of the scenarios of the development plan

Approximately 8000 people are employed currently in the Eesti Energia group, from whom 1700 are directly connected with the generation of electricity and 3400 with oil shale mining. Decrease in the employment by approximately 1000 people, including 500 in oil shale mining and the rest in electricity generation, can be expected in the next few years. This is connected with the increase of efficiency and is not due to the reduction of production capacities.

Table 1. Number of employees as at the end of the financial year

Number of employees	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7
Eesti Põlevkivi	5601	4913	4617	4680	4458	4036	3754
Narva Power Plants	1852	1829	1837	1861	1855	1772	1794

Reference: Annual reports of Eesti Põlevkivi and Narva Power Plants

Table 2. Distribution of employees by age as at 26.06.2008

Number of employees	up to 24	25-34	35-44	45-54	55-64	over 64	total
Eesti Põlevkivi	133	443	779	1378	648	13	3394
Narva Power Plants	49	225	422	513	432	18	1659

Reference: Eesti Energia 26.06.2008

The adverse effect accompanying the reduction of the number of employees will be mitigated by the usual movement of employees out of the undertaking (retirement, for other reasons). According to the data concerning the period from April 2006 to June 2008, more than 10% of the employees left Narva Power Plants and approximately 20% of the employees left Eesti Põlevkivi in a year. The high mobility is due to the decrease of the number of employees in the undertaking and does not reflect only the so to say common mobility. Rather few people of pensionable age (at least 63 years of age) leave employment as this group forms also a relatively small share. Due to the nature of the work many employees leave the undertaking already before they attain the official pensionable age.

The employees changing jobs move to several different specialities; most often the employees who have left Eesti Energia find new jobs in general construction or in the transport sector.

Additional impacts on employment in case of different alternatives

Construction of wind turbines

At present Eesti Energia has wind turbines with the capacity of approximately 50MW; there are 5 employees directly connected with them. The maintenance service of the wind turbines is outsourced. Each wind turbine (with the capacity of approximately 2MW) shall undergo maintenance four times a year, which means one day of work of two people. The estimated need for labour force is more or less the same in case of off-shore wind turbines³⁷, although their maintenance is more expensive due to poor accessibility.

During the construction of wind turbines Estonian labour force will be engaged in the construction of the foundations and installation of the wind turbines; towers, generators and other components of wind turbines will be produced abroad. The share of general construction forms approximately 25% of the cost of a wind turbine.

Together with the construction of wind turbines gas turbines shall be constructed for capacity fluctuations. These are automatically operating stations which need minimum labour force. It is necessary to use labour force temporarily upon the construction of the station.

Nuclear power plant

Based on the experience of Finland, 250 highly qualified jobs could be created in Estonia upon the construction of a nuclear power plant, from which 10-15 would be nuclear physicists and chemists.

³⁷ 2 persons 1 day every six months, 2 persons 4 days every year.

Since the construction period is long, it is possible to train the persons with the required skills and knowledge. In addition, there will be demand for 50 person-years of employment with respect to outsourced services. It is also necessary to establish a nuclear safety agency, where e.g. 40 people are employed in Lithuania. At present there is a radiation centre in Estonia with 30 employees, who can be reprofiled.

The estimated labour force demand in the construction phase is 21,000 person-years of employment, which would be divided into approximately 8 years.

If Estonia decides to participate in the project of the nuclear power plant in Lithuania or Finland, it would not bring about significant demand for labour force for Estonia.

Construction of oil shale units

The construction time of an oil shale unit is approximately 30 months; the maximum of 1000, but more likely fewer employees would be connected with it. In the previous construction, 2/3 of the employees were from Estonia, the rest were from abroad. In addition to the construction of new oil shale units, installation of new purification equipment for old units is under consideration.

Impact of the alternative scenarios of the electricity sector on employment

Employment in power industry is most affected by changes in oil-shale-based electricity production. According to the scenarios, the available capacity of the oil shale units will be reduced by approximately 300MW in the period 2013-2014, which will bring about the estimated loss of 150-200 jobs³⁸. This corresponds to the common amount of employees leaving the undertaking and thus, no significant impacts are expected in connection with the abovementioned changes. Only the decrease of the demand for labour force arising from a change in production capacities has been taken into account here; the loss of jobs accompanying the increase of the efficiency of operation mentioned above will be added to it.

The decrease of the production of electricity based on oil shale should not have a significant impact on the capacity of oil shale mining, since there is sufficient demand for oil shale for the production of oil. It is presumed that the mining capacities not used for electricity production will be used by oil producers and thus, there will be also demand for labour force. If the total capacity of oil shale mining was limited (e.g. by a development plan), it would bring about bigger changes in the number of employees.

Significant reduction of the production of electricity from oil shale has been forecasted by 2016. Depending on the remaining capacity of oil-shale-based electricity production the number of employees will decrease by 400-900 employees (see table 3). The new production capacities to be constructed (gas turbines, wind turbines) need a minimum amount of employees for operation. If it is planned to construct a nuclear power plant, it will be necessary, until the completion of the nuclear power plant (in 2025), either to import the lacking electricity or to produce electricity in the existing oil shale fired power plants by installing purification equipment in the plants. In case of the scenarios B and D, import of the lacking electricity may be considered more likely, since there is a short-term (a couple of years) demand for it. The installation of purification equipment may be considered in case of other alternatives, since the demand for either imported or oil shale electricity with purification equipment will last for approximately ten years. If the production of electricity from oil shale with purification equipment is continued, the estimated decrease of employees will be approximately 200-400 employees, in case of scenario B, however, 800-900 employees. These numbers exceed the number of usual movement of employees (approximately

³⁸ In oil shale fired power plants the number of employees does not change in one to one correspondence with the change in the units/capacity, since there are several devices serving the whole complex which need to be serviced. The decrease of labour force may be forecasted with respect to repairs and administrative staff. In August-September a comparative analysis with coal fired plants should be completed, on the basis of which more detailed assessment of the changes in the number of employees could be provided. It has been presumed in the abovementioned analysis that the elasticity between the number of employees and a change in the capacity of oil shale fired power plants is 0.9.

200 people a year). It may also be presumed that in addition to direct decrease of the number of jobs, it will be accompanied by an indirect effect (the decrease of the number of jobs in servicing branches).

If a nuclear power plant was built in Estonia, there would be an additional demand for approximately 260 employees, but this only around 2025. There would be no additional demand upon the construction of the nuclear power plant in another state.

Eesti Energia wishes to increase the production of oil from oil shale, which, however, will not create a significant number of new jobs (capital intensive production, the number of jobs created would remain probably under 100).

Although the decrease of the number of employers will be partially compensated by the movement of employees to the labour market, this still means the decrease of the number of jobs. At the same time a considerable decrease of the number of potential employees (0.5-1% a year) is expected after 2012 due to demographic trends. According to the assessments, the number of employees in north-eastern Estonia will decrease by approximately 3 thousand people in the period 2010-2015, by 5 thousand more (approximately 40% of them men)³⁹ in the period 2015-2020.

Table 3. Different scenarios and estimated impacts on employment

MW	Current state	Scenarios					
		A1	A2	B	C1	C2	D
Oil shale	2000	400	400	400	800	800	1200
Oil shale with purification equipment*		1200	1200	0	400	400	0
Cogeneration stations	200	200	200	200	200	200	200
Wind turbines	50	250	250	1200	400	400	400
Gas turbine		100	100	1200	400	400	400
Nuclear energy in Estonia		1200			400		
Nuclear energy abroad			1200			400	
Change in the number of employees							
By 2016		Approximately -200	Ca -200	-800 ... -900	-400 ... -500	-400 ... -500	-400 ... -500
By 2016 in case of import*		-800 ... -900	-800 ... -900	-800 ... -900	-600 ... -700	-600 ... -700	-400 ... -500
By 2025		Approximately -600	-800 ... -900	-800 ... -900	-300 ... -400	-600 ... -700	-400 ... -500

* In the basic version it has been taken into account that, in case of long-term shortage of energy, purification equipment will be installed for the oil shale units, the required energy will not be imported. The estimated impacts on the number of employees are indicated in the row "By 2016 in case of import".

³⁹ Based on population projection of Statistics Estonia until 2050, variant 4. Population 2005-2006. Statistics Estonia 2007. In order to find the number of potential employees, it has been presumed that the employment rates by sex and by age group will remain on the current level.