

1969

EESTI POWER PLANT
COMMISSIONED

+

As part of the pilot project the first nitrogen capture system, which decreases nitrogen oxides emission up to two times, was installed at the Eesti power plant.

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Eesti power plant is the most significant electricity producer in Estonia. Eesti power plant is equipped with eight generating units.

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Over the last few years major investments have been made to upgrade the generating units of Eesti power plant and reduce the environmental impact from production. In 2012 the five-year project to equip the generating units of Eesti power plant with unique desulphurisation equipment was completed. The project helped to reduce SO₂ emissions three times.



Largest oil shale based power plant in Estonia and in the world.



1972

ESTONIA MINE, THE LARGEST ESTONIAN UNDERGROUND MINE, WAS OPENED. AT THE TIME IT WAS THE LARGEST IN THE WORLD.

1980

NEW NARVA OIL PLANT, USING THE UNIQUE UTT-3000 TECHNOLOGY TO PRODUCE SHALE OIL, COMMISSIONED.

2002

FIRST UP-TO-DATE WINDPARK IN ESTONIA OPENED IN VIRTSU.

2006

UNDERWATER POWER CABLE ESTLINK 1 IS THE FIRST INTER-CONNECTION BETWEEN THE BALTIC AND NORDIC ENERGY SYSTEMS.

2010

PARTIAL OPENING OF ESTONIA ELECTRICITY MARKET TO LARGE CUSTOMERS.

2011

EESTI ENERGIA ACQUIRED ONE OF THE MOST ABUNDANT OIL SHALE RESOURCES IN THE STATE OF UTAH, USA.

2012

FIRST OIL PRODUCED IN ENEFIT280 TECHNOLOGY BASED OIL PLANT. ENEFIT TECHNOLOGY ALLOWS FULL UTILIZATION OF THE MINED OIL SHALE.

2013

FULL ELECTRICITY MARKET OPENING TO ALL CUSTOMERS.

2014

EESTI ENERGIA CELEBRATED ITS 75TH ANNIVERSARY.

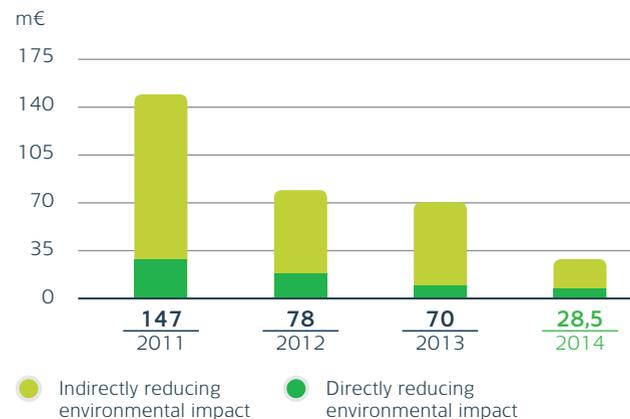
Environmental Activities

The movement towards greener oil shale industry is a constant process and so is the more efficient usage of resources the industry relies on. Innovation and investments are the key drivers on this road.

Innovation in oil shale industry is inevitable. New solutions lead the road to increased efficiency and improved environment sustainability of conventional work methods and equipment. The implementation of these new solutions depend on investments. In 2014 we invested a total of 28.5 million euros, which had direct or indirect impact on improved environmental sustainability of our production.

Investments to the technological development have enabled us to reduce the environmental impacts without affecting existing production levels. We believe such investments will enable us reducing environmental impacts also in the future while increasing the production levels at the same time. In recent years Eesti Energia has paid a lot of attention on innovative solutions. Oil shale industry is often a pioneer in implementing major

The Group's Investments Towards Reducing Environmental Impact



improvements. In 2014 the focus was on air pollution reduction: we commenced installing nitrogen emission capture system on seven boilers of Eesti Power Plant and reached the final stage of the construction of Auvere power plant, which is using the best available technology in the world. The air emission of Auvere power plant will

be significantly lower compared to other power plants due to CFB (circulating fluidized bed) and biomass energy utilisation capacity.

Eesti Energia is following all environmental requirements set by the European Union. In our daily work procedures Eesti Energia is following the general principles of environmental protection:

- We use environmental management systems that conform to the international standards ISO 14001 and EMAS to manage environmental impacts.
- We analyse the environmental impact of any new project before starting it and apply the best available technology (BAT) to reach our targets.
- We use our resources carefully and conservatively, we are increasing our reuse and recycling of waste and we are reducing our environmental emissions.
- We are lowering the CO₂-intensity of the energy delivered to customers.
- We work closely with scientific research establishments and consulting firms and we are always looking for new solutions.
- Under equal conditions in procurement tenders, we prefer suppliers with a certified environmental management system.

Environmental Investments are the Key to Cleaner Industry

Environmental investments have turned oil shale industry cleaner than ever before. Similarly to previous years number of outstanding projects helped us to reduce environmental impacts in 2014.

Pioneering in Nitrogen Capturing

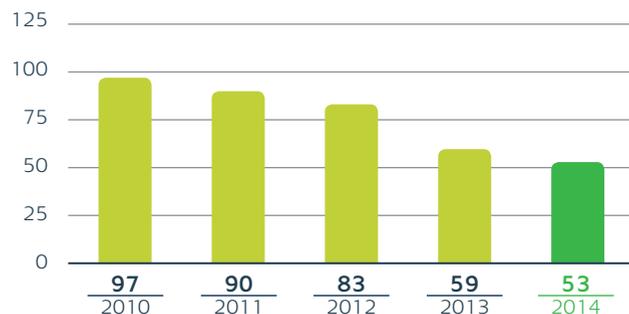
By the end of 2014 the pilot project on reduction of nitrogen emissions, first in the history of oil shale industry, had run little over 12 months. In 2013, one boiler of the Eesti power plant was supplied with NOx capture system, which has allowed reducing its NOx emissions approximately two times. Last year the pilot project was followed by a three-year project to equip another seven boilers with similar emission capture systems. The total cost of the NOx emissions reduction project is 28 million euros.

Emissions

	UNIT	2011	2012	2013	2014
SO ₂	thousand t	56.8	23.2	20.9	24.2
incl. Narva Power Plants	thousand t	56.6	23.1	20.8	24.1
NO _x	thousand t	12.8	9.7	8.8	8.5
Fly ash	thousand t	28.1	5.7	9.1	8.5
CO ₂	thousand t	12.3	11.0	13.4	12.8

NOx Emissions of Boiler Involved in Nox Emissions Reduction Pilot Project

Tonnes per 1,000 working hours



Biomass is Setting Foothold

Modern Auvere power plant, which is more environmentally friendly than other similar power plants due to implementation of the best possible technology, was completed in 2014. The 300-MW power plant allows using biofuel in the extent of 50% of total fuel intake. The option of using biomass as a renewable energy source instead of oil shale reduces the environmental impact of power generation and increases the competitiveness of Auvere power plant in the light of stricter European Union climate policy. The investment to Auvere power station is a crucial decision on guaranteeing the national energy security. More than 10.5 million euros was invested to feeder system to create biofuel capacity while total cost of the power station is 640 million euros.

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New Chimneys – Broader Opportunities

We started with the construction of five new chimneys to Eesti Power Plant in 2014. Additional chimneys allow reducing sulphur emissions through the maximum usage of desulphurisation equipment. The new chimneys will also enable us to measure the emissions of each energy generating unit separately and therefore increase the efficiency and flexibility of the whole generation process. The stricter environmental regulations make this investment especially significant and necessary. Additionally, we can now separate the older and newer generation capacities and thus reduce the usage of amortizing generation

equipment gradually while not impacting the functionality of other generation equipment. Total cost of additional chimneys is 15 million euros.

Waste-to-energy Saving Fossil Fuel

2014 was the second year when we used waste as fuel for heat and power cogeneration. We can save approximately 70 million m³ of natural gas by producing energy from waste. After sorting household waste another 300,000 tonnes of mixed municipal waste remains in Estonia, which is now used for producing heat and power in Iru. In 2014 221.4 tonnes of mixed municipal waste was used to produce 248.1 GWh of heat and 111.8 GWh of electricity.

- ▶▶ The launching of waste-to-energy unit can be seen as a nation-wide environment project: the Estonian waste management became environmental friendlier and the large-scale landfilling in the country has ended.

Solid Waste

	UNIT	2011	2012	2013	2014
Oil shale ash	million t	7.1	6.9	8.1	7.9
incl. recycled	million t	0.1	0.1	0.1	0.1
Waste rock	million t	9.0	8.1	6.3	6.4
incl. recycled	million t	8.1	7.6	4.4	1.8

The mixed municipal waste used in Iru plant is mostly local but the power plant is also providing environment friendly waste management services to Irish and Finnish cooperation partners. Heat generated by Iru power plant is provided to the inhabitants of Maardu and Tallinn at prices, which are up to 25% lower than before. Iru waste-to-energy unit impacts every single inhabitant in Estonia since the waste management in Iru is approximately twice cheaper than landfilling. The launching of waste-to-energy unit can be seen as a nation-wide environment project: the Estonian waste management became environmental friendlier and the large-scale landfilling in the country has ended. A total of 105 million euros was invested to Iru waste-to-energy unit.

Road Made of Oil Shale Ash

The construction of 500 meter road section as part of OSAMAT pilot project and using oil shale ash from Narva Power Plants was completed in 2014. The oil shale ash and cement mixture was used as a binding agent in the depth of up to 4 meters in peat stabilisation of Simuna-Vaiatu road in Lääne-Virumaa region. As a result of this project the whole road section was mass stabilised. The 500-meter road section was divided into five parts in each of which a different binder mixture was used. The analysis of test results helps to determine the optimal binder mixture. The completed road section will be monitored until 2016 to identify potential impacts on oil shale ash based road surface. Total cost of the project started in 2011 and co-financed by Eesti Energia, its partners and EU LIFE+ fund was 2.4 million euros.

Expanding Odour Monitoring

In 2014 Eesti Energia Oil Industry focused on occasional odour pollution in the area. Oil industry has worked out an action plan to deal with the unpleasant smell. Eesti Energia, international consulting firm Ramboll and Estonian Environmental Investment Centre performed a study on air quality to analyse and determine the responsibility of Eesti Energia Oil Industry in odour pollution in the industrial area of Ida-Virumaa region. The study included measuring the quality of outdoor air with operational monitoring equipment in different locations of the plant territory. The results were used as input for modelling the impact of Eesti Energia Oil Industry on the quality of local air. The analysis indicated that the torches of Enefit140 have the most significant impact due to their

- ▶▶ Oil industry will install permanent odour monitoring station to the area in order to identify the direction and extent of odour.

- ▶▶ Therefore, the co-generation of oil and electricity reduces CO₂ emissions from power generation by up to 40%.

technological speciality. Oil industry will install permanent odour monitoring station to the area in order to identify the direction and extent of odour pollution. Local authority and Estonian Environmental Investment Centre will assist in determining the location of the station. Oil industry will invest a total of 3.5 million euros to odour pollution management.

Greener Co-generation

Enefit280, oil plant running on innovative technology, reached 70% of total capacity in 2014. Enefit280 is greener and more efficient than the other oil plants in Estonia. Enefit280 is a unique shale oil, electricity and oil shale gas cogeneration plant, which allows us to extract twice as much value from oil shale reserves and increase efficiency from 30–40% to up to 70%.

The sulphur content of oil shale gas, by-product of the new plant, is significantly lower, the content of incomplete combustion products in flue gas is very low and all air emission indicators are significantly lower than those of the older technology. Oil shale gas combustion generates considerably less CO₂ than direct combustion of oil shale. Therefore, the co-generation of oil and electricity reduces CO₂ emissions from power generation by up to 40%. The strategy of Eesti Energia foresees gradual switching to sustainable and efficient oil and electricity cogeneration over the next 10–15 years. Total investments to Enefit280, the new generation oil plant, amounted to 237 million euros.

New Life of Former Mining Territories

The territory of former Viru mine, which produced 80.5 million tonnes of commercial oil shale in 48 years, remains almost unnoticed – no sign of administration and production facilities and the entrance to underground mines is closed. Only 1.5 years after closedown the territory of Viru mine is fusing with nature.

Forest is slowly taking over also the mined areas of still operating open cast mines. The reclamation of mined

- ▶▶ Estonian Mining Society awarded Eesti Energia Kaevandused with the “Best environmental act in mining” for opening a rowing channel in former Aidu opencast mine.

Reforestation in Former Eesti Energia Mining Territories



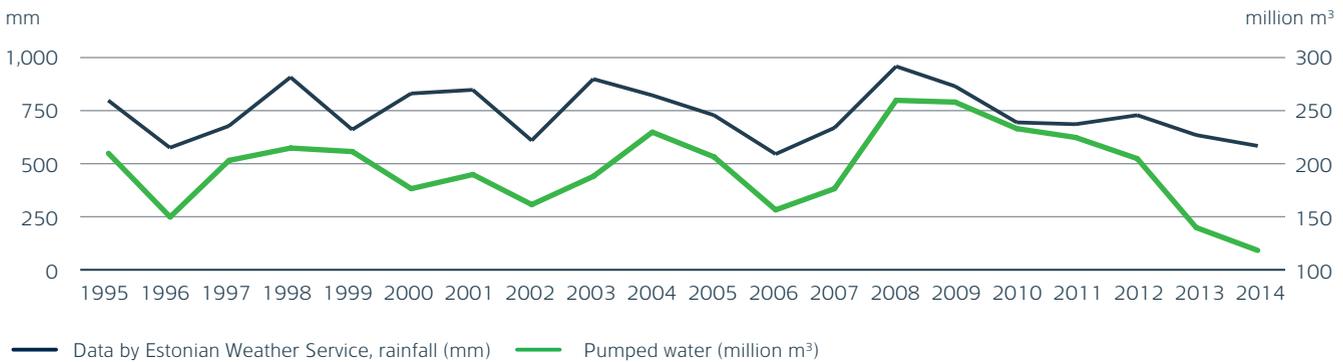
territory is a constant process and therefore we can find trees of 5 and 50 years of age growing side by side. In 2014, 103 ha of trees were planted to the mined areas. Over the last fifty years we have afforested already 14,000 hectares of land.

Yet, afforestation is not the only way to give life to former mining areas. Estonian Mining Society awarded Eesti Energia Kaevandused with the “Best environmental act in mining” for opening a rowing channel in former Aidu opencast mine. The Estonian Mining Society highly

appreciated the new life given to former industrial object and the development work done to achieve this. Several competitions and boat tours were already held in Aidu rowing channel in 2014. The area is also popular among hikers and extreme sports fans.

The Estonian Defence Forces continued to use reforested Sirgala mining field of Narva open pit mine as a military training ground. The polygon, which can also be used with heavy weapons, will be expanded further southward in future.

Correlation between rainfall and pumped mine water



Mine Water Deserves New Studies

In August 2014, Eesti Energia held the traditional environment day, which this time concentrated on mine water. Presenters included scientists, experts, specialists and practitioners. Mine water is a water that is pumped out of the mine to dewater the latter. Mine water is always returned to nature after purification in sedimentation pools. In 2014, Eesti Energia Kaevandused pumped 117.3 million m³ of water, which is considerably lower from previous years due to closedown of pumping stations in Aidu opencast mine and Viru underground mine.

According to Geological Survey of Estonia rainwater accounts for 80% of mine water in open pit mines and approximately 50% in underground mines.

- ▶▶ Mine water is always returned to nature after purification in sedimentation pools.

Sustainable Development Wherever we Go

In 2014, we achieved an important breakthrough in the development Utah project concerning the rare plant that grows on outcrops of oil shale. Graham's beardtongue is quite common also in Eesti Energia's oil shale mines in Utah. In August the U.S. Fish and Wildlife Service approved the conservation agreement to protect beardtongue plant. Enfit Americal Oil allocated part of its territory to support the protection of these rare plants. The further developments proceed according to the initial plan.

Water Pollutants

	UNIT	2011	2012	2013	2014
Suspended matter	thousand t	1.7	1.1	0.8	0.8
Sulphates	thousand t	131.5	76.0	64.8	51.7

Environmental Fees Paid and Investments Towards Reducing Environmental Impact

	UNIT	2011	2012	2013	2014
Resource fees	million €	28.7	30.4	28.3	28.5
Pollution fees	million €	19.8	17.8	24.5	31.8
Environment-related investments	million €	147.1	78.5	69.8	28.5
Directly reducing environmental impact	million €	30.2	17.9	7.7	11.2
Indirectly reducing environmental impact	million €	116.9	60.6	62.1	17.2

Environmental Impacts and Indicators

Environmental Charges

In 2014, Eesti Energia paid the government of Estonia 60.3 million euros in environmental charges, 28.5 million euros of this were for oil shale and water resource and 31.8 million euros for compensating the environmental impacts on water and air pollution and waste.

As main portion of environmental charges is collected by state the oil shale industry reaches the whole Estonian population. Each year portion of the environmental

charges is invested in Estonian Environment Investment Centre. Local municipalities gain access only to charges paid for the usage of natural resources and water, which is 25 percent of the rate of the charge in force in 2011. In 2014, 5.5 million euros paid as environmental charges by Eesti Energia were distributed to the local municipalities of Ida-Virumaa region.

Environmental Surveys and Environment Protection Plans

The analysis of environmental data indicates growing sustainability of oil shale industry. Environmental impact is largely dependent on technological improvements, which depend on industry's environmental standards.

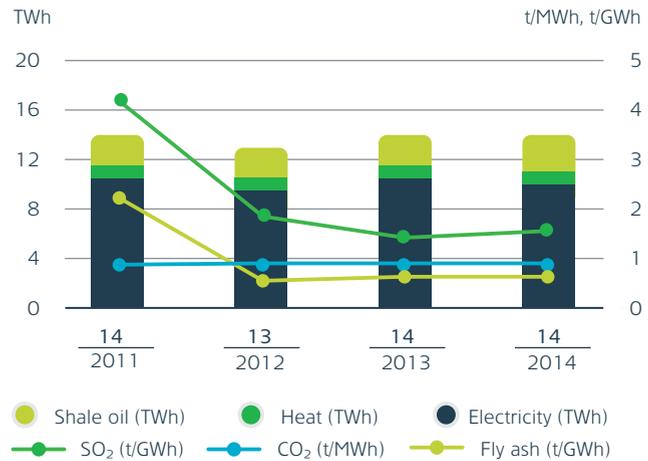
To quantify and understand the exact nature of actual environmental impacts, the company and government need to constantly measure, assess and analyse these impacts. However, on analysing these impacts the government needs to understand the impacts on broader and company level. The analysis of environmental status is a key input to development activities for companies but also to government tax policy and other strategic decisions.

Eesti Energia is actively involved in the analysis of environmental impacts such as direct involvement in environment protection research and collaboration with different technological developments. The lack of standard solutions makes the oil shale usage issues especially important for us. Together with world-famous technology producer

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Outotec we established a joint venture Enefit Outotec Technology to test oil shale of different origin and adapt technological solutions in a lab and pilot plant in Frankfurt, Germany. We are also working closely with state institutions, consulting firms and research centres to test the characteristics and usage potential of oil shale ash.

The Group's Energy Production and Emissions per Unit of Production



Production

	UNIT	2011	2012	2013	2014
Electricity	GWh	10,428	9,378	10,560	9,687
Renewable electricity	GWh	408	534	263	297
Heat	GWh	1,263	1,137	1,242	1,309
Produced using biofuels and waste	GWh	107	155	223	337
Shale oil	thousand t	184	209	214	265
Retort gas	million m ³	58	65	61	72

Resources Used

	UNIT	2011	2012	2013	2014
Commercial oil shale	million t	15.8	14.8	17.2	17.0
Natural gas	million m ³	97.7	61.1	47.3	43.7
Biofuels	million t	0.4	0.5	0.1	0.1
Municipal waste	thousand t	0.0	0.0	183.6	221.4
Cooling water	million m ³	1,522.9	1,302.2	1,475.0	1,454.5
Pumped mining water	million m ³	224.8	203.0	138.2	117.3
Water from open cast mines	million m ³	131.8	112.2	61.6	57.0
Water from underground mines	million m ³	93.0	90.8	76.5	60.3

Eesti Energia has set the following environmental goals for the next five years:

- Increasing efficiency of oil shale resource in oil and electricity cogeneration by utilizing the new generation Enefit technology
- Reducing CO₂ footprint through oil and electricity cogeneration
- Reducing air emission of oil shale industry including solving the odour emission problem of oil industry
- Reducing mining losses by employing the best possible technology
- Using of water from closed mines in heat production
- Increasing recycling and diversification of residues from oil shale processing – waste rock, ash, waste heat
- Restoring former mining territories considering the needs and expectations of community

Selection of environment studies conducted in 2014 by or in the participation of Eesti Energia.

- We were involved with several studies focusing on large-scale usage of oil shale ash as a raw material. In partnership with Tallinn Technical University we continued with studies that deal with granulation of oil shale ash in agriculture. We were a key partner to four Estonian parties in OSAMAT-project conducted with the financial support from EU LIFE+ and focusing on technical and environmental monitoring of road sections based on oil shale ash. We worked with Kunda Nordic Cement and Tallinn Technical University in determining the key characteristics of oil shale ash as a binder. With the support from Estonian Environment Research Centre we partnered with the National



Half a century ago
fuming chimneys were
a sign of operating
power plant.



Modern technologies have clearly
reduced air emissions.



Institute of Chemical Physics and Biophysics to conduct a study on using fly-ash from new circulating fluidised-bed boilers of Narva power plants as the component of cement with core focus on environmental safety and compliance with CEM II standard.

- In cooperation with Oil Shale Competence Centre, Tartu University, Tallinn Technical University and other oil shale processing companies we continued with studies to investigate the environmental impacts of oil shale mining and processing. The aim of the study is the objective assessment of environmental damages caused by oil shale industry in order to compare the benefits of oil shale industry with costs arising from environmental impacts.
- We continued to work with Tallinn Technical University on the baseline studies of oxygen driven oil shale combustion for the purpose to prepare for potential future CO₂ capture and stratification projects.
- When preparing for the opening of Uus-Kiviõli mine in 2014 we asked the experts to assess the environment impacts of mining including the impact of mining on fauna, water level and groundwater.
- In the cooperation of experts we studied the impacts of migration of fish and dam of Linnamäe hydro-electric power station.
- Together with Estonian Environment Institute we analysed and studied the composition of municipal waste and assessed the quantity of CO₂ emerging from burning the fossil part of waste. We will continue with further studies in 2015.
- Together with Ramboll and Estonian Environment Research Centre we studied the potential causes of odour disturbance from oil industry and the potential solutions to the problem.
- In close cooperation with Tallinn Technical University and the eco lab of Eesti Energia we continued with industrial testing of co-combustion of oil shale of variable calorific value and coal or the mix of other fuels in circulating fluidised-bed boilers of Narva power plants.
- Different experts were involved to study the impact of windparks on wild birds and bird habitat considering both the potential offshore windpark and exploitation of Paldiski windpark.