



Eesti Energia – operating the world’s largest oil shale industry



What is oil shale?



Oil shale is not:

- conventional crude
- oil/tar sands
- shale gas

Oil shale is a sedimentary rock with significant amounts of kerogen, which **when heated** at the appropriate temperature **releases oil and gas**.



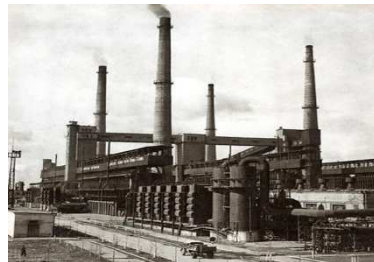
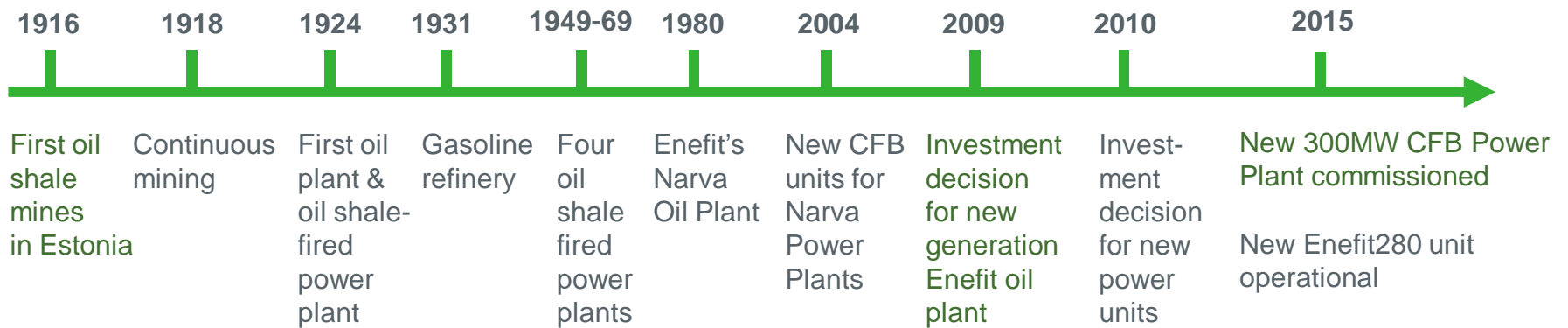
Oil shale is large global resource

The amount of oil in world oil shale deposits is considered 3-9 times larger than proven conventional oil reserves.



Oil shale has been utilized for 100 years in Estonia

- More than 1,1 billion tons of oil shale has been mined
- More than 600 TWh of electricity has been produced
- Nearly 200 million barrels of shale oil have been produced
- The most advanced shale oil technology has been developed



Eesti Energia in brief



Eesti Energia in Numbers

**Established in 1939, 100% of shares held by
the Republic of Estonia**

Employees and services:

- 6000 employees
- 25 subsidiaries and related companies
- 19 services and business units

Fields of activity

- Production of electricity, heat and oil from oil shale
- Production of electricity and heat from renewable energy sources
- Electricity sales to Baltic retail customers
- Elektrilevi, a company in the Group, provides grid services in Estonia

Markets:

- Baltic and Nordic electricity and gas markets
- Global liquid fuel market



Eesti Energia
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About Eesti Energia

Our mission is to derive maximum value from oil shale by using it as efficiently as possible for operations with the highest added value.

Oil Shale Mining

- 1,1 billion tonnes of oil shale mined in total
- **15 million tons** annually
- Underground and open cast mines



Oil Shale Power Generation

- 65 years of experience in oil shale fired power generation
- Operating world's largest oil shale fired power plants
- **9 TWh** annually



Shale Oil Production

- Over **30 years** of commercial experience
- **1,7 million barrels** annually



What can we produce out of 1 ton of Estonian oil shale?



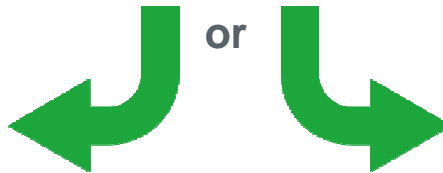
Oil plant



- 125 kg of shale oil (9 500 kcal/kg)
- 35 Nm³ of retort gas (11 200 kcal/m³)
- 430 kg ash
- 180 kg CO₂

Out of 1 ton
of oil shale

or



Power plant



- 850 kWh of electricity
- 430 kg ash
- 870 kg CO₂

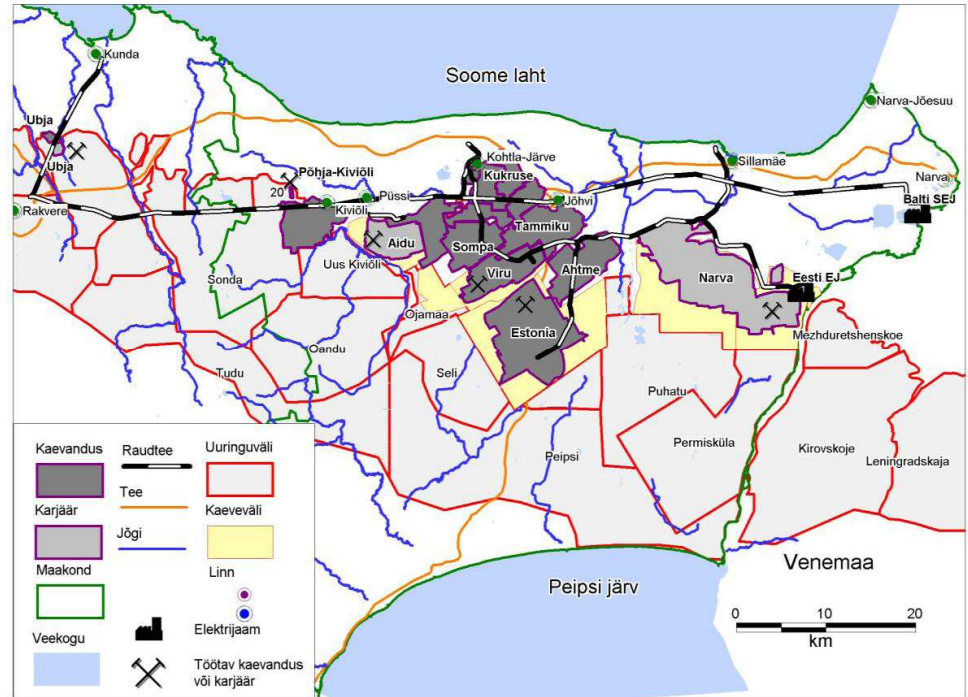
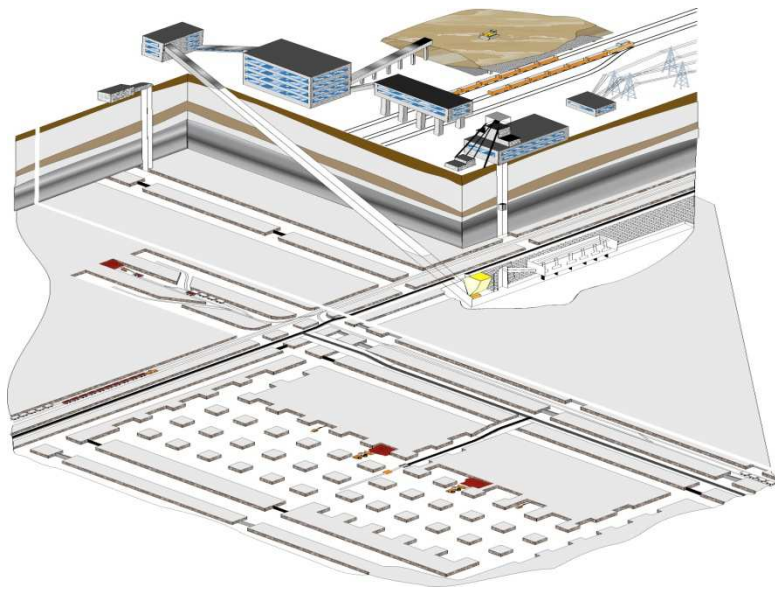


Mining

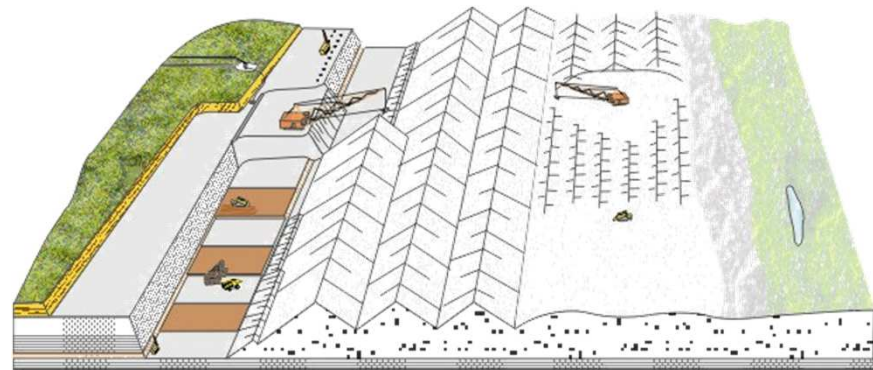


Our Mines

Underground mine (Estonia)



Open-pit mine (Narva)





Oil shale mining in open pit mine Narva



Oil shale underground mining in Estonia mine



Mining Activities Performance Improvements

Water pumping



Settling ponds



Use of the resource



Discharge to nature



Opencast mine



Reforestation



Forest area



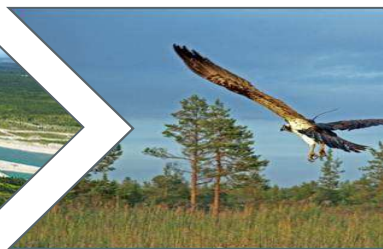
Recreation area



Sporting area



Area for wild nature



Shooting range



Eesti Energia

Mining Activities Performance Improvements



For the efficiency improvement following areas are important to develop:

- Reuse of the mining/enrichment residuals
- Development of the flexible enrichment process
- Minimizing the mining losses



Power Production



Power Generation, 9 TWh in 2014

Eesti Energia owns and operates 3 oil shale power plants



Balti and Eesti Power Plants

Balti and Eesti Power Plants are the largest oil shale fired power plants in the world

Total installed generation capacity 2380 MW

District heat capacity 484 MW

Annual oil shale consumption 12 million tons

Two Circulating Fluidized Bed (CFB) blocks are in operation since 2004

Total capacity 430 MW

Investment 250 million EUR

Balti and Eesti power plants supply over 90% of Estonian electricity



Auvere Power Plant: the Most Efficient Electricity Generation Using Oil Shale and Biomass

- Up to half of the oil shale can be replaced with biomass
- 300 MW, max 2,2 TWh per year
- Efficiency of energy production: >40%
- The largest industrial investment
- The best available technology for producing electricity from oil shale
- Planned commissioning Q1



Shale Oil Production



Shale oil production



- More than 1,7 million barrels annually
- 35 years of experience
- New generation oil, power and gas generation plant Enefit280 operating and works ongoing to increase capacity:
 - Annual oil shale consumption: **2.5 M tons**
 - Annual shale oil production: **315,000 tons**
 - Annual retort gas production: **2,650 M ft³**
 - Annual power production: **280 GWh**



Enefit280: Most Efficient Shale Oil and Power Cogeneration Technology with Lowest Environmental Impacts



Best Available Technology

Energy efficiency 72%

CO	3000-6100 mg/Nm ³
SO ₂	30-500 mg/Nm ³
NO _x	100-400 mg/Nm ³
Dust	40-200 mg/Nm ³
TOC	1000-2000 mg/Nm ³

Enefit280

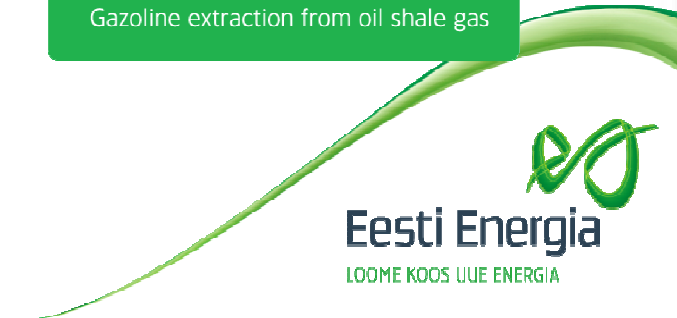
Energy efficiency 80%

CO	200 mg/Nm ³
SO ₂	10 mg/Nm ³
NO _x	200 mg/Nm ³
Dust	30 mg/Nm ³
TOC	10 mg/Nm ³

Enefit280 ramp-up

- Energy efficiency ↑
- Production ↑
- Air emissions ↓

Solids separation *
Gazoline extraction from oil shale gas



Enefit Outotec Technology Pilot Plant in Frankfurt, Germany

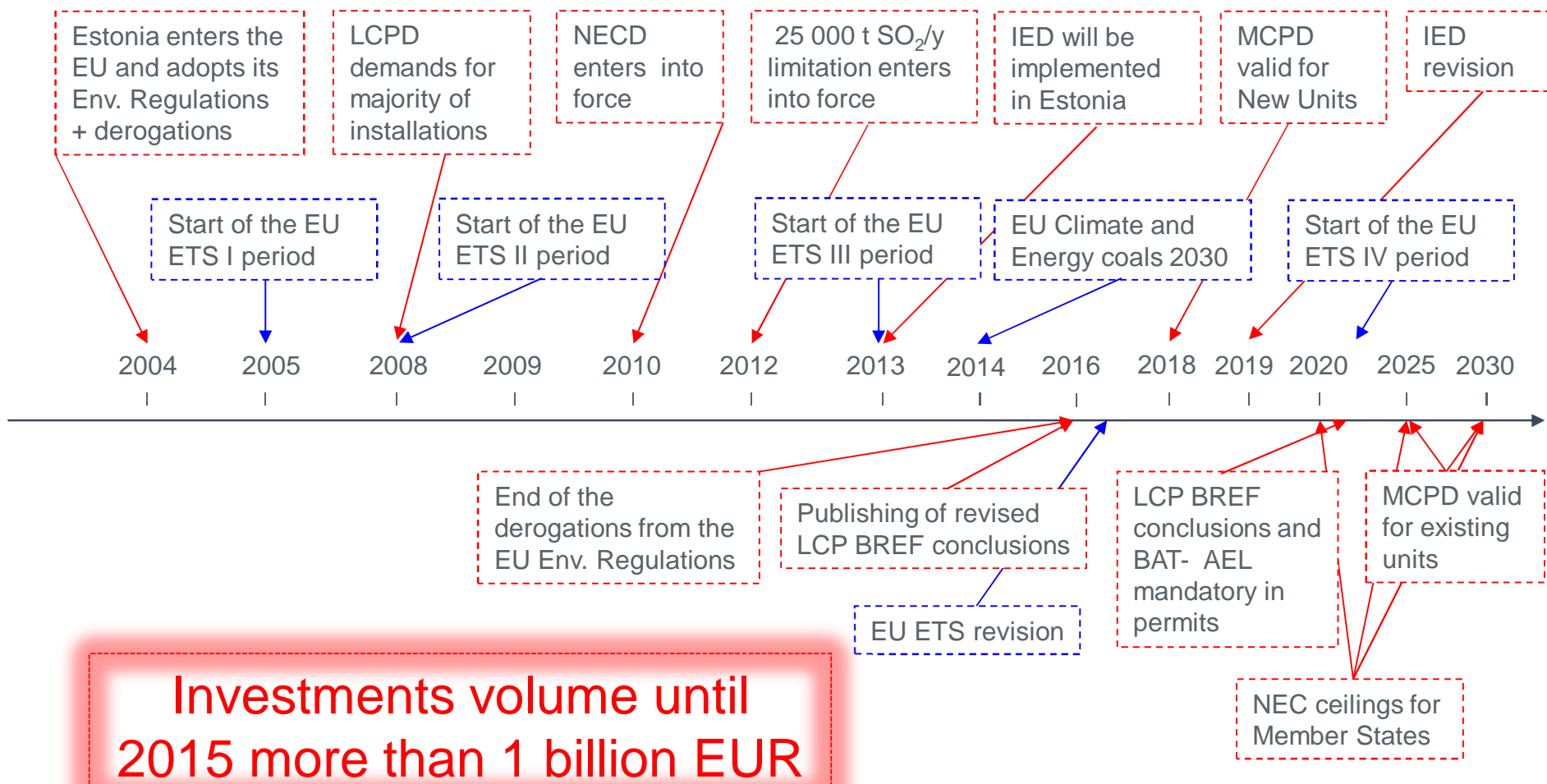
- Location: Frankfurt R&D Center, Germany
- First oil production May 2013
- Final hot commissioning run with Estonian shale in June 2013
- Oil shale processing capacity: 350 kg of oil shale per hour
- Needed for technology development and adaptation for „unknown“ oil shales



Environmental Performance



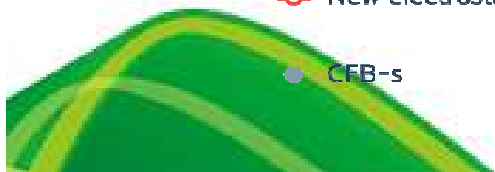
Environmental Regulation as Driving Force of Investments



Our Investments have Decreased Air Emissions Dramatically



- Fly ash emissions
- SO₂ emissions
- NO_x emissions
- Production
- New electrostatic precipitators
- SO_x capture system
- NO_x capture system
- CFB-s
- Closing down the older part of Balti powerplant



Energy Sales



Our retail market: electricity, gas and heat



Electricity:

- In total 575 000 consumption points throughout the Baltics
- Market shares in electricity sales:
 - Estonia 59%
 - Latvia 15%
 - Lithuania 6%
- Estonia is part of Nord Pool Spot
- Trends of smart energy consumption
- Increasing of small-scale (micro) electricity production (~500 micro producers in Estonia)

Gas:

- 13% market share in Estonian gas market
- Gas supply from Lithuanian LNG terminal
- Membership at Lithuanian natural gas exchange GET Baltic

Heat:

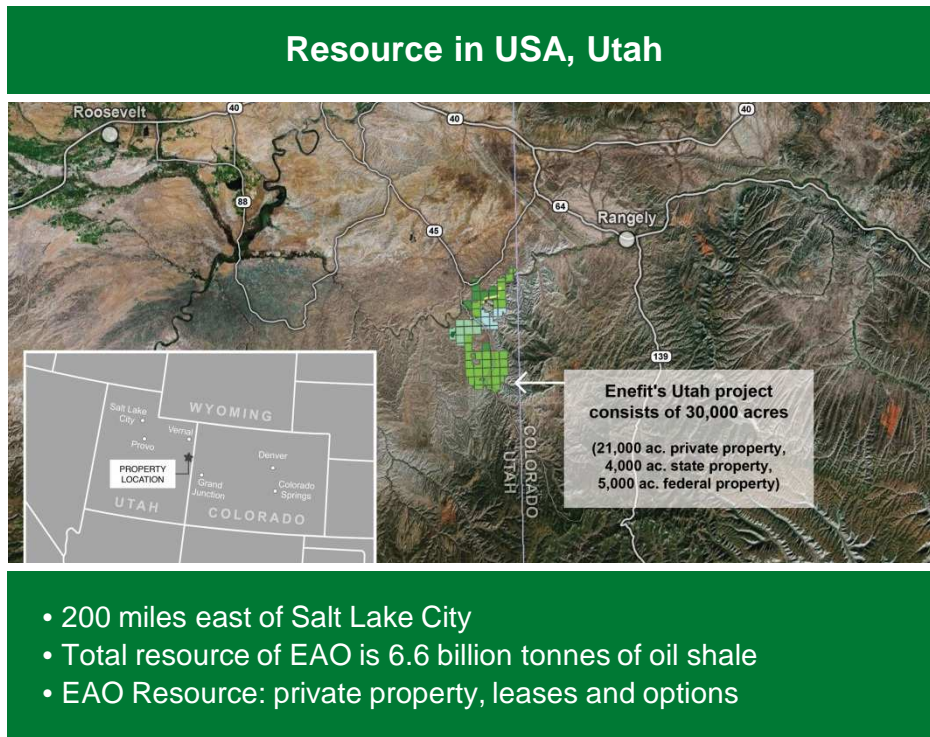
- We produce and sell heat in 4 Estonian towns (Tallinn, Maardu, Narva, Paide) to ca 135 000 consumers and in Valka town in Latvia to ca 4000 consumers

International Projects



Enefit development project in Utah (USA)

Enefit American Oil (EAO) ownership: 100% Enefit



Enefit development projects in Jordan



Enefit Jordan ownership:
65% Enefit, 30% YTL, 5% Near East Group

Project schedule:

- 554 MW oil shale fired power station in 2019





Photo: Our Aidu open cast mine is transforming into an international water sports centre