Oil shale – The Unconventional Which Will Become Conventional

Sandor Liive
CEO, Eesti Energia, Enefit

WEC Montreal, 2010

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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**

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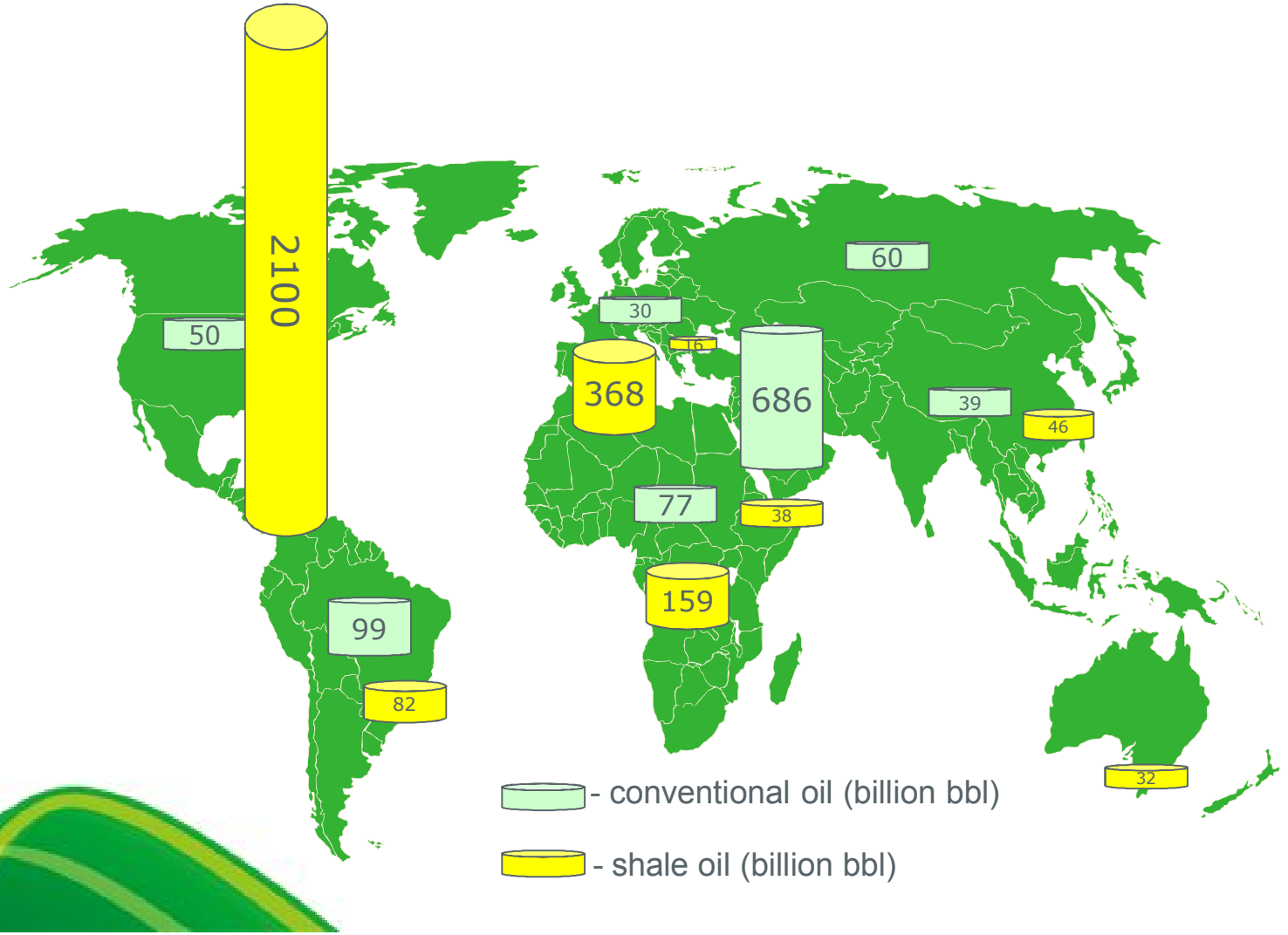
Why Talk About Oil Shale?

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



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Squeezing Oil From a Stone – Proven in Estonia

Estonia has almost 100 years of commercial oil shale experience

Commercial Shale Oil Production Has Been Proven:

Estonia: established 1924

Brazil: established 1981

China: established1930/1989

Proven Estonian Track Record:

- More than 1 billion tons of oil shale has been mined
- More than 550 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

1916

Industry Inception
- 1916: First oil shale mines
- 1924: First shale oil plant
- 1931: Gasoline refinery
- To 1950: Different retorts tested and used

1950

Solid Heat Carrier
- Launch of the solid heat carrier
- Throughput: 200 t/d

1980

Enefit 140
- 1980: Comissioning of Enefit 140
- Throughput: 140 t/h
- 2 Enefit 140 lines operating today

2012-2016

Enefit 280
- 2012: Comissioning of Enefit 280
- Throughput: 280t/h
- 2016: 30 th bbl/day shale oil industry

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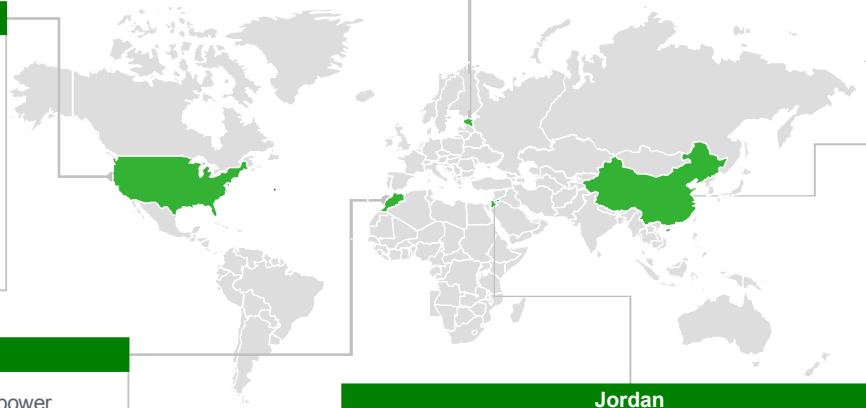
Globally Attractive

Countries across the world are developing their domestic oil shale resources

Enefit worldwide oil shale projects for oil and power production



USA

Project:	50,000 bbl/d shale oil
Enefit interest:	technology sale
Developer:	OSEC, Mitsui, Petrobras
Project status:	conceptual study completed- negotiations ongoing

Estonia

Project:	Enefit 280 construction
Enefit interest:	project owner
Developer:	Eesti Energia (Enefit)
Project status:	construction ongoing

China

Projects:	shale oil production
Enefit interest:	technology sale
Developers:	Local mining companies
Project status:	MoU signed negotiations ongoing

Morocco

Projects:	shale oil + power
Enefit interest:	technology sale project development
Developer:	Government
Project status:	MoU with local partners for power opportunity analysis for oil

Jordan

Projects:	38,000 bbl/d shale oil 600-900 MW power
Enefit interest:	project development technology sale
Developer:	Government Enefit
Project status:	Concession agreement signed feasibility study ongoing

Enefit is in early stage negotiations with several other countries

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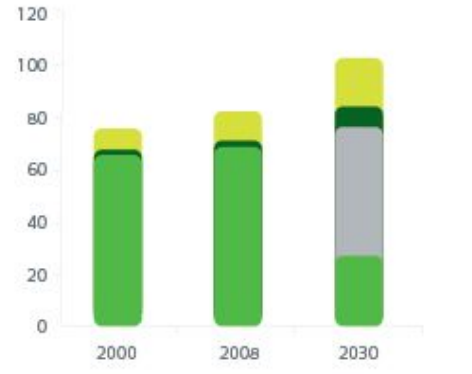
Oil Shale Is a Top Unconventional Future Resource

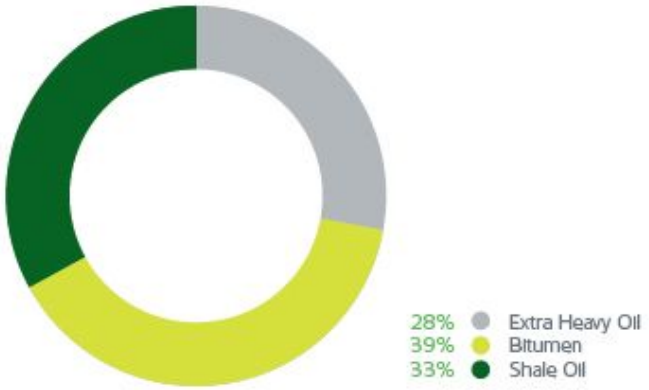
However growth of unconventionals has been limited – why?

WORLD OIL PRODUCTIONBY SOURCE



Source: World Energy Outlook, OECD/IEA 2009
Note: Excludes processing gains. Conventional oil includes crude oil, natural gas liquids (NGLs), extra heavy oil from Venezuela and chemical additives

GLOBAL UNCONVENTIONAL HYDROCARBON RESOURCES



- Oil Shale is considered as top unconventional hydrocarbon resource for the future
- Shale Oil is currently produced in Estonia, China and Brazil, but studies are ongoing in several countries

Source: World Energy Council (2007)

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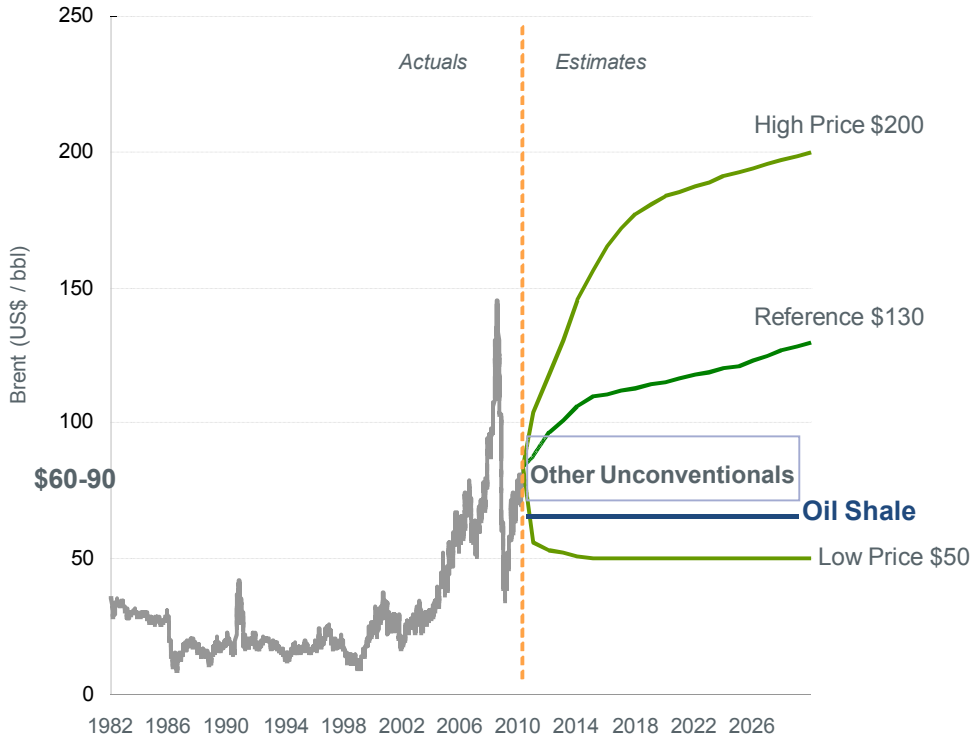
Profitable

Oil shale is competitive with conventional resources

Historical & future oil prices



Source: Bloomberg, EIA (U.S. Energy Information Administration)

Demand for oil is increasing

- World 0.9% (2006 to 2030)
- China last years 9%, forecast 3.3%
- India 4-5%

Developing new oil fields is more capital intensive

- Onshore US $60bbl
- Deepwater Mexico $75bbl
- Deepwater Angola $79bbl

The unconventionals can be cheaper than developing new oil fields

- Tar Sands $60bbl - $90bbl
- Oil Shales starting at $60bbl

Source: CERA

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Clean

Oil shale can meet international standards

ACCEPTABLE STANDARD INDUSTRY	
MINING	Mining is similar to coal and other standard mineral mining Enefit has a long history of government approved remediation
PROCESS	Process emissions are similar to refining or a chemical industry Enefit plants can be CO2 capture ready
WATER USE	Enefit oil extraction process is water free Industry proven solutions exist to minimize related water needs

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Existing Oil Shale Technologies Key Features

Heat Carrier	Technology	Units in operation	Use of 100% Shale	No external energy	No organic waste	Low CO_2 emissions	Additional Revenue Streams
Gas	Fushun	●	○	●	○	●	○
	PetroSix	●	○	●	○	●	○
Solid	ATP	○	●	●	●	○	●
	Enefit	●	●	●	●	○	●
In-situ technologies		○	○	○	○	●	○

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Oil shale Benefits

Energy Independence

- Opportunity to create a domestic supply of synthetic crude for many years
- Oil shale can be used for power production to replace coal and/or gas

Employment

- 30,000 bbl/d shale oil industry will create around 1000 new direct jobs
- Involvement in the supporting sectors due to the industry

Balance of Payments

- Improve current account
- Reduce imports of crude oil and improve the balance of payments

R&D Capacity Building

- Knowledge transfer to support the industry
- Academic potential (universities, laboratories)

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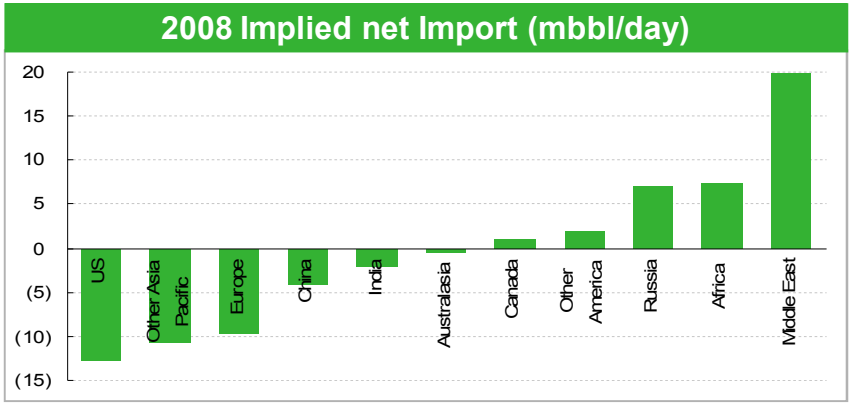
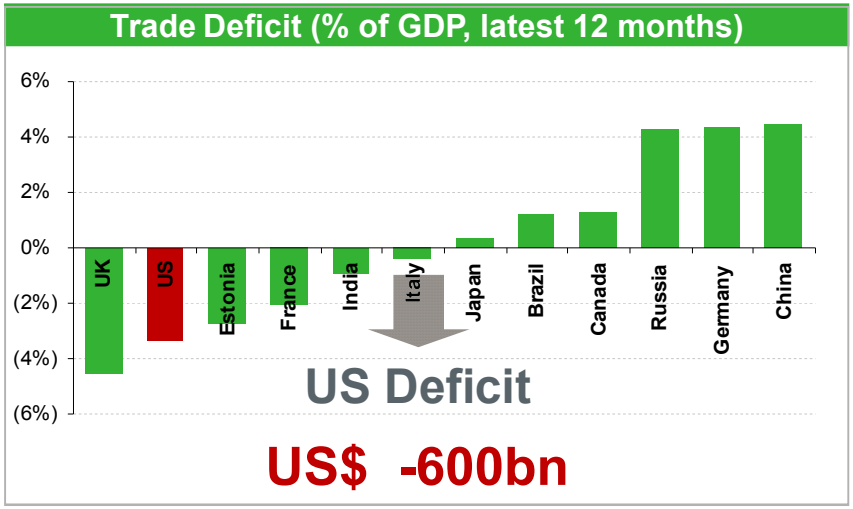
Half of the US trade deficit comes directly from oil imports



Source: BP Statistical Review 2009



Source: The Economist (10 October 2009)

Implied net import[1] = 13 mbbl/day

@ 365 days; @ $75 / bbl

= US$ -350bn per annum

US has enough oil shale to cover annual imports (5bn bbl/y) at the current level for 400 years

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