Oil Shale, Vol. 16, No. 3
pp. 193-196
ISSN 0208-189X

https://doi.org/10.3176/oil.1999.3.01

EDITOR'S PAGE

BLACK SCENARIO OF OIL SHALE POWER GENERATING IN ESTONIA

I

In 1998 the oil shale mining company in Estonia AS *Eesti Põlevkivi* (EP) supplied oil shale to the following consumers (round numbers):

	million tonnes
Narva power plants for producing power and heat	9.5
Estonian Power Plant for producing shale oil	0.5
Kohtla-Järve and Ahtme heat and power plants	0.6
AS *Kiviter* (now *Viru Chemistry Group* AS)	1.5
AS *Kunda-Nordic Cement*	0.3

EP produced and sold 12.5 million t of oil shale this year, 13.3 % less than in 1997. The reduction of oil shale purchase by Narva power plants was somewhat less - 12.7 %.

In spite of the fact that when consumed at the level of 1998, Estonian oil shale resources would last for hundred years and even more, it seems that we have to consider a further decline in oil shale production, i.e. a black scenario.

Even provided that the consumption of electric power in Estonia will remain at the present-day level, and the reports will even show some rise on account of electricity being stolen at present, the production of oil shale by EP would drop by the following reasons:

1. Termination of the production of oil shale for oil and cement industry reduces the demand by 0.5-1.8 million t/a.

   The new level of oil shale consumption: 10.7-12 million t/a

2. Termination of oil production at Estonian Power Plant – 0-0.5 million t/a.

   The new level of oil shale consumption: 10.2-12 million t/a

3. Co-production of power and heat outside the town of Narva would cover 10-30 % of the demand for electric power in Estonia reducing the consumption of oil shale for Narva power plants by 1-1.25 million t.

   The new level of oil shale consumption: 7.7-11 million t/a

4. Reduction of power losses (about 20 %) in transmission and distribution grids. The aim is to halve the losses that in turn would bring about the reduction in the power production at Narva power plants and thus also their oil shale consumption by 0.5-1 million t/a.

   The new level of oil shale consumption: 6.7-10.5 million t/a

5. Modernization of the equipment at Narva power plants will reduce the fuel consumption by 10 % (atmospheric fluidized bed boilers), and by 20 % (pressurized fluidized bed boilers).

   The new level of oil shale consumption: 5.3-9.8 million t/a

II

Let us examine the situation of supplying Narva power plants with oil shale at the reduced level of 5-7 million t/a.

The Estonian power company AS *Eesti Energia* (EE) has predicted that oil shale based power generating will come to an end if oil shale price (franco for power plants) in the future will exceed 100 kroons per tonne. EE hopes to avoid the situation by subordinating the trust AS *Eesti Põlevkivi* (EP) to power plants, considerably reducing the number of mines, and constructing a railway track between *Ahtme* and *Viivikonna* mines.

In reality, in long-time perspective and considering the inflation, obtaining oil shale of the average heating value of 8.6 GJ/t for the above-mentioned price is quite utopic.

According to EP prognoses, even in seemingly inexpensive openpits like *Sirgala* and *Narva*, expenses proportional to production (explosives, spare parts, diesel fuel, electricity, and resource taxes) will after ten years reach 98 (at the yearly output 4.0 million t) to 107 (2.9 million t) EEK/t, being already 67 (4.05-4.08 million t) EEK/t in 1999. The expenses for manpower, capital and transport have to be added.

The key position at forming the oil shale average price by EP belongs to the *Estonia* mine – the biggest one by the production (designed for enriched oil shale output of 5 million t per year), and by the resources (307 million t stated on January 1, 1998).

The mine is now greatly underloaded: in 1998 2.6 million t of oil shale were produced, 1550 workers and 216 officials worked 3.77 days per week on the average. The average prime cost of commercial shale was 140 EEK/t. The electric equipment installed in the mine is 50 MW, solely for water pumping and ventilating 36 GWh of electric power was used. Losses of shale energy at enrichment make 17 % and other enrichment losses exceed 10 EEK/t.

There is a paradox: if a new potential owner of EP will force cheap openpit mining, the increase in oil shale prime cost at *Estonia* due to the lowering of the workload will bring about bigger expenses than those expected to be gained by forcing openpit mining. One may even plan the closing of the *Estonia* mine by the aid of state support to keep the oil shale price at openpits near 100 EEK/t. This would mean counting off and flooding 47 % of EP active resources that would be exhausted only within 115 (!) years when exploited at the 1998 level.

A yearly output of 5-7 million t is quite within the powers of the present openpits with their planned total capacity 7.5 million t/a and active resources 200 million tonnes (for 30-40 years) as stated on January 1, 1998. Relatively low expenses on manpower (the total number of workers was 1924 in December 1998) form a contrast with growing expenses explosives and power as well as on buying new excavators needed for working thicker soil covers.

An opposing possibility is to force the operations at the Estonia mine with simultaneous simplifying of the enrichment process and parallel exploiting of the areas in Sirgala and Narva where overburden characteristics are more favourable. Exploiting of those openpits as compensating production capacities is necessary to level out all-the-year-round production capacity. At present, EP valuates the nominal capacity of this complex to be 8.2 million t/a. In December 1998, the number of employees was 2946. In the case of restricting the output of openpits this number would not drop below 2500. This production strategy is not feasible without completing the suspended construction of the Ahtme-Viivikonna railway track. That would essentially facilitate supplying Estonian power plants with oil shale. This approach has the advantage of a considerable more reasonable and stable use of material and financial resources.

The first step in forcing the activities at *Estonia* is establishing a five-day working week instead of 1998's 3.77 working days. Preserving the average daily throughput at 13.8 thousand t, the level of December 1998, it makes 3.5 million t per year. Simplification of enrichment would increase the yield of sold power without additional expenses at least by 10 %; i.e. the yield would correspond to the yearly oil shale production nearly 4 million t shale of the 1998's quality. Special consumption of electric power for water pumping and ventilating would lower by ~35 %, etc. Those means could lower the oil shale price at *Estonia* to the level of openpit shale price and, within a decade, even considerably lower.

The experts of mining works have to calculate expedient ways of oil shale production at the yearly capacity of 5-7 million tonnes.

III

Decline in oil shale power generating may be contrasted with several scenarios of optimistic shade. However, prerequisites for their realization are problematic. Some examples of alternative scenarios:

- Closing down Ignalina and/or Sosnovyi Bor nuclear power plants.
- Selling cheap power produced at co-production of power and heat via a sea cable to Finland. In Estonia, more expensive oil shale electricity from Narva condensation power plants would be used.
- Starting oil production at the *Estonia* mine.

The last case needs some comments. One possibility to exploit *Estonia* could be the replacement of the mechanical enrichment (17 % energy losses) by enrichment in Taciuk retorts producing oil and gas. The proposal for using this equipment has been made by the Canadian oil corporation Suncor Energy. For the lack of corresponding technical data for Estonian oil shale, the characteristics of Galoter retorts operated at the oil factory of the Estonian Power Plant in Narva are discussed below. The Galoter process is in principle similar to the Taciuk method. The efficiency (oil and gas energy) of the Galoter is 82 % (57 % in oil, 25 % in gas), i.e. energy losses make 18 % that are at the level of mechanical enrichment, but considerably more valuable products than enriched oil shale are produced. We note here that the efficiency of the Kiviter retorts, in which oil and gas are produced from enriched oil shale, is 76 % making $100 \times (1 - 0.83 \times 0.76) = 37$ % for total losses.

Taciuk retorts are suited for processing materials with low (below 10 %) oil yield. Otherwise, retorts may be choked. The real oil yield from nonenriched shale at *Estonia* (the process not studied yet) may be within the range 9-10 % plus gas yield (in oil equivalents) 3.5-4 %. The amount of mined ore equivalent to enriched oil shale output 3.6 million t/a is 6 million t/a. Such an amount would yield yearly 540-600 thousand tonnes of raw shale oil and 200-250 thousand tonnes of gas (in oil equivalents). The latter is to be burnt at local power plants, and about 1 TWh/a would be sold at the power market so competing with the power from Narva power plants. The price of mined ore at *Estonia* may drop to the level of 50 EEK/t considering the increase in ore output and absence of enrichment losses. It would make 350-400 kroons per 1 tonne of both oil and gas oil equivalents. Whether the price is reasonable must be decided by the marketers.

Besides some uncertainties concerning the technical solution of Taciuk process as well as its economical side, the establishment of an oil factory at the Estonia mine may be hindered or banned by environment protection organizations as the mine is located in the catchment basin of the Lake Peipus.

I. Öpik