

THE POSSIBILITY OF INTEGRATING SUSTAINABILITY INTO LEGAL FRAMEWORK FOR USE OF OIL SHALE RESERVES

A. TEEDUMÄE*, A. RAUKAS

Institute of Geology at Tallinn University of Technology
7 Estonia Blvd., 10143 Tallinn, Estonia

The Estonia oil shale deposit is not only of national but also of regional importance. The paper shows the urgent need for a long-term general strategy of sparing and sustainable extraction and protection of oil shale reserves which is elaborated by specialists and accepted at governmental level. Regulating the land use within the mineral deposit guarantees the most complete use of oil shale reserves and flexibility to avoid/reduce/mitigate impact of mining.

The integration of the concept and tools for environmental and social management of explored reserves for mining is a complex task for law and policy making in the mining sector. The purpose of this paper is to offer insight into problems relating to sustainable development of reserves of the Estonia oil shale deposit.

Sustainability is based on the reforms of instruments and institutions, which include technical, administrative, economic and environmental measures. This means that sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are in harmony and enhance both current and future policy, meet human needs and aspirations [1, 2].

The Estonia oil shale deposit is not only of national but also of regional importance, being the world's largest exploited deposit of oil shale (Fig. 1a). The mining was started in 1916, the continuous exploitation has been going on since 1919 [3]. The reserves of the deposit are rather completely explored. Up to the present, ca 1×10^9 t of oil shale have been mined. According to the present assessment, the total amount of resources is 5×10^9 t. The annual output reached its peak ($>30 \times 10^6$ t) in the early 1980s [4] and has stabilised in the last years at the level of $12\text{--}13 \times 10^6$ t. More than 80% of mined oil shale is used for

* Corresponding author: e-mail teedumae@gi.ee

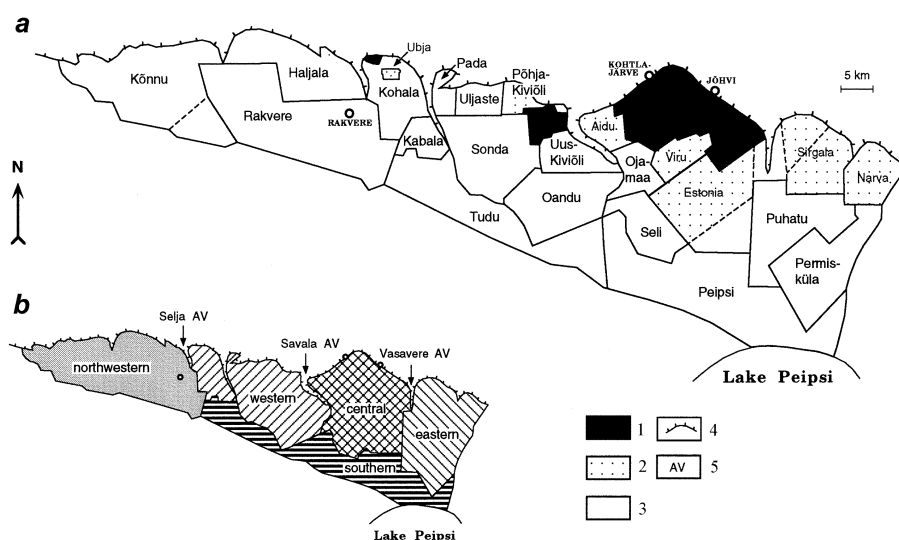


Fig. 1. Subdivisions of the Estonia oil shale deposit (modified after [1]): a – abandoned mines (1), fields of active mining (2), explored fields not in mining (3), recent erosional boundary of the kukersite oil shale formations (4); b – ancient erosional valleys (5)

power production, 2–3% for cement production, and the rest for retorting of shale oil.

Estonian oil shale belongs to the class of carbonate fuels. The current commercial bed is a composite of individual kukersite seams (A-F₁) interbedding with limestone. According to the degree of exploration, thickness and quality of the commercial bed and its depth from the surface, the Estonia deposit has been arbitrarily subdivided [5] into five areas (Fig. 1b).

The **northwestern** area (590 km²) is characterised by a rather low oil shale quality, particularly due to the low organic matter content and small thickness of commercial bed. This part of deposit is regarded as a low prospective area.

Of the 620 km² covered by the **western area**, only about 30 km² have been mined out. Currently, oil shale is mined on the Ubja quarry belonging to Kunda Nordic Tsement, for cement production. Ignoring the principles of rational use of reserves only the upper part (kukersite seams D-F₁) of the commercial layer is extracted. This area would be the most prospective area for mining, if there were no environmental restrictions due to which hardly 3.5×10⁹ tonnes of oil shale are minable today.

In the **central area** (660 km²) the commercial kukersite seams are at their thickest. The mines in the northernmost part of the area are closed with about 1×10⁹ tonnes of reserves left on the abandoned mining fields (Fig. 1a). As oil shale mining is not permitted within the Seli and Ojamaa nature reserves, the currently minable resources of the area account only for 0.6×10⁹ tonnes.

In the **eastern area** the mining conditions are much the same as in the central area, only quality of the oil shale is a bit lower. This area extends over 530 km² of which ca one-fifth has been mined out. From the remaining 0.8×10⁹ t of reserves 0.5×10⁹ t lay within the limits of nature reserves and are not available for mining so far.

The **southern area** (570 km²) holds a little prospect for mining in the near future because the quality of the commercial bed does not meet the current requirements of the oil shale industry. The main reasons are the gradual increase of overburden and the lowering of calorific value of the oil shale seams southward.

All the former and currently operating mines and open pits are located in the northern part of central and eastern areas (Figs. 1a, b) of the deposit, which are characterised by the best technological and mining parameters resulting in the lowest mining costs. The prospective, but less feasible mining areas are farther in the south and west. The quality of reserves has been studied well. Up to now the oil shale reserves are classified on the basis of energy rating – for active (economic) reserve it is minimum 35 GJ/m², for passive (subeconomic) reserves 25–35 GJ/m². This classification is mainly in accordance with the requirements of the energetic industry. For other customers, such as the oil and chemical industries etc., some additional specifications will most probably be needed. The total active reserves of the Estonia deposit are estimated at 1.4×10⁹ tonnes, which will meet the current and future need for about a century. The active reserves of operating fields make up about 30% of total reserves.

However, technologies and technical solutions are progressing constantly, new fields of use, and more advanced methods of mining and processing are being introduced, their efficiency is based on, and results from the suitability of reserves. The reserves of oil shale as a mineral, are non-renewable, their location in the Earth crust and their quality are constant for the all existence of mankind. This is the factor of primary significance, which cannot be ignored while making any decision concerning the use of oil shale. The general strategy of sparing and sustainable extraction and protection of oil shale reserves elaborated by specialists and accepted at the governmental/legislative level will be the key document for the long-term rational development of mining operations on the deposit. It will also provide a basis for the development of industries concerned and effective environmental policy for the whole region. In the strategies worked out for the energetic industry so far these problems have not been sufficiently touched upon.

There is an urgent need for this kind of document. The Estonian Earth's Crust Act regulates the granting of extraction permits and establishes restrictions on receiving the extraction permit, which the holder is obliged to follow. The Ministry of the Environment grants the extraction permit of the deposit of national (state) importance. The release of the real property in possession of a physical person for mining has to be agreed between the holder of the extraction permit and the owner of the real property. For the

state and municipal property the decisions are made at the governmental or municipal level, respectively. In this respect, planning of the mining of explored reserves in the Estonia oil shale deposit or any other large deposit is not depending on the principles of rational use of reserves alone, but also on the decisions made by the owners of the separate real properties. Where has this policy led?

The first consequences have manifested themselves on the large deposits of limestone around Tallinn. The reserves of limestone explored for the building purposes explored in Soviet period (before 1991) cannot be taken into use, because the land ownership has changed since the exploration. Owners of real estate, not interested in quarrying, refuse to sell their properties and so the development of the building material industry in Tallinn, and for Tallinn, is already facing real difficulties in supply of reserves regardless of their abundance.

In the case of the Estonia oil shale deposit the situation reverses itself. Several owners of real estates have sold their properties and new owners have applied for the extraction permit of oil shale. These sites of real properties are of different size and location. When starting mining of these sites the principles of the rational use of the reserves of the deposit as a whole cannot be followed. At the present time, the government has stopped granting of extraction permits of the Estonia oil shale deposit until the elaboration of a general scheme for the development of the industry concerned. As an inevitable and basic part of this work, the order of introduction oil shale reserves into industry has to be fixed.

All the decisions concerning oil shale resources are made at the level of the Ministry of the Environment. AS Eesti Põlevkivi group as a parent company operates main mining activities. Kunda Nordic Tsement operates only one mining field – Ubja, and the chemical industry (Kiviõli Keemiatööstuse OÜ) a part of the Põhja-Kiviõli field (Fig. 1a). Up to the present, general management and development of mining of reserves have been carried out according to the scenarios of Eesti Põlevkivi. These scenarios are based on the experience gained through the company's 90 year-long mining activities and the resultant consequences – waste, pollution of the environment, reclamation of worked out territories, etc. The power plants and oil producing companies predict the annual amount of the extraction of oil shale, Eesti Põlevkivi plans the mining operations of oil shale of needed quality on operating mine fields. The technical-technological and environmental aspects of mining have been studied well. There is an abundance of information to draw up the general territorially fixed order (zoning) of successive long-term management of the explored reserves. In this case the extraction permits will be given in accordance with the fixed zoning whenever the application is coming. General assessment (territorial zoning) of reserve development of the whole deposit, based on the mining conditions, quality of reserves and environmental objectives is to regulate the mining activities following the principles of the most rational and complete extrac-

tion and to ensure the protection of reserves in the Earth crust. In the case of the well-studied Estonia deposit this zoning corresponds to the first stage of the environmental impact assessment (EIA) process, providing the most valuable information for decision-making and serving as a background for the detailed assessment of new sites. It also shortens the administrative process of extraction permits.

The scheme has to be accepted at the level of the government with special complements of the Earth's Crust Act and other legislative documents concerned. In the coming future oil shale will remain the main source of primary energy; however, other measures applied in the energy sector will reduce oil shale consumption, and it definitely deserves special treatment.

There is one more item needing regulation at the legislative basis – it is the status of the reserves, explored before 1991, when the exploration was state-financed. The whole Estonia oil-shale deposit is well explored at the level of proved or possible reserves. The government has paid all the costs so far, as the exploiting company is state-owned. The owners of real properties, applying for the extraction permit in the case under consideration, have not made (paid for) exploration. The extraction permit can be granted only after the mineral reserves within the boundaries of the mining claim have been officially certified. The last means that the reserves have to be properly explored and their amount identified. Due to abundant data obtained through numerous explorations of the Estonia oil shale deposit, the reserves of any site with proven active reserves can be presented for certification without additional geological investigations, except recalculation according to the space of the site. This is causing some inequality among applicants, as some explorations have been made at the expense of users, others not. One way for regulation is to make it through the extraction tax.

Mineral resources, including oil shale, present unique challenges for land use planning and resource management because they require a different, legislative approach than other natural resources. Regulating guarantees the land designation within the mineral deposit increases the security to develop the most complete use of reserves of the deposit once located and the flexibility to avoid /reduce/mitigate impact of mining.

In general terms, Estonia today lacks a comprehensive vision of sustainable introduction into the industry of reserves of the Estonia oil shale deposit. The workable framework for sustainability in mining intends to identify the criteria of the sustainability of reserves. It has to unite the needs of nature protection including Natura 2000 needs.

Acknowledgements

The present study was financed by the governmental target-funding project No. 0332088s02.

REFERENCES

1. *Raukas, A.* Oil Shale Industry and Sustainability – Governance through Dialogue // *Oil Shale*. 2005. Vol. 22. No. 1. P. 3–4.
2. *Ratas, R., Raukas, A.* Main Outlines of Sustainable Development in Estonia. Ministry of the Environment, Environment Information Centre.– Tallinn, 1997.
3. *Kattai, V.* Eesti põlevkivi. – Tallinn, 2000 [in Estonian with English summary].
4. *Veiderma, M.* Estonian oil shale: Reserves and Usage // *Symposium on Oil Shale 2002 Abstracts*. Tallinn, 2002. P. 8–9.
5. *Veiderma, M.* Estonian oil shale – resources and usage // *Oil Shale*. 2003. Vol. 20. No. 3 Special. P. 295–303.
6. *Bauert, H.* Oil shale // *Geology and Mineral Resources of Estonia* / A. Raukas, A. Teedumäe (eds.). Tallinn : Estonian Academy Publishers, 1997. P. 313–326.

Received March 20, 2006