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MODERN TECHNOLOGIES IN SHALE OIL EXTRACTION

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The relevance of the research is that the total volume reserves of oil shale far exceed the reserves of conventional oil. The object of research presents consideration of future production and use of shale oil. The subject of the research is scientific articles, experts' forecasts in the oil and gas industry.

The research implies accomplishment of the objective which to study the development prospects of shale oil extraction while performing the following set of tasks:

• To conduct a literature review for investigated theme;
• To investigate the positive and negative factors of shale oil extraction;
• To compare the different methods in terms of their resource intensity, efficiency and borders of applicability.

The theoretical basis of our research is based on the general scientific methods of research: information, logic. The use of these methods of research allowed showing the way and prospects of shale oil extraction.

Oil shale is a sedimentary rock that is also a fossil fuel. Shale oil extraction is commonly conducted above ground (ex situ processing) by mining the oil shale and then treating it in processing facilities. Other contemporary methods conduct the processing underground (on-site or in situ processing) by using heat and extracting the oil by means of oil wells.

The earliest description of the process dates to the 10th century. There are three major methods of in shale oil extraction.

1. Horizontal Drilling (Fig.) is the key compared to vertical methods; horizontal drilling puts the well casing in contact with a much greater percentage of the oil reservoir's surface area, making recovery from shale faster and more efficient. In modern horizontal drilling, producers drill straight down until they hit shale, and then use directional drilling techniques to bend the drill string in parallel to the shale layer. Downhole motors and advanced measurement using drilling sensors at selected intervals along the drill string help the crew above ground steer the drill and make real-time adjustments based on directional data [2].

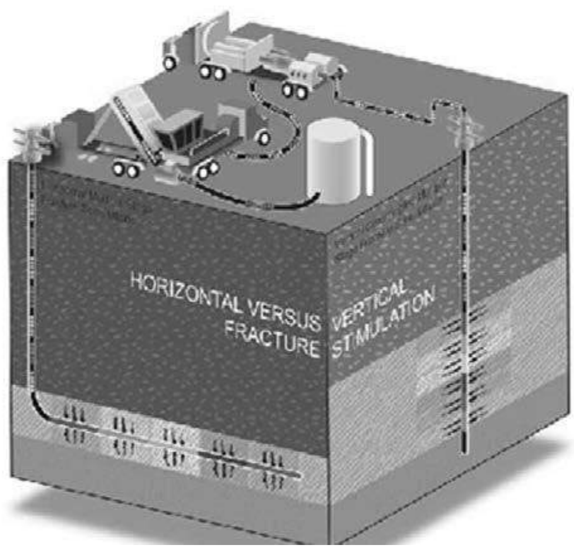

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Fig. Horizontal Drilling

2. Multistage hydraulic "fracking" increases the speed and precision of the fracturing process, increasing cost-effectiveness and production output. Area residents and environmental groups have raised concerns about possible effects of this method on groundwater and air quality, but environmental impact studies suggest that horizontal drilling effects are comparable to conventional techniques [1].

3. Situ technologies boil up oil shale underground by injecting hot fluids into the rock formation, or by using linear or planar heating sources followed by thermal conduction and convection to distribute heat through the target zone. Shale oil is then regained through vertical wells drilled into the formation. These technologies are potentially able to extract more shale oil from a given area of land than conventional ex situ processing technologies, as the wells can reach

greater depths than surface mines. They present a chance to recover shale oil from low-grade deposits that traditional mining techniques could not extract [4].

ExxonMobil's in situ technology (ExxonMobil Electrofrac) uses electrical heating with elements of both wall conduction and volumetric heating methods. It injects an electrically conductive material such as calcined petroleum coke into the hydraulic fractures created in the oil shale formation which then forms a heating element. Heating wells are placed in a parallel row with a second horizontal well intersecting them at their toe. This allows opposing electrical charges to be applied at either end.

The Illinois Institute of Technology evolved the idea of oil shale volumetric heating with the help radio waves. This method was subsequently developed by Lawrence Livermore National Laboratory. Oil shale is heated by vertical electrode arrays. Deeper volumes could be processed at slower heating velocities by instruments, which spaced at tens of meters. The idea assumes a RF (radio frequency) at which the skin depth is many tens of meters, so overpassing the thermal diffusion times, which necessary for conductive heating. Its disadvantages are intensive electrical demand and the opportunity that groundwater or char can absorb undue amounts of the energy. RF processing in combination critical fluids is being developed by Raytheon together with CF Technologies and tested by Schlumberger. In any case, all the ways of shale oil extraction negatively effect on the environment [5].

Environmental influence of the oil shale industry contains the discussion of issues such as land use, waste management, and water and air pollution caused by the extraction and working up of oil shale**.**

Surface mining and in-situ processing requires extensive land use. Mining, processing and waste disposal require land to be withdrawn from traditional uses, and therefore should avoid high density population areas. Oil shale mining reduces the original ecosystem diversity with habitats supporting a variety of plants and animals. After mining the land has to be reclaimed. However, this process takes time and cannot necessarily re-establish the original biodiversity. The impact of sub-surface mining on the surroundings will be less than for open pit mines. However, sub-surface mining may also cause subsidence of the surface due to the collapse of mined-out area and abandoned stone drifts. The waste material may consist of several pollutants including sulfates, heavy metals, and polycylic aromatic hydrocarbons (PAHs), some of which are toxic and carcinogenic[3].

Main air pollution is caused by the oil shale-fired power plants, which provide the atmospheric emissions of gaseous products like nitrogen oxides, sulfur dioxide and hydrogen chloride, and the airborne particulate matter (fly ash). It includes particles of different types (carbonaceous, inorganic ones) and different sizes.

The global influence of shale oil could spread revolutionary ideas in the world's energy markets during the next couple of decades, as a result emphatically lower oil prices, higher global Gross domestic product, changing geopolitics and shifting business models for oil and gas companies, according to new analysis from PwC.

The effects of a lower oil price resonate along the entire energy value chain, and investment choices based on long-term predictions of a steady increase in real oil prices may need to be reassessed. The potential magnitude of the impact of shale oil makes it a profound force for change in energy markets and the wider global economy. It is therefore critical for companies and policy-makers to consider the strategic implications of these changes now.

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BIOSTRATIGRAPHIC RESEARCH OF MAASTRICHTIAN SEDIMENTS IN THE SAMARA REGION

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Mesozoic sediments in the Samara region are the most common on the right bank of the Volga River in the Volga upland. The Volga Upland is mostly formed by Meso-Cenozoic sediments including Maastricht sediments represented with white writing chalk stone with beds of chalky marl and lying under Paleogene formations [5]. Tectonically operation area falls within the Stavropolskaya drawdown of theMelekesskaya depression.

Stratigraphically Cretaceous rock mass are partitioned based on macrofauna (ammonites and belemnites). Recently, the stratification of these sediments is conducted by microfauna foraminifera complex. Sampling material for microfauna research were taken in the course of field work near Ivashevka and Novoselki villages in Syzran area. Foraminifera, molluscas, echinoderms, ostracod were found out as a result of research (Fig.). The most significant findings are foraminifera.

200 copies of foraminifera were selected in the course of work. The representatives of the following kinds are predefined: *Recurvoidella sewellensis* (Olsson) *parvus* (Belousova), *Cribrostomoides trinitalensis* Cushman et Jarvis