

World's resources of oil are limited, its production and transportation costs are continuously increasing in all states. For this reason research and experimentation to improve the existing technologies and create new ones for obtaining pure products from alternative organic resources: coal, oil sands, oil shales, or even production wastes, and to use polymeric materials go on unbroken.



Commercial reserves of oil not exceeding 140 billion tons worldwide and 8 billion tons in Russia will be exhausted during the first half of the 21st century. Moreover, most of them (over 65 %) is concentrated in central east oil fields, and the majority of industrially developed states export oil in a quantity making 50-100 % of their individual needs. The situation concerning natural gas is much the same. Gas resources (in oil equivalent) equal those of oil and are as dispersedly distributed around the world: 40 % belong to the states of the Commonwealth of Independent States, mainly to Russia, and 32.5 % – to central east.

Potential resources of liquid fuel in coal and in oil shales exceed these of oil several times, but oil extraction from solid combustible ores demands expensive technology (gasification, hydrogenation, pyrolysis, etc.), and that strongly hinders large-scale realization of this potentiality in industry. However, in a number of states (China, Russia, Estonia, United Arabian Republics, etc.) coal, brown coal, oil shale and tar sands are used industrially to produce liquid fuel, process gas and power gas. Solid fuel gasification processes are more and more largely used to produce ecologically clean power gas for generating power at gas-vapour cycle units. That enables to increase the efficiency of power plants from 38-40 to 45-50 % (the USA, Spain, Italy, etc.), as well as to diminish essentially environmental pollution with sulfur and nitrogen oxides and fly ash.

Expert estimates of research centres in the USA, Great Britain, Japan and of several oil and coal companies show that production of liquid fuel from solid fossil fuels costs much more than their production from oil, especially considering the situation where oil price has been settled, perhaps temporarily, in 1997-1998. According to these expert data, the price of an alternative motor fuel obtained from coal using the method of gasification and synthesis from gas would be 50-60 USD per barrel, while the fuel made from oil shale at its pyrolysis, or from coal at its direct hydrogenation would cost 40 USD per barrel.

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As for Estonian oil shales, the corresponding numbers are markedly lower. Prime cost of shale oil obtained at oil shale pyrolysis in solid heat carrier units SHC-3000 (in the town of Narva) is 74-75 USD per tonne (oil shale price being 5 USD/t). Petroleum-originated fuel oil of much lower quality (contains sulfur and other impurities) costs in this region 62 USD per tonne. Besides, simultaneously with shale, wastes of organic chemical industry and rubber wares are processed in Narva.

In several states all around the world large-scale research and development work is carried out to lower the price of liquid fuels made from solid fossil fuels. Numerous international congresses were organized in the recent past – in Spain (1995), Germany (1997), and elsewhere.

As a matter of fact, in Estonia the design of commercial retorts (gas generators) is being improved with the aim to increase the yield of liquid products.

It is necessary to underline that chemical potential of liquid products manufactured from shale, especially from Estonian kukersite shale, may be considerably elevated considering today's tendencies to change the requirements presented to the chemical composition of the motor fuel. European and World standards foresee transition to the use of motor fuel containing 2-3 % oxygen compounds, on pure oxygen basis. That improves the combustion process.

For this purpose, manufacture of special supplements, particularly ethers, will be organized. As motor fuel fractions of liquid products obtained from Estonian oil shale contain significant amounts of oxygen compounds, regarded as harmful impurities before, it seems reasonable to evaluate the prospects of employing these natural components as an alternative of synthetic oxygen-containing additives.

Russia processes large undeveloped reserves of oil shales: in Leningrad district, Volga basin, the Urals and Siberia.

Utilization of these shales as raw material for producing liquid fuel, chemical products and power is being studied. The experiments were aimed at the construction of corresponding plants including those using the method of pyrolysis with solid heat carrier – a method developed for Estonian oil shale.

At the Fossil Fuel Institute in Moscow thermal cracking of residual fuel oils with oil shale additions is studied. The aim of this work is to increase the yield of distillation fractions by the action of hydrogen-donor products formed at shale thermal dissolution. It enables to reach a more complete refining of oil and to obtain higher yields of light petrochemicals as well as to use the resources of shale fines.

The tests made using fine fractions of Baltic oil shale (< 0.5 mm) to get an ecologically clean and economical in regard to power fuel for municipal domestic consumers have given positive results. A 98-99 % utilization of shale organic matter at combustion, a 70-75 % efficiency of furnaces, and a



practically complete liquidation of fume and fly ash emission were reached when burning granulated fuel.

For Mosbass high-ash coals a unit for producing 500,000 tonnes of fuel per year has been designed.

G. M. Krzhizhanovski Power Engineering Institute (Moscow) in co-operation with Giproschacht and Giproneftekhim (St. Petersburg) are developing a project for pyrolysis of 2.5-4.5 million tonnes of oil shale annually using the method of solid heat carrier. Oil shale processing complex will include power plants of total capacity 300-450 MW.

The technology of processing Volga basin shales is being modernized to improve the manufacture of liquid products, particularly thiophene. Investigations aimed at utilization of oil shales of the Central European part of Russia where combustibles are in short supply have been started. Power strategy of Russia has set a task of more complete and more competent use of local fuels.

I am of the opinion that the journal *Oil Shale* is a right institution to collect and mediate the results of research made in different states. *Oil Shale* editorial board could take the initiative in organizing a scientific-practical conference on oil shales (mining, utilizing) with the purpose to call the attention of governments, scientific-technical community, commercial agencies and banks to the problems of using alternative sources for producing liquid fuel, power, and other products and materials.

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