Resource saving and "green" technologies in the refining of petroleum products in Russia

Elena Efimova* and Tatiana Lukashenok

Ural State University of Economics, Ekaterinburg, Russia

Abstract.

The issues of resource conservation affect the economy in each country all over the world and with the globalization process of society and the growth in population size, as consumers of the planet's natural resources, are paramount in the aspect of economic growth. Countries with different types of economies require "individual" economic growth, but any economic growth requires material resources, including natural resources. The issues of resource conservation and meeting the growing needs of the population are at the heart of the agenda of applying "green" technologies. Without the application of new technologies, it is impossible to preserve the available resources on Earth and meet the needs of the population of different countries of the world. One of the most important factors in the economic growth of countries is fuel and energy resources, where the world demand for them has been on an upward trend over the past few years. The study provides an overview of the latest technologies used in the extraction and processing of fuel and energy resources, the use of which largely solves the issues of resource conservation and environmental conditions.

1 Introduction

The sustainability of economic development has become a relevant topic of scientific research in recent decades. Given the scale of Russia's territory, the spatial development of the country should be considered as a factor for the sustainability its economy, where the effectiveness is determined by the significant smoothing of regional differentiation. It should be noted that spatial and socio-economic development are closely interrelated: neither of them will achieve sustainability without an economic basis. That is, without effective economic development there can be no effective development of society [4], where social development in modern conditions is a strategic goal for the economy, which is written about by foreign and national scholars [4, 3, 13, 10].

Oil resources are of strategic importance in the Russian economy: Russia is one of the largest suppliers in the world market of petroleum products, oil and gas, as it has the largest reserves of fuel and energy resources [11]. Russia is in the 2nd place in the world in oil and gas production (in terms of gas reserves it is in the 1st place), in coal production it is the 4th place (huge reserves of high-quality coal in Eastern Siberia and the Far East), in the production of liquefied natural gas it is in the 5th place, with the share of the fuel and

* Corresponding author: levstrelkov@mail.ru

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energy complex in GDP of about 20% and almost 1/3 of investments in it of their total volume in the country [11]. Russia as a country possessing oil resources and as a country supplying oil products must meet the requirements of world standards. This fact calls for the need to apply the latest standards in oil production and refining, including those based on “green” technologies. Development of oilfields and production of fuel and energy products in modern conditions are in the sphere of resource conservation and preservation of the environment. Today, the issues of rational nature management, preservation of natural ecosystems, environmental safety, and resource conservation are so relevant to the prospects of life and sustainable development of socio-economic systems [3; 5, 6], as the world community and the world economy have become global. Important for economic growth are new ways to improve the efficiency of production processes through the use of the latest technologies, such as information modelling, digital tools and others. In this aspect, the issues of resource saving, ensuring rational consumption and saving patterns are put in the first place in the global society and economy. In a generalized sense, scientific and technological progress is driven by maximizing profits by reducing production costs. In recent decades, the owners of mining and processing enterprises have formed a specific demand for modern technologies that contribute to maximizing profits with increased efficiency of the production process [12]. The issues related to the application of new technologies and, along with them, the rethinking the human impact on the environment appear at the end of the XX century, when the environmental component of the concept of sustainable economic development comes to the forefront [5]. In the modern world, new technologies for improving the environmental performance of lithogenic resources extraction are in demand, since the consumption of mineral raw materials has accelerated growth and leads to the exhaustion nonrenewable resources, including the complication in mining conditions and the depth of field development.

2 Materials and Methods

The significance and importance of oil resources for the Russian economy, the relevance issues of resource conservation and environmental safety contains the interest in research in the field of application for new technologies in the oil industry. Further the authors present an overview of the most new technologies and developments aimed at achieving economic aspects in the field of processing and refining of industrial fuel and energy products.

The industrial and mining production necessary for the society requires high energy consumption, in this connection coal as a natural energy resource has actual value and the demand of the world economy in it is only growing in the conditions of the world energy deficit that has emerged in the last 2-3 years. In this aspect, the development and implementation of programmes to increase the capacity of coal preparation plants is important. Enrichment plants, including coal preparation plants, need effective solutions to increase capacity and switch to production of concentrate with the required parameters. To produce a product with the required qualities, experts suggest two options:

- construction of an additional section at the concentrator with a complete sectional chain of independent processes (screening - beneficiation - dewatering);
- replacement of the equipment with more efficient equipment using the latest technologies.

These variants require an audit of the company's operations, analyses the parameters as well as the introduction of new methods of its enrichment and an increase in the depth of enrichment.
For example, Rusmayne Engineering Company has conducted research, as a result of which it proposed a new technology of coal processing at one of the coal preparation plants: a method of re-enrichment for the product of fine and coarse machine classes of coke concentrate. The expediency of applying this new technology has been confirmed by tests, during which calculations of qualitative-quantitative and water slurries schemes have been carried out with the revealed expediency: "the increase of concentrate yield is 4.73%, ash content reduction is 0.29%, ash content of general waste has increased from 79.75 to 83.18%".

An example using "green" technologies is the eco-technopark "Green Valley" (energy coke plant using "Heat Recovery" technology of the German concern ThyssenKrupp) in the Sverdlovsk region. This technology, on the one hand, makes it possible to produce higher quality coke, on the other hand, it allows using raw materials of lower quality [3, p. 695], including the absence of chemical emissions, which makes it possible to locate enterprises near residential areas.

Further we will give examples describing the application of the latest inventions in the Russian oil industry. Among the group of fuel and energy resources (coal, oil, gas, etc.) oil occupies a leading position. Nevertheless, its extraction due to the decrease in deposits with easier extraction, reduction of oil deposits with certain quality, requires improvement in the used technologies and the relevance of the "green agenda". In Russia, there are a number of national developments (patents) in this direction.

The most common trend in the oil industry is the application of green technologies. For example, in 2020, many states have increased the amount of funding for R&D in the field of low-carbon energy: "according to IEA estimates, by 2030, the governments of different countries will allocate about $50 billion for the development of large-scale low-carbon energy technologies" [8]. There are reasons to believe that the latest technologies will maximize the use of economically viable resources (i.e. those already involved in the industry), including expanding the possibility of extracting oil resources from hard-to-reach places, since the developed sources of oil are gradually depleting while maintaining stable demand for it and its refined products.

One of the newest trends is the digitalization of the oil industry, where the example of Gazprom shows the possibilities to optimize costs through the introduction of digital technologies [8]. Innovations in the oil industry are various drilling methods, well development, planning of exploration and production methods for petroleum resources [1] and other innovative ways, systematized in Table 1.

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<tr>
<th>Technologies</th>
<th>Quality characteristics</th>
<th>Scope of application</th>
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<tr>
<td>Improvement of detailed rock (slurry) analysis</td>
<td>- nuclear magnetic logging using cryogenic technologies; - modelling, planning of oil exploration and production; - X-ray fluoroscopy, high-resolution digital microscopes, gamma ray measurement device for sludge analysis. - possibility of automatic rock examination in the process of drilling wells; - improving the efficiency of sludge and rock investigation and analysis in the process of drilling wells.</td>
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<td>Improving hydraulic fracturing</td>
<td>- a method of waterflooding a geologically heterogeneous reservoir; - mixing water injected into the rock with nano-particles that change its properties or the properties of the rock itself. - the ability to produce oil from the most difficult to develop wells; - increased efficiency of oil flushing from surfaces; - lowering the cost of the resulting product and.</td>
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3 Results and Discussion

It is obvious that "green" energy is a "new system of values" of modern man [3, p. 692], which is aimed at preserving the Earth's resources, forming a comfortable and harmonious environment for the life of society, achieving a sustainable socio-economic model of the national economy.

It should be noted that the application of the latest, including "green" technologies is required in all sectors of the Russian economy: extractive, processing, services, where each sphere has its own potential and expediency of their application.
4 Conclusion

Researchers highlight some problems in the field with the application of “green” technologies: for example, insufficient awareness about the possibilities of “green” production among entrepreneurs, lack of personnel with the necessary qualifications for their use, imperfect legislative framework that restricts the activities of owners and managers of industrial production in the field of economic stability and profit planning of enterprises [3, p. 695]. This requires building a certain system of interaction between science, business, professional community and authorities, based on the creation of conditions for discussion and exchange of experience [3, p. 695].

The study analyses the economic efficiency using the latest technologies in the sphere of industrial production, which includes the production of fuel and energy products, and highlights the advantages for strategic planning of the transition to “green” technologies. In this aspect, the authors provide recommendations to be taken into account by federal and regional authorities, the scientific community and industrialists:

- stimulation of investments in energy-saving and “green” technologies;
- activation of innovation processes, development of scientific knowledge as fundamental in the sphere of rational nature management;
- utilization of the existing potential for creation and implementation of environmental technologies within the framework of scientific, technical and investment state policy;
- development of certain types of “green” technologies characteristic for each region;
- utilizing and adapting global experience in the introduction of green technologies in the Russian economy to develop its own national approach to saving resources, including energy resources.

In conclusion, the use of green technologies in the national economy contributes to the formation of state-of-the-art infrastructure, reduction of environmental impact on the environment, growth of welfare and development as well as the development of socio-economic systems.

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