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TOPICAL ISSUES IN THE STUDY OF PRODUCTION OF ARTIFICIAL AND NON-TRADITIONAL HYDROCARBONS

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Abstract

The article addresses topical issues of studying the development of unconventional and artificial hydrocarbons. Based on the statistics of British Petroleum, the data analysis was carried out, which showed the estimated time for the development, production and processing of proven oil reserves. This forecast claims that in the long term there are risks of proven oil reserves, both in the Russian Federation and in the United States. There are reserves of unconventional hydrocarbons in the Russian Federation, however, their development and production are little studied. Renewable energy sources contribute not only to the production of artificial hydrocarbons, but also to the continuation of the life cycle of the petrochemical and oil refining industries. For example, the world's production and consumption of has a growing trend, and the United States has a leading position after Europe. Currently, the Russian Federation does not pay special attention to this area. Therefore, the concentration of petrochemical and oil refining enterprises in one territory can lead to the risk of non-supply of raw materials and a decrease in the vital activities of these enterprises. Such territories of the Russian Federation include the Republic of Bashkortostan. At the same time, the study of the production of artificial hydrocarbons based on biomass will extend the life cycle of petrochemical and oil refining enterprises in the future, and the creation of a biotechnology cluster contributes to the acquisition of an innovative product range.

Keywords: Artificial hydrocarbons, unconventional oil, renewable energy, bio-diesel, bioethanol, biotechnology cluster

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1. Introduction

The development of natural resource potential directly proportionally affects the development of the territory. Over time, this potential is depleted and, therefore, topical questions arise regarding the assessment of regional factors for the economic growth of this territory. Factors of regional development include: the productive, scientific and educational environment, labor, material and intellectual resources and others. Since dependence on natural resource potential affects production, hence the assessment of the livelihood of the population of the region in the face of a decrease in this potential will allow a decision to be made in time for the economic development of the Territory.

Oil, on the one hand, is not a renewable resource, on the other, no one can say exactly how much it is under the surface of the earth. However, the end of the 19th and beginning of the 20th centuries contributed to the development of industrialization, which contributed to the expansion of urban agglomerations, and later influenced the huge consumption of hydrocarbon resources (Bakhtizin et al., 2007; Ishalin et al., 2007; Yergin, 2011). During oil production, the field is depleted, but over time there is a tendency to replenish (Kamaletdinov, 2008; Lurie & Schmidt, 2011). At the same time, it should be noted that the replenishment of deposits takes a certain time, therefore, in general, there is a decrease in oil on the solid surface of the Earth, especially in the polarization areas of the oil refining and petrochemical industries. Such a region should include the Republic of Bashkortostan, located on the territory of the Russian Federation.

2. Problem Statement

On the territory of the Republic of Bashkortostan there is a unique complex of petrochemical and oil refining industries. The reduction of traditional oil in the long term can lead to high risks of the life of enterprises of this complex and the life support of the population living in this territory. Therefore, the study of issues related to proven reserves of traditional oil, the development of hard-to-recover and artificial hydrocarbons is a priority for regions dependent on production related to natural non-renewable raw materials.

3. Research Questions

Reducing the risk of life activities of oil refining and petrochemical industry enterprises is the introduction into production of innovative technologies that contribute to the expanded production of an innovative range of commodity products. Such technologies include the processing of artificial hydrocarbons and unconventional hydrocarbons. Unconventional hydrocarbons are undoubtedly natural hard-to-recover hydrocarbons, such as shale oil. It is known that artificial hydrocarbons include hydrocarbons obtained from plant and food crops, namely sugarcane, sugar beet, rapeseed, sunflower and other plant crops, as well as animal fat and algae.

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4. Purpose of the Study

The purpose of this study is to compare the study of artificial and unconventional hydrocarbons that contribute to the continuation of the life of the petrochemical and oil refining complex of the Republic of Bashkortostan.

5. Research Methods

For comparative analysis of proven oil reserves, statistical data of British Petroleum (BP, 2021) of the Ministry of Energy of the Russian Federation (Ministry of energy of Russian Federation, 2021), as well as methods for producing unconventional oil (Abdullin et al., 2020) and artificial hydrocarbons (Arkhipov, 2018; Galynkin et al., 2010; Vlaskin et al., 2019). The work uses the method of spatial and economic research (Valiev & Fedorova, 2019). In an era of declining traditional proven oil reserves, the question arises - how to further develop energy? Switch to renewable energy sources or continue to explore and implement ways of extracting unconventional hydrocarbons.

Suppose that the amount of proved oil reserves is divided by the amount of production per year equals the amount of the estimated years expected for its development and production. Using work statistics (BP, 2021; Fedorova, 2016; Ministry of energy of Russian Federation, 2021) in Table 1 presents an analysis of oil reserves taking into account production and its consumption, both around the world and in the territories of the Russian Federation and the USA, which showed the duration of production and consumption of proven oil reserves.

Table 1. Analysis of proven oil reserves, production and consumption worldwide, the Russian Federation and the USA

Years	Proven oil reserves, million barrels	Oil production, million barrels per year	Oil consumption, million barrels per year	Oil reserves, years
Worldwide (Population about 7.713 billion)				
1980	683400	22980	22350	29.7
1985	802600	20973	21625	38.3
1985	802600	20973	21625	38.3
1990	1027500	23865	24359	43.1
1995	1148800	25493	26211	45.1
2000	1300900	27348	38057	47.6
2005	1374400	29917	30810	45.9
2010	1636600	30364	32071	53.9
2015	1697600	33460	34678	50.7
2019	1733900	32878	35869	52.7
In the Russian Federation (Population as at 1.01.2021 - 146.2 million people)				
1991	116149	3381	1795	34.4
2000	112112	2403	928	46.7
2005	104405	3503	978	29.8
2010	105800	3783	1057	28.0
2015	102400	4007	1136	25.6
2019	107200	4165	1211	25.7
In the United States (Population by 1.07.2019 - 330 million)				
1999	29700	No data	No data	No data
2009	30900	19446.2	2365.1	0.63
2018	68900	41102.6	4923.7	0.60
2019	68900	45611.6	5474.3	0.66

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According to Table 1, it can be seen that there is a tendency to increase the world proven oil reserves, at the same time, the Russian Federation has a downward trend, but the United States has been holding this figure for the past 10 years. Perhaps this trend is associated with a change in the definition of traditional and unconventional (difficult to recover) oil.

Thanks to the discoverers of "rock oil" - US oil is on the one hand a leader in the development of traditional and unconventional hydrocarbons (Yergin, 2011), on the other hand, they are actively developing the production of artificial hydrocarbons based on biomass.

In 2010, in the United States, the boom in shale oil and gas production (the Bakken Formation) significantly affected not only the development of the industry, but also environmental pollution.

First, according to the work (Zhukov & Zolina, 2016), financial levers, namely the requirements for issuing loans, allowed to expand not only the list of undeveloped reserves, but also put large volumes of hydrocarbon resources on the balance sheet. Thus, during the period from 2008 to 2014, hydrocarbon reserves put on the balance sheet of enterprises were estimated at 9.7 billion barrels, of which 5.5 billion barrels. refers to undeveloped fields from wells not yet drilled. Secondly, to attract financing in the form of issuing bonds and selling shares of companies of the corresponding profile. However, on the one hand, low oil prices reduced dividend payments and reduced the credit rating. This circumstance back in 2015-2016 led to a series of bankruptcy in the US oil and gas sector, while low prices help oil and gas multinational companies import hydrocarbons and fill oil storage facilities and reservoirs for the subsequent processing and sale of petroleum products.

On the other hand, the authors of the work (Bosletta et al., 2021) conducted a study that showed that during the period 2000-2012 in the United States during the period of active development of non-traditional oil production through horizontal drilling and hydraulic fracturing (GRP), light, chemical and noise pollution in rural areas increased. This in turn affected the lack of sleep and poor health of the population living in places within a radius of up to 25 km. from wells of drilled wells. On the one hand, pollution of the environment can negatively affect the vital activities of people living in such territories, on the other hand, to solve this problem, limiting wells in places of residence of a resident population is the optimal solution.

On the territory of the Russian Federation, a concentration of unconventional oil is located in the Bazhenov retinue of the Salymskoye field in the North-West of the country. At first glance, according to the work of the author Khurshudov (2017), the analysis of the Bakken Formation and the Bazhenov retinue showed that, unlike the productive tub board, which can be developed using GRP, the Bazhenov retinue has dismemberment and contains increased clay, therefore, according to the author, the idea of billions of tons of extracted reserves in bazhen On the other hand, science does not stand still and it is possible that a method of oil production will soon appear that can increase the oil recovery of low-permeable reservoirs. For example, according to the publication (Geo-Guru…, 2018), Gazpromneft is actively investing in a project related to the development of the Bazhenov retinue. The inventors of the invention (Abdullin et al., 2020) propose a method of producing shale oil by heating containers from powder charge packages in a well. Flameless burning will cause the influx of light hydrocarbons along the cracks formed by cracks in the clay rock, which in turn will increase the oil recovery of the formation. Despite the distance of the Bazhenov retinue from densely populated areas, there are also prerequisites for environmental pollution.

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It should be noted that renewable energy sources are actively developing in the world - the production of artificial hydrocarbons based on biomass. The re-profiling of the refinery in the city of Marseille France into a bioprocessing (Total, 2014), contributed to the active development of an innovative range of products. One example is the preparation of bio-diesel (Arkhipov, 2018; Galynkin et al., 2010; Vlaskin et al., 2019). Figure 1 according to the data (BP, 2021) shows the dynamics of the production and consumption of traditiesel in the world over the period 2009-2019 years.

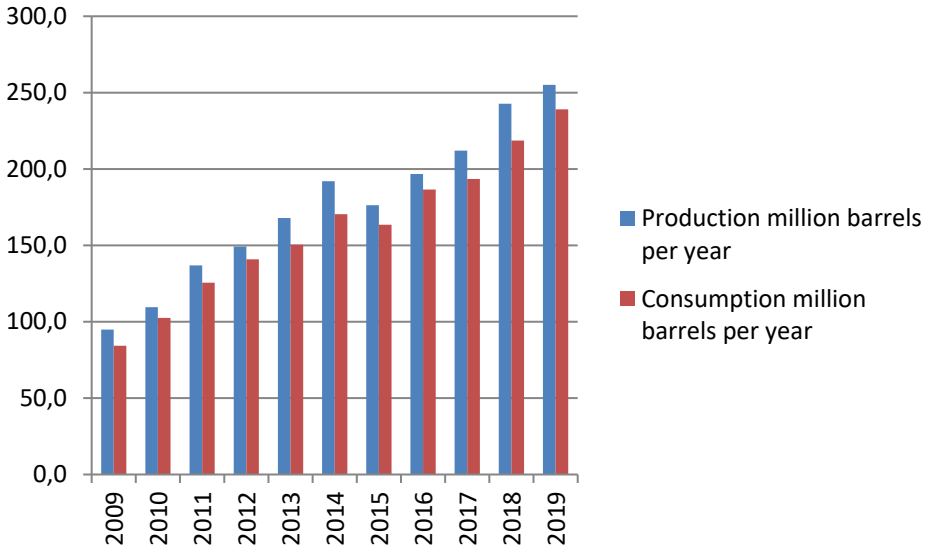

Figure 1. Trends in the production and consumption of traditiesel in the world over the period of 2009-2019

As can be seen from Figure 1, there is an increasing trend in the world in the production of traditiesel. At the same time, the United States takes a leading position after Europe.

6. Findings

Talking about the reduction of traditional oil reserves, the issue of the life cycle of petrochemical and oil refining enterprises, especially fuel, is acutely raised. The concentration of such enterprises in one territory can lead to an economic crisis in the region. An example of such a region is the Republic of Bashkortostan. Based on the automated method of spatial economic research (Valiev & Fedorova, 2019) for the sustainable development of the territory on the basis of existing production capacities in the Republic of Bashkortostan, it is proposed to develop renewable energy sources, namely, to obtain an expanded range of marketable products based on artificial hydrocarbons, including mixed fuel - bio-diesel and bioethanol. The optimal ratio of mixed fuel is considered to be up to 80% of traditional hydrocarbons and up to 20% of artificial hydrocarbons (Fedorova & Valiev, 2021). Available arable and released sowing areas located in the region and nearby areas could become an experimental site for the production of artificial hydrocarbons. At the same time, the creation and development of the Biotechnology Cluster in the region (Fedorova & Valiev, 2021) contributes to:

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- creation of new and preservation of existing jobs, etc.
- creation of renewable and non-renewable energy products from local resources;
- creating a system that affects the overall infrastructure of the cluster and determines the economic interest of the enterprises in the cluster;
- a guide to the creation of an expanded product range;
- implementation of new capacity commissioning and modernization of existing stages;
- orientation on interaction with other branches of the national economy located in this territory;
- inclusion in the Territory's advanced development programmes;
- creation of new jobs and preservation of existing jobs, etc.

Polarization of the petrochemical and refining industries has created a strong scientific potential for the study of traditional and non-traditional hydrocarbons. Therefore, the development of this area contributes to new scientific and technological discoveries, new ways of mining and the rational use of non-renewable energy sources, as well as environmental protection.

7. Conclusion

The study concludes with the following conclusions:

- with the reduction of proven traditional oil reserves, there is a tendency to replace alternative - renewable energy sources;
- US shale boom, showed a negative impact on the environment, which in turn affected the health of the population living in the development territories of such deposits;
- despite proven reserves of unconventional hydrocarbons in the Russian Federation, this area is not given sufficient attention;
- in areas where the polarization of petrochemical and oil refining enterprises is concentrated, in order to continue their life cycle, optimally develop the direction of renewable energy sources based on artificial hydrocarbons;
- creation and functioning of the Biotechnological Cluster of the Republic of Bashkortostan contributes to the sustainable development of the region

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