Advantages and Disadvantages of the Production and Using of Liquid Biofuels

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Abstract. This article is devoted to the study of the possibilities of using liquid biofuels to mitigate environmental pollution and stabilize the economy in countries where there is a shortage of natural resources that are energy carriers. To this end, the authors considered the positive and negative aspects of using biofuels as a mixture, including bioethanol or biodiesel. In addition, the article includes an analysis of the situation in Russia regarding the orientation towards replacing traditional fuels.

1. Introduction
The increase in the use of technologies and the growth of environmental pollution associated with this, the depletion of natural resources and the rise in the cost of methods for their extraction have led humanity to search for alternatives to modern fuel. Bioethanol and biodiesel are currently among the most popular alternatives to conventional fuels. Bioethanol is produced from any plant material with a high starch or cellulose content, and as a final product, it is an alcohol with a maximum strength of about 95 degrees. Biodiesel is a mixture of fatty acids that are flammable [1].

Since the issues of environmental protection are currently among the most relevant in the agenda of strategic development of the energy sector in all countries, it seems expedient to study all aspects of the use of liquid biofuels and determine further prospects for its production.

2. Materials and methods
The purpose of this study is to analyze the strengths and weaknesses of the production and using of liquid biofuels and determine the prospects for its further use. In the work, the following tasks were formed:

- Determine the advantages and disadvantages of large-scale production and use of liquid biofuels;
- Identify prospects for further use of liquid biofuels.

The information base of the study was information from government, corporate and analytical organizations. The study used descriptive, comparative, economic-statistical and logical methods; the authors relied on the achievements of such sciences as economics, physics and chemistry.
3. Results
Biofuels are divided into three generations, depending on the production methods. The first generation has the easiest production method and is used in many countries. It is made from crops that are high in sugar and oil. The second generation includes biofuels, which are produced from non-food raw materials, grown specifically as raw materials for the energy industry (figure 1) [2-4].

Figure 1. Approaches to First and Second Generation Liquid Biofuel Production.

The fuel of the third generation is the most energy-intensive, since it surpasses the raw materials of previous generations by several times in energy output. The raw materials for this fuel are algae and photosynthetic microorganisms. Unlike fuels of the first generation, the second and third have a very complex production process, since the second requires a large number of chemical transformations and, accordingly, this process carries large energy costs, and the raw materials for the third generation - algae and other microorganisms, require a very complex structure, storage and content. All of the above costs explain the capital intensity of the process of producing second and third generation fuels, respectively, and the choice of first generation biofuels by most countries.

Liquid biofuels have many positive traits [5-7]:

- When using this type of fuel, CO₂ emissions are much lower than with its traditional counterparts.
- If leaked and hit on biological objects for other reasons, biofuel does not harm them and is almost completely subject to water decay.
- The raw material for it is renewable crops.
- The use of biofuels will allow countries that do not have large reserves of fuel to maintain their economic sovereignty.
- High lubricating characteristics, which increases the service life of the equipment.
- High temperature of ignition - 150 degrees, which makes it quite safe.

Despite the fact that liquid fuels made from biological raw materials have so many advantages, at the same time we cannot completely abandon the traditional one. Thus, bioethanol is used with a concentration of 9 to 1 because of its low thermal conductivity, which, as a consequence, leads to a higher consumption of this type of fuel. If we talk about biodiesel, then it is worth paying attention to the fact that it has a sufficiently high viscosity, which, at a high concentration, is very dangerous for equipment, especially in frosty conditions, accordingly, it also cannot be used independently, but only mixed in a ratio of 2 to 8 diesel fuel. Therefore, today it is possible to use only a mixture of traditional and biofuel. Many countries have established ingredient ratios that roughly correspond to the proportions shown above [8].

It would seem that the most rational thing for everyone today is to start using fuel created on the basis of a mixture. But since most countries for objective reasons choose the production of first generation biofuels, for the production of which it is necessary to use high-quality arable land in very impressive volumes, the problem of land distribution between the energy and food industries arises. Very few countries now have sown areas to provide raw materials for each of these industries in the required quantity.

In addition to the problem of the banal lack of such sown areas in many countries, there is another possible problem - the possibility of a massive transition of food crop producers to the production of products used as raw materials for fuel, because this will be much more profitable, the purchase price of fuel companies will be higher. This can lead to a situation where even a country with sufficient land will not have enough raw materials for the food industry, due to the desire of agricultural producers to compete as suppliers for fuel companies. So according to Law of the United States and the National Standard for Renewable Fuels, refineries in the United States must use 50 billion liters of biofuel in the production of gasoline. According to the US Department of Agriculture, in 2017, the corn crop was 268 million tons, which was the lowest since 2011 (the price per ton was more than $ 320). Accordingly, a colossal large share went to the production of bioethanol - 42%. Competition between pastoralists and ethanol producers for the supply of corn was formed in the country, which led to an increase in grain prices and a decrease in the profitability of meat producers. Which led to an insignificant but still food crisis [9].

Another very important risk arises in the production of liquid biofuels - the cultivation of monocultures. For the food industry, agricultural products must be very diverse due to consumer preferences. If a very large plot of land is used to grow raw materials for biofuels, then it will most likely be sown with a certain monoculture due to economic rationality and lack of preferences as such in the use of raw materials. This situation can lead to biological domination by only one type of pest, since their survival rate will increase dramatically, and over time they will develop immunity to pesticides, which will lead to a drop in the harvest, as insects will destroy it. Since only one type of agricultural crop was cultivated by producers, it will not be possible to replace it, which will lead to a crisis of raw materials [10].

Also, in spite of the fact that the consumption of biofuels does not produce carbon dioxide emissions into the atmosphere, we should not forget that while we are using only a mixture, emissions, although reduced, still exist. And since the cultivation of raw materials for biofuels of the first and second generation, which is currently the most profitable from an economic point of view, requires the use of cultivation technology and much more, accordingly, the production of this type of biofuel is not as safe for the environment as it seems.
It should also be understood that a country, having switched partially or completely to second and first generation biofuels, becomes in some way dependent on weather conditions. The volume of possible fuel production in this case directly depends on any changes in weather conditions, which can lead to an extremely acute crisis in the event of natural disasters. So now, the state in the event of a lean year or any natural disasters (fire in forests and fields or flooding) will have to compensate for raw materials not only for the food industry, but also for the fuel industry, which can make its economy very unstable.

4. Discussion
In Russia, there is a sufficient number of cultivated areas for the production of raw materials for biofuel, however, there are other aspects that prevent this. Firstly, in Russia there is no unified state strategy for the use and production of liquid biofuels, therefore there is no systematic support for this industry, which weakens both the coordination of production and its organization. In addition, until recently, the development of this industry was stopped by excise taxes, despite the fact that biofuels were not subject to excise taxes on gasoline, ethanol producers had to pay excise taxes for alcohol-containing products. This form was canceled only recently on November 28, 2019 (according to the Federal Law "On Amendments to the Federal Law" On State Regulation of the Production and Turnover of Ethyl Alcohol, Alcoholic and Alcohol-Containing Products and on Restricting the Consumption (Drinking) of Alcoholic Products" dated November 28, 2018 N 448-FZ (latest edition)), which will undoubtedly increase the profitability of this industry.

In Russia, the ratio of the mixture of biodiesel fuel is regulated: 6% -20% in accordance with state standards that establish requirements for ethanol obtained from plant materials.

In conclusion, we would like to conclude that there are prospects for the development of the biofuel industry in Russia, but there is no urgent need. There is more than enough fossil raw materials for the fuel sector, and CO\textsubscript{2} pollution of the country is not a very acute problem, due to the very large forest areas.

5. Conclusion
Thus, it can be concluded that the production of liquid biofuels has a number of disadvantages. A country that wants to produce alternative fuels must have sufficient acreage to avoid a food crisis, as well as introduce strict control measures, regulating the shares of raw materials supplied to the food and fuel markets. There must also be certain state standards regulating the proportions according to which a mixture of biodiesel with diesel and bioethanol with gasoline will be produced. Do not forget about the need for support and subsidies for the development of the production of second and third generation biofuels, which, despite their capital intensity in production, use a much smaller amount of land and most of them are not arable.

References
[1] Gibadullin A A, Ryabina E V, Morkovkin D E, Sodikov K A, Trifonov P V, Kirpicheva M A and Kokurina A D 2020 Engineering solutions in the field of digital transformation of the electric power industry. *IOP Conference Series: Materials Science and Engineering* **862** 062055
[2] Tsimbalist A V and Dmitrenko E A 2014 Prospects for the production of bioethanol in Russia. *Science of man: humanitarian research* **3**(17) 57-65
[3] Gibadullin A A, Sadriddinov M I, Kurbonova Z M, Shedko Yu N and Shamraeva V V 2020 Assessment of factors ensuring sustainable development of the electric power industry in the context of transition to renewable energy sources of the national economy. *IOP Conference Series: Earth and Environmental Science* **421** 032051
[4] Morkovkin D E, Gibadullin A A, Safarov B G and Alpatova E A 2020 Definition of factors limiting the growth of industrial production. *IOP Conference Series: Materials Science and Engineering* **862** 042013
[5] Kolnichenko G I, Sirotov A V and Tarlakov Ya V 2010 Liquid biofuel: problems and prospects of creation and use. *Vestnik MGUL Lesnoy Vestnik* 1 105-7

[6] Gibadullin A A 2020 Assessment of the level of stability and reliability of the electric power complex. *IOP Conference Series: Materials Science and Engineering* 837 012007

[7] *Biofuel market: problems and prospects. Information and analytical bulletin "Most"* Retrieved from: http://trade.ecoaccord.Org/bridges/0313/3.html

[8] Morkovkin D E, Lopatkin D S, Shushunova T N, Sharipov B K and Gibadullin A A 2020 Formation of the conditions for the development of innovation. *Journal of Physics: Conference Series* 1515 032002

[9] *Russian statistical yearbook 2018* (Moscow: Rosstat) 694

[10] Pulyaeva V N, Gibadullin A A, Usmanova T J, Ivanova I A, Rudakova E N and Dmitrieva O A 2020 Formation of modern requirements for the development of human capital in the context of increasing the efficiency of the industrial potential. *Journal of Physics: Conference Series* 1515 032020