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DEVELOPMENT OF THE BIOFUEL MARKET IN THE UKRAINE

Key words: biofuel market, biodiesel, bioethanol, decision-making model, bioenergy

ABSTRACT. The state and prospects of development of the liquid biofuel market in the context of rationalization of the use of the available natural resource potential of the Ukraine are considered. It is established that, in general, the balance of renewable energy sources, production and use of liquid biofuels is negligible. It is noted that for the full development of the market of liquid biofuels, it is necessary to create a strong raw material base and appropriate infrastructure to ensure the storage, processing, transportation and sale of finished products. Attention is drawn to a lack of an effective public policy system that would encourage the production and use of bioethanol and biodiesel and the feasibility of developing a financial support programme for producers of this type of biofuel to ensure greater consumer appeal over traditional fuels. It is determined that in order to meet the indicators of the National Action Plan for the production of bioethanol and biodiesel, it is necessary to increase capacity and put new processing enterprises into operation. The structure of economic model formation is suggested, which reflects the necessary solutions for the development of the liquid biofuel market, which considers its benefits, risks, product confidence and types of support.

INTRODUCTION

In modern economy, more and more attention is paid to the production of bioenergy, which is derived from organic raw materials (biomass). Biomass can be used in the production of energy in its original form, as a fuel or refined to various types of solid, gaseous or liquid biofuels. These fuels can be used for electricity production, transport, heating and cooling as well as in various industrial processes. In developed countries, bioenergy is treated as an alternative source of transport fuels, such as bioethanol and biodiesel. It is also used for the production of electricity and heating buildings. In many countries, particularly less developed, biomass is often the dominant domestic fuel, especially in rural areas.

The bioenergy sector, including liquid biofuels, has an impact on the development of the food market. The goals of the UN's sustainable development pay special attention to both of these issues, food and energy security [Kline et al. 2017]. Understanding the relationship between food security, biofuel production and natural resource management requires in-depth analysis. The analysis of production and biofuels, in recent years, has

often been the subject of scientific research. Numerous studies have presented the dynamics of the liquid biofuel market [Borychowski 2014], the diversification of production costs of agricultural raw materials used to produce bioethanol [Klepacka, Mączyńska 2018], the impact of the production of energy crops on biodiversity [Immerzeel et al. 2014, Lewandowski 2015], support for the bioenergy sector under EU policy [Rakowska, Gołębiewski 2017], advantages of bioenergy development in the sense of reducing GHG emissions [Souza et al. 2017, Silveira et al. 2017], the impact of biofuel production on food security [Tomei, Helliwell 2016, Wicki 2017, Zabaniotou 2018] and changes in the bioenergy value chain [Scheiterle et al. 2018]

RESULTS

Biofuel is a renewable energy source, its main advantage is environmental friendliness, and modern production methods make it possible to obtain fuel samples that have advantages over traditional products in terms of their characteristics and value. Biomass-derived liquid fuel is a motor biofuel and is used for transportation. The most common types of motor biofuels are biodiesel and bioethanol. Biodiesel can be made from any vegetable oil or animal fats. It is used as biofuel or a biocomponent. It is an environmentally friendly fuel, since sulfur dioxide is not released during combustion. It is one of the most fire-resistant fuels. Spilled biodiesel decomposes almost completely. In contact with soil or water, it is not a danger to living organisms. To date, biodiesel is the only alternative source of energy that can compete with traditional diesel [Eenergy 2019].

Bioethanol is ethanol that is obtained in the process of processing plant material for use as a biofuel or fuel additive. This is the first generation of biofuels. The relatively low cost and absence of harmful emissions into the atmosphere is a major advantage of bioethanol over gasoline. For the production of bioethanol, crops with a high content of sugar or starch are used. The most promising for the production of bioethanol is corn grain and sugar beet.

The global production of biofuels is growing at a rapid pace, due to the significant rise in oil prices. The increase in biofuel production averaged 9.7% in 2018. Two countries, i.e. Brazil and Indonesia together accounted for almost two-thirds of the global increase in biofuel production (Table 1). The largest producers of bioethanol and biodiesel are the United States (40% of world production) and Brazil (22.4%), which are constantly increasing their production. Calculated on fuel, ethanol production in 2018 was 60.4 mtoe in total, and North America accounted for 56%. Biodiesel production in 2018 was 34.9 mtoe, with Europe accounting for 37% [BP 2019a]. Among EU countries, Germany, France, the Netherlands, Spain and Poland are currently the largest producers of biofuel. The main raw material for its production in these countries is rapeseed.

In 2013-2017, Ukraine did not support the cultivation of raw materials for biofuel production. However, for agricultural enterprises, from 2019, partial compensation for the cost of bioethanol and biomass electricity equipment purchased from domestic producers has been introduced. The amount of state support for 2019, under this programme, is 0.9 billion UAH [CMU 2019, Orzhel et al. 2019].

Table 1. Worldwide production of liquid biofuel

Specification	Thousand tonnes oil equivalent			Growth rate per annum		Share
	2007	2017	2018	2018	2007-17	2018
Total North America:	15,211.1	38,503.7	39,536.3	2.68	9.73	41.46
–Canada	502.3	1,359.4	1,436.0	5.64	10.47	1.51
–The US	14,708.7	37,132.0	38,087.9	2.57	9.70	39.94
Total S. & Central America:	13,178.6	22,598.1	25,477.7	12.74	5.54	26.71
–Argentina	173.1	3,115.4	2,726.0	-12.50	33.51	2.86
–Brazil	12,426.5	18,240.0	21,374.9	17.19	3.91	22.41
Total Europe:	6,047.3	15,280.3	15,949.0	4.38	9.71	16.72
–France	1,127.6	2,615.5	2,727.1	4.26	8.78	2.86
–Germany	2,839.5	3,293.5	3,444.9	4.60	1.49	3.61
–Netherlands	81.9	2,011.0	2,099.3	4.39	37.73	2.20
–Poland	103.4	921.7	911.9	-1.06	24.46	0.96
–Spain	377.7	1540.5	1,840.5	19.47	15.09	1.93
–The United Kingdom	388.7	742.4	707.8	-4.66	6.68	0.74
Total Asia Pacific:	2,061.1	10,068.7	13,937.8	38.43	17.19	14.61
–China	1,208.8	2,146.6	3,099.4	44.39	5.91	3.25
–India	100.1	602.0	1,023.4	70.00	19.65	1.07
–Indonesia	217.2	2,686.0	4,849.2	80.54	28.60	5.08
–Thailand	148.2	1,976.0	2,119.1	7.24	29.57	2.22
Total World, of which:	36,560.2	86,918.7	95,371.1	9.72	9.05	100.00
–OECD	21,358.0	53,994.9	55,722.8	3.20	9.72	58.43
–Non-OECD	15,202.2	32,923.8	39,648.3	20.42	8.03	41.57
–European Union	6,016.7	15,052.0	15,686.3	4.21	9.60	16.45

Source: [BP 2019b]

There are currently about 13 bioethanol producers in the Ukraine. Six of them work quite successfully. Last year, they produced 80,000 tonnes of bioethanol, which went into alternative fuel production. Expected demand in the Ukrainian market will be more than 300 thousand tonnes of bioethanol with a 5% additive in gasoline. With an increase in bioethanol content of up to 7%, demand is expected to reach 450,000 tonnes with alternative fuels. In the Ukraine, molasses and corn are the most effective raw materials for bioethanol production. An increase in biofuel use would create preconditions for ensuring the energy stability of the transport sector, which is currently highly dependent on external factors, as imports account for more than 62% of domestic gasoline consumption and about 90% of diesel [Ukrsugar 2019].

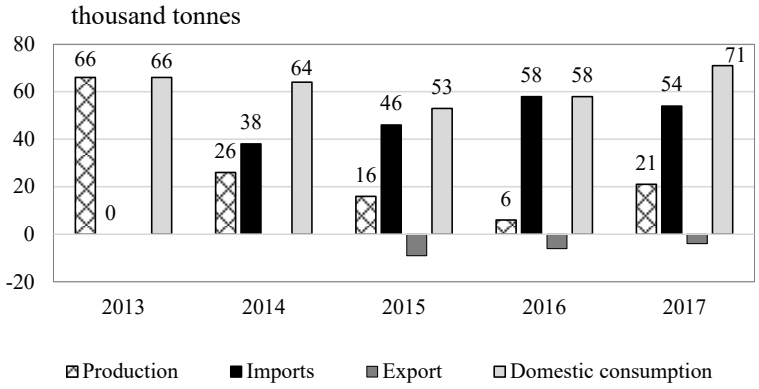

Figure 1. Motor biofuel balance
Source: [Orzhel et al. 2019]

Analysis of motor biofuel production showed its decline by 11 times from 2013 to 2016, and most of its domestic consumption is met by imports (Figure 1). Already, in 2017, there has been some increase in the production of biofuel, but the volume of domestic production from 2013 to 2017 has decreased 3-fold [Orzhel et al. 2019].

It should be noted that the Ukraine, like the vast majority of EU countries, is import-dependent in the energy sector. To reduce energy dependency, these countries have been developing alternative fuel production in recent years. For the full development of the biofuel market, it is, first of all, necessary to create a strong raw material base and appropriate infrastructure to ensure the storage, processing, transportation and sale of finished products. The Ukraine is known for its rich soils on which crops are grown. Therefore, agricultural biomass is not only widely available throughout the country, but also cheaper than other sources [Misiuk et al. 2020]. Currently, major investments in the Ukraine are directed mainly to the raw material base, as foreign and domestic investors are interested in increasing the exports of rapeseed rather than processing it into biofuel.

The advantages of production and use of motor biofuels in Ukrainian conditions include: resource recoverability, the reduction of emissions and economic security. Unlike other fuels produced from oil, biofuels have a renewable nature because their resources are endless. In the process of creating food, there are always waste products, which create the basis for the production of biofuels from this type of raw material. Biofuels also cause a reduction of emissions of harmful products that have a negative impact on the atmosphere. Petroleum products emit significant amounts of carbon dioxide, sulfur-containing compounds and other substances during the combustion process. Unlike fossil fuels, biological ones can reduce the amount of harmful emissions by 30-50%, and carbon is emitted as much as the plant consumes during its growing season. Economic security, namely the reduction of import dependency, will result in an improvement in the trade balance, GDP growth, employment and tax revenues [Orzhel et al. 2019].

According to the Ministry of Agrarian Policy, there are enterprises in the Ukraine that can complete the process of biomass processing for bioethanol production. That is, there are significant prospects for the production of bioethanol and biodiesel and their further

use as alternative fuels or as a component of traditional fuels in the transport field. As for gasoline containing biocomponents, seven refineries have the right to produce them. By 2020, the Ukraine will need to replace 10% of imported gasoline with biofuels, which will reduce oil imports by nearly USD 400 million and replace 5-10% of fuel with bioethanol and biodiesel. This will save over USD 500 million, which will increase the GDP by USD 1.5 million [Mykolaenko 2017].

Increasing the use of renewable energy sources in the Ukraine's energy balance is one of the most important areas of its energy policy. This will increase the level of diversification of energy sources, which will contribute to strengthening energy independence of the state. In addition, reducing the use of traditional fuel and energy resources will affect the improvement of the environment [Kucher, Prokopchuk 2018].

According to the National Renewable Energy Action Plan, for the period up to 2020, to achieve the mandatory indicative targets for the use of renewable energy sources for 2020 in the transport sector, bioethanol use should be 320 thousand, i.e., biodiesel – 70 thousand tonnes. Intermediate volumes of biofuel use have the following meanings (Figure 2) [CMU 2014].

However, due to a lack of an effective public policy system that would stimulate the production and use of bioethanol and biodiesel, which can be generated through tax incentives and market quotas, these indicators have not been achieved. There is no financial support programme for producers of this type of biofuel. In addition, the Energy Strategy stipulates that, by 2035, the conditions for the creation of a system of logistical support and infrastructure must be created. The Energy Strategy of the Ukraine (ESU) up to 2035 "Security, energy efficiency, competitiveness" is a policy document outlining strategic guidelines for the development of Ukraine's fuel and energy complex for the period up to 2035. The key quantitative and qualitative characteristic of the ESU is the overall primary energy supply structure. ESU shall be structured in three stages: (a) 1st stage concerns the reform of the energy sector (completion by 2020); (b) 2nd stage concerns the optimization

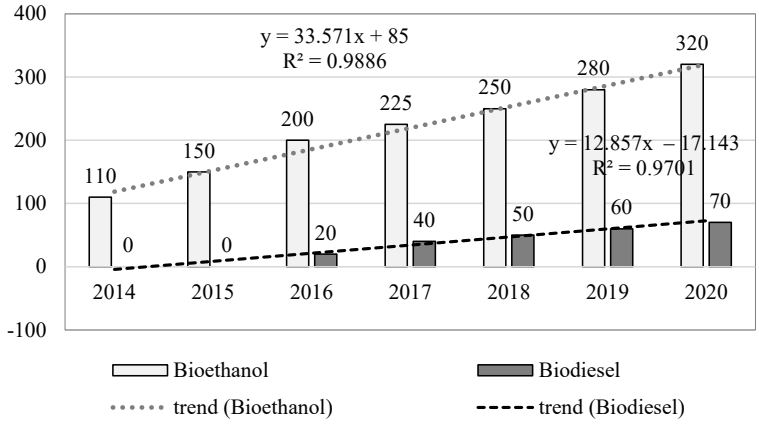

Figure 2. Transport volumes of biofuel in the transport sector according to the National Plan of Action for the period up to 2020, thousand tonnes of oil equivalent

Source: [CMU 2014]

and innovation of the energy sector infrastructure (completion by 2025); and (c) 3rd stage must ensure sustainable development (completion by 2035). The scope of ESU shall be to meet the demand of the society and economy in fuel and energy resources in a technically reliable, safe, cost-effective and ecofriendly way so as to guarantee the living conditions of the population. The strategic objective shall be to form a solid basis for the sustainable development of a competitive economy and an integral part of the European energy sector. Energy security, reliability and stability of the fuel and energy sector envisages the application of best practices in the sphere of environmental protection [CMU 2017].

Increasing the production and use of renewable resources is only possible if a number of measures are implemented at a national level, in particular, the introduction of a preferential excise duty on alternative motor fuels and the introduction of affordable credit for the construction of new facilities. The need to increase biofuel production will require careful planning and sustainability of the supply of primary raw materials, as well as compliance with food security requirements. The necessary solutions for the development of the liquid biofuel market are presented in the model (Figure 3).

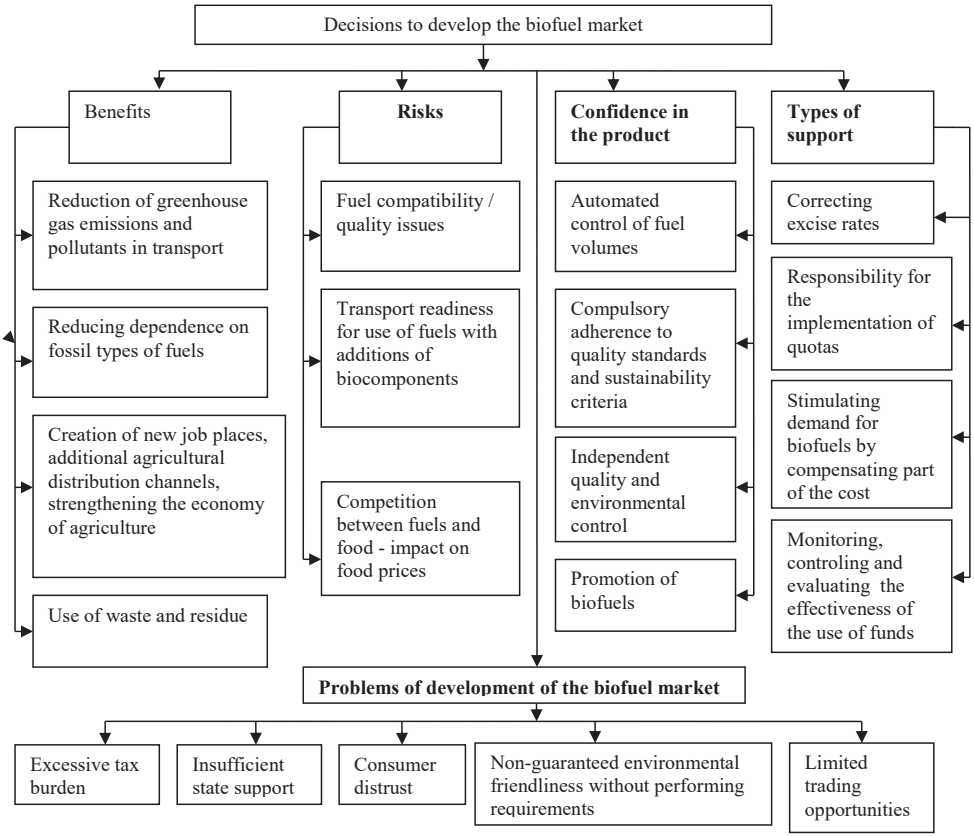

Figure 3. The decision-making model for the development of the biofuel market in the transport sector

Source: own study

For the development of the biofuel industry, clear and transparent legislation should be established that establishes a long-term model of the industry's operation, outlines basic rules for market participants, the requirements for commodity products, creates conditions for the formation of a logistics system and an infrastructure for the collection of biological raw materials, its transportation and production of biofuel.

Thus, in order to solve the problem, the draft Law of the Ukraine "On Amendments to Certain Legislative Acts of the Ukraine on the Development of the Production of Liquid Biological Fuels" through state regulation proposes to solve the problem of ensuring the Ukraine fulfills its international obligations. on the share of energy from renewable sources in the gross final consumption of energy in transport in 2020 by at least 10% and the fulfillment of commitments made by the Ukraine concerning accession to the Energy Community in terms of production of liquid biofuels (bioethanol, biodiesel) [Law of Ukraine 2016].

CONCLUSIONS

Summarizing the results of the study, we can distinguish the following key positions in the development of the market for liquid biofuels:

– the adoption of state programmes, national action plans, etc., determining the strategic foundations for the development of production and consumption of liquid biofuels as an element of renewable energy;
– an increase in biofuel use creates the preconditions for ensuring the energy stability of the transport sector, which is currently highly dependent on external factors, as imports account for more than 62% of domestic gasoline consumption and about 90% of diesel;
– for a full-fledged development of the biofuel market, it is necessary to create a strong raw materials base and appropriate infrastructure to ensure the storage, processing, transportation and sale of finished products;

In order to meet indicators of the National Action Plan for the production of bioethanol and biodiesel, capacity needs to be increased and new processing plants put into operation. Therefore, it is extremely important to create a domestic market for the production and use of liquid biofuels, since the Ukraine has sufficient resource potential for the development of this field.

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ROZWÓJ RYNKU BIOPALIW W UKRAINIE

Słowa kluczowe: rynek biopaliw, biodiesel, bioetanol, model decyzyjny, bioenergia

ABSTRAKT

Celem opracowania jest ocena stanu i perspektyw rozwoju rynku płynnych biopaliw w kontekście racjonalizacji wykorzystania dostępnego potencjału zasobów naturalnych Ukrainy. Ustalono, że ogólnie bilans odnawialnych źródeł energii, produkcji i wykorzystania biopaliw płynnych jest znikomy. Podkreślono, że dla pełnego rozwoju rynku biopaliw płynnych konieczne jest stworzenie silnej bazy surowcowej i odpowiedniej infrastruktury w celu zapewnienia magazynowania, przetwarzania, transportu i sprzedaży produktów gotowych. Zwrócono uwagę, na brak skutecznego systemu polityki publicznej, który zachęcałby do produkcji i stosowania bioetanolu i biodiesla, a także na możliwość opracowania programu wsparcia finansowego dla producentów tego rodzaju biopaliw, aby zapewnić konsumentom większą atrakcyjność niż tradycyjne paliwa. Ustalono, że w celu spełnienia wskaźników krajowego planu działania w zakresie produkcji bioetanolu i biodiesla konieczne jest zwiększenie mocy produkcyjnych i uruchomienie nowych przedsiębiorstw przetwórczych. Zaproponowano również strukturę modelu ekonomicznego, który odzwierciedla niezbędne rozwiązania dla rozwoju rynku biopaliw płynnych, korzyści, ryzyko, zaufanie do produktu i rodzaje wsparcia.

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