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DOI: [10.24412/2520-6990-2021-18105-13-19](https://doi.org/10.24412/2520-6990-2021-18105-13-19)**ПЕРСПЕКТИВНІ НАПРЯМКИ ВИРОБНИЦТВА РІПАКУ ТА АСПЕКТИ ЙОГО
ВИКОРИСТАННЯ У ВИРІШЕННІ ЕНЕРГЕТИЧНОЇ БЕЗПЕКИ В УКРАЇНІ****Amons S.E.**

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**PROSPECTIVE DIRECTIONS OF RAPS PRODUCTION AND ASPECTS OF ITS USE IN SOLVING
ENERGY SECURITY IN UKRAINE****Анотація.**

Встановлено, що особливе місце серед сільськогосподарських культур в Україні займає ріпак, олія з якого завдяки унікальним біологічним і хімічним властивостям знаходить широке застосування у харчовій та в багатьох галузях народного господарства.

Наголошено, що в даний час ріпак набув особливого значення у результаті його переробки на біодизель, використання якого розглядається як один із засобів диверсифікації джерел енергії і зниження залежності України від імпортованих енергоресурсів. Наша держава має значний потенціал і умови для виробництва біодизеля. Однак при сьогоднішньому співвідношенні цін на енергоносії і біопаливну сировину виробництво біопалива в Україні не вигідне.

В результаті дослідження виявлено, що нині негативним явищем є високий рівень експорту українського ріпаку за кордон, в тому числі в країни ЄС. Наша держава залишається постачальником сировини, натомість, власне виробництво олії та біодизелю залишається на досить низькому рівні.

Abstract.

It is established that a special place among agricultural crops in Ukraine is occupied by rapeseed, the oil of which due to its unique biological and chemical properties is widely used in food and in many sectors of the economy.

It is emphasized that currently rapeseed has become especially important as a result of its processing into biodiesel, the use of which is considered as one of the means of diversifying energy sources and reducing Ukraine's dependence on imported energy resources. Our state has significant potential and conditions for biodiesel production. However, with today's ratio of prices for energy and biofuel raw materials, biofuel production in Ukraine is not profitable.

The study found that the current negative phenomenon is the high level of exports of Ukrainian rapeseed abroad, including to EU countries. Our country remains a supplier of raw materials, instead, its own production of oil and biodiesel remains quite low.

Ключові слова: ріпак, виробництво, ресурсний потенціал, економічна ефективність, біодизель, біопаливо, енергетична безпека.

Keywords: rapeseed, production, resource potential, economic efficiency, biodiesel, biofuel, energy security.

Introduction.

One of the main criteria for the effectiveness of the state is its ability to ensure national security. Energy security is an important component of national security. In the XXI century, the problem of energy security is becoming especially relevant, due, on the one hand, the depletion of proven reserves of natural energy, and on the other hand, the constant increase in fuel consumption and various types of energy.

Energy security is the timely, complete and uninterrupted supply of fuel and energy of the required quality of material production, non-productive sphere, population, utilities and other consumers to avoid harmful effects on the environment.

Energy security is the foundation on which the future of the Ukrainian economy is built, and on which

the quality and standard of living of Ukrainians will depend. Ukraine has an excellent potential for this and has everything you need. Our country has significant reserves of gas, oil and coal. Unfortunately, it is no secret that today we are an energy-dependent country. We import everything: gas, oil, petroleum products, nuclear fuel and even coal.

Timely supply of Ukrainian energy resources is a necessary condition for the normal functioning of the economy of most European countries. The downside of this situation in Ukraine is the high dependence and vulnerability of the domestic economy to external conditions. In this regard, the issue of Ukraine's energy security, in particular the formation of an optimal strategy in world energy markets, the effective use of competitive advantages and improving energy efficiency, is quite critical.

In recent years, significant changes are taking place in the world energy markets. The reason, first of all, is the constantly growing needs of society in energy due to economic and technological development. Leading countries are beginning to fight for the right to develop energy deposits in the neutral Arctic and Antarctic territories.

Tightening environmental safety standards is the impetus for the transition to cleaner energy and the development of an emissions trading market. There is a need to find new energy sources and develop technologies for their use, as well as increase the efficiency of existing energy technologies. Thus, ensuring the country's energy security is becoming an increasingly complex and multifaceted task.

Formulation of the problem.

The availability of biofuels in the energy balance of each country is a very important issue in the context of energy and environmental security. Agriculture is becoming a source of raw materials not only for the food industry but also for the energy industry. Given the great agricultural potential, our country could partially provide itself with its own bioenergy resources, which would help reduce dependence on energy imports and improve the environment.

The Law of Ukraine "On Alternative Types of Liquid and Gaseous Fuels" (№ 1391-XIV) in the wording of 2009 defines: "biological fuels (biofuels) - solid, liquid and gaseous fuels made from biodegradable raw materials (biomass), which can be used as a fuel or component of other fuels" [1].

Fuel obtained with the use of vegetable oils is promising for Ukraine. In terms of properties, they are closest to diesel fuel, and in the process of operation of diesel engines on this fuel, the emission of harmful substances into the atmosphere is reduced.

The development of oilseeds and, accordingly, oil and oil and fat products, is a very promising area of agricultural production in the world and in Ukraine. Thus, in recent decades, the demand for oilseeds and products of their processing (meal and oil) is constantly growing. This interest is caused by a number of relevant factors, which gives perspective in the future, namely: priority and constant growth of consumption of oils and vegetable fats; favorable world market conditions; extensive use of vegetable oils not only in the food but also in the technical sphere - the production of environmentally friendly biofuels from renewable sources, which are oilseeds.

In the EU, the most common oilseed crop is rapeseed, which is significantly ahead of other crops in terms of sown area. EU countries account for 27.8% of world production of rapeseed, with shares of Canada, China and India accounting for 28.3%, 17.9% and 11.1%, respectively. The main world exporters of this culture are Canada and Ukraine, whose share in world exports reaches 62.6% and 17.1%, respectively. In Canada, rapeseed occupies 95% of the area of all oilseeds. The world's largest importers of rapeseed are the EU (29.7%), China (24.4%) and Japan (17.2%) [2].

The increase in world consumption of rapeseed oil during 1990–2020 is due to its peculiarities - it is suitable for both food use and for processing into biodiesel. Due to this, rapeseed oil ranks first in the world among

vegetable oils in terms of its value. Due to this, the demand and volumes of rapeseed production are growing at a particularly significant pace.

In Ukraine, the production of rapeseed, culture has revived, in terms of profitability - out of competition. The products of its processing are currently in great demand in the developed countries of the world, unfortunately, not yet in our country. Thus, domestic producers have favorable prospects for the sale of this oil crop on the world market. Increasing income from rapeseed cultivation should lead to increased investment in technology, which will increase crop yields at optimal costs and high-quality seed performance.

Increasing the productivity of livestock and poultry through the efficient use of rapeseed feed, as well as the development of technologies for new types of rapeseed products and comprehensive generalization, promotion of best practices and effective developments, will significantly increase the level of environmental and energy security of Ukraine and significantly reduce national oil dependence due to the production of rapeseed "biodiesel" [3].

Soil and climatic conditions of Ukraine are favorable for normal growth and development of rapeseed plants, both winter and spring, and meet its biological requirements. In particular, good soil fertility, their satisfactory water and air permeability, optimal rainfall and temperature allow the correct cultivation technology to obtain yields up to 4 t / ha.

The best conditions for growing winter oilseed rape are in the following regions of the state: - Lviv, Ivano-Frankivsk, Ternopil, Khmelnytsky, Vinnytsia, Kyiv, Rivne and Volyn regions; spring: - Kirovograd, Kyiv, Cherkasy, Odessa, Kherson, Poltava, Chernihiv, Sumy, Kharkiv regions and Crimea.

In the European Union, biodiesel production has significant government support. In Germany, biofuels are not subject to mineral and environmental taxes, there is a subsidy system for rapeseed cultivation, in France the tax rebate is 0.35 euros / liter of biodiesel, in Spain motorists who use biofuels are allowed free intra-city parking. In Europe as a whole, 1 liter of biodiesel is 0.10-0.15 euros cheaper than diesel.

In Ukraine, according to various data, the cost of 1 liter of biodiesel is from 6.5 to 8.7 euros / liter. The cost of biodiesel depends on a number of factors: rapeseed yield, efficiency of straw and meal, the cost of chemical ingredients (methanol and alkali), the depth of processing of glycerol water, the quality of the technological process of obtaining biodiesel [4].

Research of world and domestic trends in the development of biofuel production, determination of economic aspects of the use of crops as raw materials for the production of various types of biofuels is devoted to the scientific works of such famous scientists: Gerasimovich V.A., Rybak L.H., Kaletnik G.M., Marshalok M.S., Vyshnivsky V.S., Kolenskaya S.M., Gubenko V.I. etc.

Despite a significant number of scientific programs, developments and guidelines on the cultivation of oilseeds, biofuel production, sources of raw materials, the question of mastering foreign technologies that ensure the quality of rapeseed oil production at world standards remains open. The issue of expanding the volume of rapeseed processing for technical needs, in

particular for the production of biodiesel, technical lubricants, synthetic detergents, technical and methodical glycerin is also slowly advancing.

The aim of the study.

Analysis of trends in the development of rapeseed production as an important energy crop in the EU and Ukraine. Achieving this goal involves studying the dynamics of crop production, sown areas, yields, profitability to identify general trends and promising opportunities for processing and use it as a raw material for bio-fuel production in Ukraine.

Materials and methods of research - scientific works on the cultivation, processing and use of rapeseed by domestic agricultural scientists, data from the Center for Socio-Economic Research, statistics, etc. During the study we used methods of quantitative and qualitative comparison, analytical and monographic methods.

Presenting main material.

At first glance, it may seem that rapeseed is a new agricultural crop that is spreading rapidly in the fields of Ukraine. Indeed, rapeseed production has been gaining momentum so rapidly in recent times that the question has repeatedly been asked, "What is this crop and where did it come from in our fields?". However, rapeseed is a completely traditional, although not very common crop before, a certain tradition of growing which has existed in our fields for a long time.

Rapeseed is one of the oldest crops. This plant is known for 4 thousand years BC. Researchers have not agreed on the homeland of rapeseed: some consider it the southwestern coast of Europe, others - the Mediterranean. In the XVII-XIX centuries rape was a very common crop. The area under it only in Germany at that time reached 300 thousand hectares [5]. The revival of rapeseed as an industrial crop in Ukraine began almost anew 20 years ago. Most rapeseed was sown in 1986-1990. It was planned to sow it in 2000 on an area of 0.5 million hectares. However, the expected growth of sown areas in 1990-2000 did not occur mainly due to the lack of processing plants and declining demand for rapeseed in the domestic market.

According to the report of the State Statistics Service of Ukraine, the sown area of winter rapeseed for the 2020 harvest was 1.1 million hectares, which is 15% less than the previous figure for 2019. Gross rapeseed production in 2020 was at the level of 2.7 million tons, which allows us to include our country, along with others, to one of the world's leading suppliers. The main

markets for Ukraine are - Germany, Belgium, France, the Netherlands, Portugal [6].

Rapeseed (*Brassica napus L. var. Oleifera Metzg.*) Is the most common oil crop from the cabbage family. Its seeds contain 38-50% oil, 16-29% protein, 6-7% fiber. Oil is the main purpose of rapeseed cultivation. Rapeseed oil is used as a food product and as a raw material for various industries. Only rapeseed varieties with a low erucic acid content of less than 2% are used for food purposes. For industrial needs (fuel, plastics, varnishes, paints) are more valuable varieties with a high content of erucic acid [7].

It should also be noted that rapeseed oil of sleeveless varieties is widely used in food, as well as in the confectionery, canning, food industry; oil of ordinary varieties of rape - only after refining. It is used in soap, textile, metallurgy, paint and other industries. Winter rapeseed meal and meal are a high-protein concentrated animal feed. Meal without rapeseed varieties contains up to 0.5% of harmful glycosylates (instead of 6-7% in conventional varieties) and is equated to soybean in terms of fodder qualities. Cake and meal of conventional varieties are also fed to animals in small doses; 1 kg of cake is equivalent to 1 feed unit [8].

Rapeseed is an extremely valuable fodder crop. When processing it from 100 kg of seeds, in addition to 38-41 kg of oil, get 55-57 kg of cake containing 32-34% well-balanced amino acid protein and 10-18% fat or meal (34-38%) protein and only 2-5% fat. The protein contains essential and vital for animals, amino acids - lysine, methionine, cytotin, tryptophan, treopin. A ton of meal or cake allows you to balance the protein of 8-10 tons of feed, while increasing the content of digestible protein in 1 feed unit from 80 to 110 g [9].

Rapeseed is the second oilseed crop in Ukraine in terms of sown area and gross production. It is second only to sunflower. In 2019, it harvested more than 3.1 million tons, which is almost three times higher than in the 2016 marketing year. This was achieved by increasing the area from 560 thousand hectares in 2016 to 1.4 million hectares in 2019 and a relatively high level of yield, respectively, 2.5 t / ha.

Rapeseed production is one of the sources of foreign exchange resources in the country. The full use of all economically valuable properties of rapeseed production will help expand the capabilities of domestic producers, their economic growth, and strengthen Ukraine's position in world food markets.

World production of rapeseed in recent years exceeds 70 million tons (Table 1).

Table 1

World production of rapeseed in 2016-2020, (thousand tons)

Indexes	Marketing years				2019/2020 in % until 2016/2017
	2016/2017	2017/2018	2018/2019	2019/2020	
Production	69.43	74.82	71.94	68.57	98.76
Imports	15.51	15.47	14.25	15.37	99.09
Export	15.80	16.20	14.61	15.68	99.24
Consumption	70.32	71.63	70.89	70.07	99.64
Stocks	4.99	7.56	8.25	6.44	129.06

Source: [12]

Over the past 4 years, world rapeseed production decreased by 0.86 million tons or 1.4% (to 68.57 million tons). The largest share (61%) in the world wholesale of oilseeds is soybeans, 10% - sunflower seeds,

11% - rapeseed, 8% - cotton seeds, 6% - peanuts, 4% - palm kernels and copra. World production of rapeseed in 2020/21 is projected at 70.8 million tons (+ 4%, or 2.6 million tons). Production is expected to increase in

Canada to 19.9 million tons (+0.9 million tons), Australia - to 3.1 million tons (+0.77 million tons), in Ukraine - to 4.0 million tons (+0, 54 million tons).

One of the important players (consumers) in the world market of rapeseed consumption and processing is China (Table 2).

Usually, the needs of Chinese processors were met almost entirely by importing rapeseed from Canada. In

August-February 2019, rapeseed imports from Canada accounted for only a third of the monthly volume shipped a year earlier. The reason for this was the still unresolved trade conflict between these countries. China has covered part of its rapeseed needs with imports from Australia. To some extent, there are opportunities for rapeseed imports to China from European countries.

Table 2

World's top producers of rapeseed, 2019, million tons

Indexes	Canada	EU	China	India	Ukraine	Australia	Russia	USA	Belarus
Production	21.1	20.1	12.9	8.0	2.9	2.2	2.0	1.6	0.5
Imports	0.1	4.3	3.8	0.2	0	0	0	0.6	0.3
Export	9.1	0.1	0	0	2.5	0.6	0.6	0.2	0

Source: [10]

According to the table, the largest producers of rapeseed in the 2019/2020 marketing year were the countries of the European Union and China. These countries produced 20.1 and 12.9 thousand tons of rapeseed, respectively. Ukraine has a fairly stable position on the world market - 2.9 million tons.

World experts predict a decrease in world consumption of rapeseed oil by 1.1 million tons (meaning the third consecutive reduction). In the EU, rapeseed oil use could fall by 0.7 million tons and 0.5 million tons in China. According to the latest USDA (US Department of Agriculture) data for ten years (from 2010/11 to 2019/20 marketing years) total rapeseed exports increased by 41% (to 15 million tons).

Exports of rapeseed oil also increased by 87% (to 5.1 million tons) and meal by 90% (to 6.9 million tons).

Of course, the main exporter of rapeseed in the world is Canada, the total volume of exports in 2019/20 MY is 9.5 million tons or 62%. In turn, the main importers are the EU countries, for the last year their total volume amounted to 6.0 million tons, in second place - China (2.5 million tons) and Japan (2.4 million tons) [11].

Ukraine grows mainly winter rape, it accounts for 97% of all crops and only 3% falls on spring rape (colza). Over the past five years, the sown area of rapeseed in Ukraine has increased by 204% (to 1.39 million hectares), which has led to an increase in production almost three times - up to 3.1 million tons (+ 182%). Almost 90% of all rapeseed produced is exported. 0.37 million tons are sent for processing (Table 3).

Table 3

Dynamics of rapeseed production in Ukraine

Indexes	Years					2019 in% until 2015
	2015	2016	2017	2018	2019	
Sowing area, thousand hectares	671	560	862	1076	1389	204.0
Gross collection, million tons	1.7	1.1	2.1	2.7	3.1	182.3
Yield, t / ha	2.6	2.5	2.7	2.5	2.5	96.1

Source: [12]

Ukraine, which in 2019/20 MY became the headliner of oil supplies to the EU, especially in the first half of the season, will retain its position as a major exporter, however, according to Oil World forecasts, may reduce rapeseed supplies to the bloc - up to 2.43 million tons. compared with 2.89 million tons of the previous season against the background of declining domestic production of the current marketing year.

According to the forecasts of experts of the news agency "APK-Inform", the production of rapeseed in Ukraine in the 2020/21 marketing year may decrease to 2.7 million tons compared to 3.3 million tons in the 2019/20 season, which will also lead to a reduction export potential of the new season to 2.5 million tons, or 13.5% lower than the previous marketing year (2.89 million tons). It should be noted that in 2019/2020 Ukraine exported 2.73 million tons of rapeseed to EU countries [13].

According to world experience, rapeseed is a market-attractive crop for which demand is constantly growing. The strategic task is to make rapeseed a

source of increasing the efficiency of agricultural production, increasing the working capital of agricultural enterprises, increasing the profits of agricultural producers by determining the optimal sales channels for rapeseed and its products.

Rapeseed is an ideal crop for export, as it is in great demand in many foreign markets. Rapeseed is especially popular in Asian countries, especially in China, as Ukrainian products are highly valued there, and therefore their value in foreign markets is always an order of magnitude higher than competitors.

In the 2019/2020 marketing year, only 477 thousand tons of rapeseed are expected to be used for the needs of the country, which is 12.9% of the total supply. The processing enterprises will receive about 400 thousand tons, for the formation of the seed fund - 50 thousand tons, possible losses are expected at the level of 25-27 thousand tons.

For Ukraine, rapeseed is an export crop. We export the bulk to foreign markets. Moreover, by October-November, we will ship 90% of the forecast for export.

The key customer is the EU countries that produce biodiesel from rapeseed oil. Reducing rapeseed production in the EU leads to active demand for our oilseeds. In the domestic market, processors also receive the oil

and export it to the European Union. So far, domestic consumption of rapeseed products (except meal) is low (Table 4).

Table 4

Rapeseed production and distribution in the world and in Ukraine, million tons

Indicator	Country	2016/2017	2017/2018	2018/2019	2019/2020	2019/2020 +/- until 2016/2017
Production	World	69.4	74.9	72.8	70.5	1.1
	Ukraine	1.3	2.2	2.9	3.2	1.9
Export	World	15.8	16.2	14.6	15.6	-0.2
	Ukraine	1.0	2.1	2.5	2.8	1.8
Processing	World	67.3	68,5	67.5	67.3	-
	Ukraine	0.2	0.1	0.4	0.4	0.2

Source: [12]

From 01.01.2020 in Ukraine begins the abolition of VAT refunds on rapeseed exports. We have not heard about the cancellation of this innovation. Therefore, next season, we will get a similar situation that was in the soybean market. Traders will reduce the price by 20% and their competitiveness will be low. Therefore, significant volumes will go to domestic processing plants. The current season will not affect the innovation, as rapeseed will be exported before the beginning of this period. But the prices for the future harvest are in question.

In the 2019/2020 marketing year, Ukraine harvested a record rapeseed harvest - 3.1 million tons. Compared to previous years, rapeseed production in Ukraine has grown significantly. For example, in 2016/2017 MY 1.3 million tons were produced, which is 40% less than in the reporting year. Although preliminary estimates of production for our country were even 3.9 million tons, but the weather has made its adjustments. There were problems such as insufficient oil in rapeseed and weight loss of the seed itself, which led to reduced yields.

The main advantages of rapeseed, compared to other crops, are the stable demand for it, which has been observed in recent years and is characterized by a high level of purchase prices. In August-September, the price for food rape reached 2200-2300 UAH / t, for technical - 2100-2200 UAH / t. Therefore, at an average cost of 3200-3500 UAH per 1 ha, the profitability of rapeseed will be from 30% and more, which equates it to the most profitable crops this season.

The main factors influencing the quality and competitiveness of rapeseed oil and fat subcomplex products include advanced breeding work, the use of intensive technology of cultivation (plant protection, fertilizers, rational tillage), reducing the cost of harvesting and storage, improving the quality of seed processing, application of modern technologies of oil purification and processing [14].

Rapeseed is usually in demand in the Western European market, where most of the rapeseed oil, about 57% of which is used for biodiesel. According to the OIL WORLD (ISTA report for March), biodiesel consumption in the European Union has declined significantly following their governments' restrictions on Covid-19 and reduced industrial production.

The main consumers of rapeseed oil for biodiesel are Germany and France, but currently the saturation of

cars and fuel use have decreased significantly due to traffic restrictions. As a result, biodiesel reserves accumulate. Its producers are forced to reduce capacity utilization, which, in turn, leads to lower demand for rapeseed, palm and other oils and fats used for energy. According to experts, the demand for rapeseed oil may partially recover by the end of May 2022, after countries begin to gradually weaken quarantine measures and the industry will return to standard operation.

The cost of biodiesel is influenced by a number of factors: seed yield; its cost; oil content in seeds; its, output from the seeds; cost of chemical ingredients (methanol, catalyst); the cost of processing; quality of technological process; maintenance costs; the cost of electricity, as well as staff salaries.

Economic efficiency of agricultural production means obtaining the maximum amount, of products per hectare of land with the lowest labor costs and funds for the production of a unit of production. For strategic planning of efficient rapeseed production, it is necessary to take into account the relationship between crop yields and profitability of its production. It should be noted that the costs in the process of growing rapeseed consist of about 50% of such production items as seeds, plant protection products and fertilizers. The other 50% is accounted for by mechanized work (sowing, care, harvesting) and other costs.

Improving the efficiency of rapeseed cultivation is possible by observing the technology of growing crops, the use of both intensive and rational technologies of its cultivation, attracting the necessary financial and material resources. This will help both increase crop productivity and reduce unit costs, with planned yields and prices.

I would also like to note the fact that having received quite high profits from the sale of this oil crop over the past few marketing years, domestic farmers not only annually expand the sown area under it, but also increasingly use efficient technologies for high yields.

In developed countries, scientists, technologists, inventors are working hard on the problems of introducing non-traditional energy sources, replacing petroleum products with alternative fuels. Each country, depending on the climate and economic conditions, finds its own way to solve the problem of energy security. One of the alternatives to dirty fuel is now considered to be biodiesel - a fuel synthesized from vegetable oils.

Biodiesel is a product of processing vegetable oils or mineral diesel fuel with the addition of 20-25% ethanol. Biodiesel is used alone or in a mixture with conventional diesel fuel. One of the main raw materials for biodiesel is rapeseed. It contains a lot of fat, which provides high heat of combustion [15].

Biodiesel production is currently available only to those who grow rapeseed on their own and produce rapeseed oil at their own production facilities. Therefore, the potential range of biofuel producers today is limited to large agricultural firms that cultivate 10-20 thousand hectares of land and use fuel produced from biological raw materials exclusively for their own needs.

In Ukraine, the industrial production of biodiesel has not yet been established, but small agricultural enterprises and farmers already produce it for their own needs (about 20 thousand tons). Today, more than 62% of domestic gasoline consumption and 90% of diesel fuel Ukraine meets at the expense of imports. The production and use of biofuels can provide additional tools for the country's energy independence, in particular the transport sector.

However, instead of its own production, Ukraine annually exports significant amounts of raw materials. For example, rapeseed and soybean seeds exported in 2017-2018 could replace up to 35% of imported diesel. Despite the goals declared by the Energy Strategy to increase the share of alternative fuels, the corresponding potential of Ukraine is practically not used. Thus, in the world due to motor biofuels about 4% of transport energy consumption is satisfied, and in Ukraine - less than 1%.

The results of the study indicate that the most common raw material for production is rapeseed. Rapeseed contains from 38% to 50% oil. Rapeseed oil has a wide range of applications in various technical fields. Compared to petroleum fuel for road transport, rapeseed oil-based biodiesel has significant advantages.

It contains almost no sulfur, so its use reduces emissions of sulfur dioxide, combustion of biodiesel does not enhance the greenhouse effect, because rapeseed, like all biomass, is CO₂-neutral; as a product of processing of vegetable raw materials, biodiesel does not contain carcinogenic substances, such as polycyclic aromatic hydrocarbons and, in particular, benzopyrene; rapeseed oil has a higher oxygen content than diesel fuel [16].

Experts' calculations show that if the current level of energy efficiency is maintained, Ukraine has no prospects for its state development. In this situation, the consumption of primary fuel and energy resources (FER) in 2030 will be about 860 million tons of conventional fuel, which will be 18.3 tons per capita. (860 million tons of conventional fuel / 47 million people.)

However, this is not a realistic enough figure and the economy will not be able to withstand such a load of energy costs. Therefore, the question of possible directions of development of our state socio-economic system with its largest subsystem - the fuel and energy complex is extremely important. In addition, the Energy Strategy until 2035 provides for the introduction

of another European trend - the rejection of the dominance of fossil sources [17].

Against the background of a sharp rise in prices for oil and gas and, accordingly, the products of their processing, the prospect of transferring the country's enterprises to the consumption of alternative fuels is beginning to materialize. Ukraine has announced its political choice in favor of joining the EU, the Energy Community. According to the National Renewable Energy Action Plan for the period up to 2020, the total expected contribution of bioethanol / ethyl tert-butyl ether produced from bioethanol to achieve the mandatory indicative targets for their consumption in transport for 2020 is planned at 500 thousand tons, biodiesel - 80 thousand tons (a total of 580 thousand tons). The annual technically achievable energy potential of liquid biofuels in Ukraine is equivalent to 1 million tons of AD (toe) [18].

As a result of calculations on the example of rapeseed, it was found that in 2017 at a yield of 2.85 tons per 1 ha of biodiesel produced for agricultural producers could be 1.8 times cheaper than diesel fuel (subject to the sale of by-products processing). If the yield of rapeseed is reached at the level of 5 tons per 1 ha, the multiplicity between the indicators could be 2.5 times. The use of these approaches both at the level of agricultural producers and at the state level will help to optimize the use of seeds of crops that serve as raw materials for biofuel production [19].

Agriculture plays an important role in the development of biological fuels, as it is the raw materials of plant origin that are used as a source for their production. In turn, increasing competition for agricultural raw materials from the production of biofuels leads to heated discussions between the governments of many countries on the diversification of agricultural production.

Varieties with a high content of erucic acid are the best for the industries engaged in the processing of fuel, plastics, varnishes and paints. Over the last decade, efficient production technologies for rapeseed biofuels for engines have been developed. From one ton of rapeseed, you can get about 300 kg of rapeseed oil, and from it 270 kg of biodiesel fuel, which is 35 times less sulfur, 2 times - soot than in diesel fuel.

A hectare of rapeseed is capable of producing 1.5 tons of biodiesel, in addition, the farm has meal, which is a valuable animal feed. Ukraine, when joining the EU, must produce and consume in 2010 more than 520 thousand tons of biofuels. According to forecasts, in the next 3-4 years 7% of fuel in Europe will be "green", ie biofuels [20].

Thus, the most urgent tasks at the present stage for the rapeseed industry of Ukraine are: development and implementation of rapeseed cultivation technologies, increase of production culture, insurance protection of crops, technical modernization of agricultural enterprises, reaching normal capacity, development and implementation of regulatory framework.

Conclusions.

The economic feasibility of growing rapeseed is beyond doubt. According to studies by foreign and domestic scientists, its cultivation provides a high level of

profitability. Our state has a powerful resource, scientific and production potential for the production of the required amount, of biofuels.

With 10% of arable land and a yield of 25 centners per hectare, Ukraine can produce up to 8.5 million tons of rapeseed annually. After its processing, it is possible to obtain about 3 million tons of biofuels per year, which will provide 60% of the country's annual demand for diesel fuel (with a total average demand of 5 million tons / year). By sowing 5-5.5 million hectares of rapeseed, Ukraine could produce rapeseed oil in volumes that can fully meet its fuel needs.

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