

10. State regulation of biofuel production in Ukraine

Today biofuels in Ukraine are seen as a significant alternative to traditional fuels, which have recently become overly expensive and at the same time inaccessible to the public. The development of bioenergy makes it possible to expand the range of available energy sources, strengthen the country's energy security, promote energy independence of the state, improve the environment [156].

Legislation of Ukraine in the field of cultivation and processing of agricultural raw materials for the production of biofuels has undergone several stages of development, but is still in the process of improvement. In our opinion, the following main stages of its formation should be identified.

The first stage (1991-1999) is characterized by the process of reforming agricultural and land relations, the adoption of a number of legislative acts aimed at the transition to growing agricultural raw materials on an entrepreneurial basis, based on land privatization and integrated property complexes, and lack of special legislation, which would regulate relations on the cultivation and processing of agricultural raw materials for biofuel production.

However, the first legislative attempts to regulate the use of renewable energy sources, including biofuel production, are already at the first stage. Thus, the Resolution of the Cabinet of Ministers of Ukraine "On Priority Measures for the Implementation of the Program of Activities of the Cabinet of Ministers of Ukraine for 1995-1996" of November 5, 1995 defines the need to develop the Concept of Food Industry provide for the widespread introduction of combined heat and power generation, use as fuel production waste (husk, agrimus, coffee extract, buckwheat husk, etc.), solar, wind and other renewable energy sources. The Resolution of the Cabinet of Ministers of Ukraine "On Approval of the Standard Regulations on the Department of Agriculture and Food of the Oblast, Department of Agriculture of the Sevastopol City State Administration" of February 12, 1996 non-traditional and renewable energy sources (wind, solar and biogas plants).

The Resolution of the Cabinet of Ministers of Ukraine "On the Comprehensive

State Energy Saving Program of Ukraine” of February 5, 1997 148 is progressive for the first stage. The program recognized that biomass and other unconventional fuels could provide a significant portion of heat and electricity needs. Renewable biofuels included household and industrial waste, non-commodity waste from agriculture and forestry, urban wastewater and livestock waste, but the main problem with the use of these energy sources is the lack of appropriate equipment and lack of technology for their procurement, preparation and use. The program also planned to increase the use of non-traditional and renewable energy sources, and in the agro-industrial complex it was planned to use wind turbines, energy from water, solar energy, alternative motor fuels from biomass. The program stated that the use of alcohol mixed with gasoline as a motor fuel is widespread in many countries, and ethanol, produced from specially grown raw materials, is a real alternative to imports of oil and petroleum products. Ukraine's need for fuel ethanol as a high-octane additive to petroleum products was estimated at 2 million tons per year. The available resources of by-products of the processing industry and substandard agricultural products were estimated at up to 1 million tons of fuel ethanol. The purchase and processing of substandard and surplus agricultural products into fuel ethanol was recognized as a tool to support agricultural producers, as is the case in other countries. In order to expand the raw material base for the production of alternative motor fuels, it was planned to conduct research on the development of low-cost technologies for growing oilseeds, sugar and starch crops, energy-saving technologies for collection, processing and storage of raw materials.

The Resolution of the Verkhovna Rada of Ukraine “On the Main Directions of the State Policy of Ukraine in the Field of Environmental Protection, Use of Natural Resources and Ensuring Environmental Safety” of March 5, 1998 also defines the need for renewable energy sources. development of programs to obtain a non-traditional energy source - biogas, the use of non-traditional and renewable heat sources to reduce overall fuel consumption. By the Decree of the President of Ukraine "On the Main Directions of Development of the Agro-Industrial Complex of Ukraine" of April 29, 1998, the main measures to stop the decline in agricultural production and meet domestic needs in food and raw materials market conditions, creating conditions for

increasing the production of grain, sunflower, sugar beet and other industrial crops.

At the end of the first stage, the Resolution of the Verkhovna Rada of Ukraine "On Measures to Ensure the Functioning of the Fuel and Energy Complex in Crisis" of December 24, 1998, based on the need to prevent the final collapse of the fuel and energy complex, types of liquid and gaseous fuels, with the adoption of which, in our opinion, came the second stage of development of legislation in the field of cultivation and processing of agricultural raw materials for biofuel production.

The second stage (2000 – 2010) is characterized by an increase in the number of regulations governing relations in the field of cultivation and processing of agricultural raw materials for biofuel production. On January 14, 2000, the Law of Ukraine "On Alternative Types of Liquid and Gaseous Fuels" № 1391-XIV was adopted, which established the principles of production and consumption of alternative types of liquid and gaseous fuels based on unconventional sources and types of energy raw materials. It should be noted that this law is currently in a different version, because at that time it regulated only the production and consumption of liquid and gaseous fuels, not including solid alternative fuels. In addition, in its original version, this Law did not define the concept of biofuels, and also referred to agricultural raw materials from which biofuels can be produced, only agricultural waste. Nevertheless, with the adoption of this Law there is a gradual increase in regulatory and legal regulation of relations in the field of cultivation and processing of agricultural raw materials for biofuel production.

At the second stage, the Resolution of the Cabinet of Ministers of Ukraine "On Approval of the Ethanol Program" of July 4, 2000 launched the Program to expand the use of ethyl alcohol as an energy source and raw material for industry. The aim of the Program was to create favorable conditions for the production of products using biological renewable sources of raw materials and energy, as well as the organization of new for Ukraine and reorientation of existing industries to use products of renewable agricultural raw materials - ethyl alcohol and its derivatives. The program establishes that in Ukraine there are conditions for growing the necessary for the production of biodiesel industrial crops – sunflower, rapeseed, sugar sorghum and others that can

provide part of the need for diesel fuel. The main tasks and expected results from the implementation of the Program included guaranteeing the agricultural producer of constant sales of raw materials with a parallel supply of fuels and lubricants, mineral fertilizers and other products.

Subsequently, for the first time in Ukrainian legislation, the Law of Ukraine “On Alternative Energy Sources” of 20 February 2003 classifies biomass energy as alternative energy sources. Among the peculiarities of the use of alternative energy sources due to natural conditions, the Law singles out such a feature as the presence of biomass, the amount of which depends on annual yields, the relationship between agricultural raw materials and energy production from alternative sources. In pursuance of this Law, the Resolution of the Cabinet of Ministers “On the Procedure for Issuing a Certificate of Fuel for Alternative” of October 5, 2004 and the Order of the State Committee of Ukraine for Energy Conservation of December 10, 2004 , which established a mechanism for conducting an examination to determine the characteristics of the fuel to confirm its affiliation to the alternative and the procedure for obtaining and form of a certificate of affiliation of the fuel to the alternative.

The Decree of the President of Ukraine "On Measures to Develop the Production of Fuel from Biological Raw Materials" of September 26, 2003 established that ensuring the development of production and expanding the use of fuel from biological raw materials is one of the priorities of the executive branch. biodiesel and biogas with measures to conduct comprehensive research aimed at determining the production and use of biodiesel and biogas, types of biological raw materials optimal for their production, studying the possibility of further use of waste generated in the process of such production; increasing the volume of crops used for the production of biodiesel and biogas, including through the introduction of advanced technologies in this area and the use of the most productive plant varieties; improving the waste collection system for use in biogas production; introduction of mechanisms of state support for activities aimed at developing new technologies and equipment for the production of biodiesel and biogas; support for investment activities in the field of biodiesel and biogas production; expanding the use of biodiesel and biogas in household and

industrial production. The decree also establishes the need to study the feasibility of introducing a fee for transactions for the sale of petroleum products in order to direct the proceeds to the development of plants that are optimal for the production of biodiesel; take measures to develop international scientific and technical cooperation in the field of production and use of fuel from biological raw materials; to ensure the harmonization of national legislation in the field of production and use of fuel from biological raw materials with the legislation of the European Union.

Following the adoption of this Decree, the Cabinet of Ministers of Ukraine approved the Order "On Development of Biodiesel Production in 2003" of October 6, 2003, which instructed the Ministry of Agrarian Policy to develop, approve and ensure a set of measures to develop biodiesel production in 2003 and together with the Ministry. finance to develop and approve the procedure for the use of funds provided in the State Budget of Ukraine for 2003 for the implementation of the program for the development of biodiesel production. Pursuant to this Order, on November 10, 2003, the Ministry of Agrarian Policy and the Ministry of Finance adopted the Procedure for Using Funds Provided in the State Budget of Ukraine for the Biodiesel Development Program, which stipulates that the use of funds exclusively for payment of works and services, including, in particular, development of the project of the State program of development of production of biodiesel for the period till 2010, working off and introduction of advanced domestic and foreign technologies of reception of raw materials for production of biodiesel, carrying out a complex of field works . Organizations that, among other requirements, had to have experience in the development or implementation of state, sectoral, regional programs, which provided for the introduction of biofuels, energy-saving technologies, the creation of raw materials for the production of biological species, were allowed to participate in tenders, fuels or energy sources, growing crops suitable for processing into biofuels.

The concept of the Diesel Biofuel Development Program for the period up to 2010 was approved by the Order of the Cabinet of Ministers of Ukraine of December 28, 2005, and the Program itself was approved by the Resolution of the Cabinet of Ministers of Ukraine of December 22, 2006. The purpose of the Program was to

increase the level of environmental and energy security of Ukraine, reduce the dependence of the national economy on imports of petroleum products, providing the agricultural sector of the economy and the transport sector with diesel biofuels. The program was aimed at solving such basic tasks as creating a raw material base for the production of diesel biofuels, in particular: development of energy-saving technologies for rapeseed cultivation, expanding rapeseed cultivation, increasing its yield, creating areas of concentrated rapeseed cultivation. biofuels, as well as the development of regulations on the production and use of diesel biofuels with further preparation of relevant state standards and others.

The Order of the Cabinet of Ministers of Ukraine of November 19, 2008 approved the Concept of the State Targeted Economic Program for Energy Efficiency for 2010-2015, the main purpose of which was to create conditions for reducing energy intensity of gross domestic product and of ways to solve energy efficiency problems. In 2009, a number of Ordinances of the Cabinet of Ministers of Ukraine were adopted, aimed at developing relations on the production and use of biofuels. In particular, the Order of the Cabinet of Ministers of Ukraine "Some issues of state policy in the field of efficient use of fuel and energy resources" of February 11, 2009, the Order of the Cabinet of Ministers of Ukraine "Issues of biogas production and use" of February 12, 2009 , Order of the Cabinet of Ministers of Ukraine "On Approval of the Concept of the State Targeted Scientific and Technical Program for the Development of Production and Use of Biological Fuels" of February 12, 2009 (however, the Program itself was not adopted). On May 21, 2009, the Law of Ukraine "On Amendments to Certain Laws of Ukraine on Promotion of Production and Use of Biological Fuels" was adopted. definition of biofuels, biomass and others.

The Resolution of the Cabinet of Ministers of Ukraine "On Approval of the State Targeted Economic Program for Energy Efficiency and Development of Energy Production from Renewable Energy Sources and Alternative Fuels for 2010-2015" of March 1, 2010 approved the Program. The aim of the Program was to create conditions for bringing the energy intensity of Ukraine's gross domestic product closer to the level of developed countries and European Union standards, reduce the energy intensity of

gross domestic product during the Program by 20 percent compared to 2008 (by 3.3 percent annually). fuel and energy resources and strengthening the competitiveness of the national economy, as well as optimizing the structure of the energy balance of the state, in which the share of energy from renewable energy sources and alternative fuels will be at least 10 percent in 2015 by reducing the share of imported fossil fuels energy resources, in particular natural gas, and their replacement by alternative types of energy resources, including secondary ones. The production and use of biofuels in the Program is named as one of the ways to solve these problems. It should be noted that according to the Resolution of the Cabinet of Ministers of Ukraine "On extension of the State Targeted Economic Program for Energy Efficiency and Development of Energy Production from Renewable Energy Sources and Alternative Fuels for 2010-2015" of November 11, 2015, the Program was extended. for the period up to 2016.

On September 24, 2010, the Protocol on Ukraine's Accession to the Treaty establishing the Energy Community was signed, which entered into force for Ukraine on February 1, 2011. To comply with Chapter II of the Treaty establishing the Energy Community and in accordance with Art. 2 of the Protocol of Accession of Ukraine to the Treaty establishing the Energy Community, Ukraine has undertaken to implement a number of European Union Directives, including Directive 2001/77 / EEC on the promotion of the use of electricity produced from renewable energy sources in the internal electricity market , and Directive 2003/30 / EC on the promotion of the use of biofuels or other renewable fuels for transport. With the accession of Ukraine to the Treaty establishing the Energy Community, in our opinion, we should consider the beginning of the third stage of development of legislation in the field of cultivation and processing of agricultural raw materials for biofuel production.

The third stage (since 2011) is characterized by the adaptation of Ukrainian legislation in the field of cultivation and processing of agricultural raw materials for biofuel production to the legislation of the European Union. Thus, the Order of the Cabinet of Ministers of Ukraine of August 3, 2011 approved the Action Plan for the implementation of obligations under the Treaty establishing the Energy Community which provides a number of measures to bring the legal framework on various issues

in the energy sector, including biofuels , to the requirements of the legislation of the European Union in specific terms.

At the third stage, there is a tendency to adopt program documents on the cultivation of agricultural raw materials, production and use of biofuels. Thus, the Resolution of the Cabinet of Ministers of September 12, 2011 approved the State Program for the Development of Domestic Production. It states that only about 1 million tonnes of conventional fuel are currently used as fuel, and a significant amount of biomass suitable for energy production is destroyed or taken to landfills. Priorities for the development of bioenergy are the creation of boilers for burning wood waste, straw-burning boilers, power plants using biogas dumps, retrofitting existing thermal power plants for burning household and industrial organic waste. It is also pointed out that in Ukraine recently the area under rapeseed for biofuel production has sharply increased, but no facilities have been created for own processing of such raw materials. There are concerns that over-exploitation of agricultural land by expanding the area under industrial crops may lead to depletion of their potential and loss of soil fertility. The main directions of development and stimulation of the use of renewable energy sources and alternative fuels by this Program are the improvement and dissemination of production of liquid biofuels and biogas, in particular from agricultural and forestry waste, household and industrial organic waste and other alternative fuels, including used plastic containers, as well as improving the regulatory framework to stimulate the use of energy in the industry from renewable energy sources and alternative fuels.

At the third stage, there is also an expansion of Ukraine's international cooperation in the field of agricultural raw materials and biofuel production. On October 25, 2011 a Memorandum of Understanding was signed between the Ministry of Energy and Coal Industry of Ukraine and the Ministry of Mining and Energy of the Federative Republic of Brazil in the field of biofuel production. Brazil is a world leader in the production of cane bioethanol, so the objectives of the Memorandum are to promote bilateral scientific, technical, technological, regulatory, administrative and commercial cooperation in the production of biofuels, including bioethanol. The parties to the Memorandum confirmed that there are many potential areas for investment in

biofuels for the public and private sectors, so Ukraine and Brazil will encourage companies located in their countries to invest in biofuels, including bioethanol.

On October 12, 2012, the Agreement on Cooperation in Agriculture was signed between the Ministry of Agrarian Policy and Food of Ukraine and the Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina, approved by the Order of the Ministry of Agrarian Policy and Food of January 18, 2013. According to Art. 2 of this Agreement, Ukraine and Bosnia and Herzegovina will develop mutual assistance and support of contacts between entrepreneurs in the field of plant growing, processing, agricultural and horticultural seed production, biofuel production and bioenergy. In order to deepen the adaptation of Ukrainian legislation to the legislation of the European Union, the Order of the Cabinet of Ministers of Ukraine of 19 June 2013 approved the Action Plan for the implementation of Directive 2001/77 / EC and Directive 2003/30 / EC. indicative task and ensuring the introduction on the market of a minimum percentage of biofuels and other alternative fuels, hold public hearings on the possibilities of using biofuels and other alternative fuels, prepare reports for the Secretariat of the Energy Community on measures taken to promote biofuels or other alternative fuels in order to replace diesel or gasoline for transport, possible volumes of biomass that can be used for the production of fuel for non-transport, prepare information on renewable energy sources suitable for biofuel production fuel for transport in order to ensure the formation of the market for biofuels and raw materials for its production.

Following the adoption of Directive 2009/28 / EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources of energy, which amends and subsequently repeals Directives 2001/77 / EC and 2003 / 30 / EU, Ukraine adopted the Order of the Cabinet of Ministers of Ukraine "On approval of the action plan for the implementation of Directive 2009/28 / EC of the European Parliament and of the Council" of September 3, 2014. According to the Plan, it is declared necessary to develop and publish a methodology for calculating GHG emission reductions for biofuels and bioliquids, to develop technical requirements for the production and use of biofuels and bioliquids with GHG emission

reductions starting from January 1, 2017. 50 percent, and from January 1, 2018 - at least 60 percent for biofuels and bioliquids produced at plants commissioned after January 1, 2017, to develop sustainability criteria for liquid and gaseous fuels produced from biomass and used in transport, as well as for liquid fuels produced from biomass and intended for energy use other than transport.

At the research stage, the state also states investment support for the cultivation and processing of agricultural raw materials for biofuel production. In particular, the Law of Ukraine "On Stimulating Investment Activity in Priority Sectors of the Economy to Create New Jobs" of September 6, 2012 defines the basics of state policy in the investment sphere during 2013-2032 to stimulate investment in priority sectors. Priority sectors of the economy are those aimed at meeting the needs of society in high-tech competitive environmentally friendly products, high-quality services that implement state policy on the development of production and export potential, job creation. According to the Order of the Cabinet of Ministers of Ukraine "On approval of the list of priority sectors of the economy" of August 14, 2013, such priority sectors of the economy include agro-industrial complex in the field of biofuel production, focusing on import substitution.

An important act for the development of agricultural raw materials for biofuel production is the adoption of the Strategy for the development of the agricultural sector for the period up to 2020, approved by the Order of the Cabinet of Ministers of Ukraine of October 17, 2013. The Strategy states that the agricultural sector of Ukraine is system-forming in the national economy, forms the basis for preserving the sovereignty of the state – food and within certain limits economic, environmental and energy security, ensures the development of technologically related sectors of the national economy and forms socio-economic foundations rural areas. According to the Strategy to ensure the development of the agricultural sector, priority will be given to support the food and processing industries - by stimulating the production of new products (bioethanol, rapeseed and soybean oil), alternative energy production, especially biofuels from crops not used for food purpose and animal feed.

One of the starting points of the third stage was the ratification of the Association

Agreement between Ukraine, on the one hand, and the European Union, the European Atomic Energy Community and their Member States, on the other hand. Chapter 5 "Economic and Sectoral Cooperation" of the Association Agreement provides for cooperation between Ukraine and the EU in the field of energy, in particular, in the field of development and maintenance of renewable energy, taking into account the principles of economic feasibility and environmental protection, as well as alternative fuels, sustainable production of biofuels and cooperation in the field of legal issues, certification and standardization, as well as technological and commercial development.

The program documents of the third stage also include the National Renewable Energy Action Plan for the period up to 2020, approved by the Order of the Cabinet of Ministers of Ukraine of October 1, 2014, which contains a section "Bioenergy". It states that the bioenergy sector in Ukraine has perhaps the greatest potential for development, due to the peculiarities of the climate, the potential of the agricultural sector and the availability of the necessary labor force. The Plan states that the greatest energy potential in Ukraine has such types of biomass as crops, wood waste, liquid fuels from biomass, the biological component of solid waste, biogas. However, the realization of the existing potential of bioenergy is complicated by the lack of infrastructure and raw materials needed to ensure uninterrupted supply of raw materials, low level of development of equipment suppliers, as well as low generation of each individual facility. As a result, the dynamics of electricity production from biomass lags behind the generation of electricity from other renewable energy sources. However, the Plan states that the use of biomass can become an important component in the balance of heat production, with the introduction of stimulating tariffs for heat generation from renewable energy sources and the development of the energy biomass market in Ukraine.

Green energy is now evolving faster than ever before. And not only because it is ecological and it is necessary to save the planet, but first of all because it is a way to energy independence of the countries.

Solar, wind, various types of biofuels, etc. have become familiar to us. Although

their share in the total generation is not so great. However, the world is beginning to use another type of fuel - hydrogen. It is environmentally friendly and, moreover, is the most common element in nature. Hydrogen is made from water using electricity.

Hydrogen can run cars, yachts, planes; it can be used instead of natural gas in industry and to heat homes; it can be used to generate electricity and be used as a high-capacity battery.

The prospect of a new type of energy is evidenced by the fact that a special term was even coined for it – the hydrogen economy.

Ukraine can produce up to 8 billion cubic meters of biomethane per year. Given the volume of its own gas production at the level of 20 billion cubic meters, this will almost completely provide the population and industry with their own natural gas.

The total consumption of natural gas in Ukraine is about 30 billion cubic meters. Now the part of the gas that is not enough is being compensated by the Russians. But it is imported from EU countries (Slovakia, Hungary, Poland).

Using biomethane together will allow Ukraine to gain energy independence. This requires the delivery of this "green" gas to millions of consumers. That is why the Regional Gas Company together with the Bioenergy Association of Ukraine have started preparing gas distribution networks to work with biomethane.

Raw materials for biomethane are waste from the agricultural sector. Ukraine has the largest area of agricultural land in Europe, so the potential for its production is great.

Experts of the Bioenergy Association of Ukraine estimate its production at 7.8 billion cubic meters per year. This is 25% of the total natural gas consumption in Ukraine.

Biomethane is a gaseous fuel derived from biogas with a methane concentration of 95-98%. Enriched biomethane is no different from natural gas, so it can be transported and used with minimal infrastructure upgrades. Biomethane has the advantages of natural gas, while remaining carbon neutral.

Most biomethane in Ukraine can be generated from cereal straw, which usually remains in the fields after harvest.

Experts of the Bioenergy Association of Ukraine estimate the potential of biogas from these raw materials at 3.8 billion cubic meters, from corn silage – 2.7 billion cubic meters, from other livestock and processing waste – 1.3 billion cubic meters.

Most biogas plants in Ukraine now use livestock waste or sugar beet pulp as raw material. The potential for crop residues and maize silage remains untapped.

Biomethane is an analogue of natural gas. This allows the use of gas distribution networks and a powerful gas transportation infrastructure without significant modernization. In contrast to "green" hydrogen, the transportation of which requires large-scale investments in network modernization.

The developed network of gas pipelines allows to connect biogas plants focused on raw material sources and to deliver energy to a large number of consumers, regardless of the weather and season. All this makes biomethane quite attractive to fuel compared to other environmental energy sources - such as wind or sun.

According to UABIO, as of 2020, there were 27 biogas projects in Ukraine. This is 50% more than in 2019.

They are focused mainly on the production of electricity and its sale at a "green" tariff. As of January 2020, 19 biogas projects in Ukraine have received a "green" tariff.

However, after enrichment, biogas can be used as an environmentally friendly alternative to natural gas by running it on the grid.

The law "On the natural gas market", which was adopted in 2015, allows the pumping of biogas into the network, but provided that it "in its physical and technical characteristics meets the regulations on natural gas." However, in the current legislation of Ukraine there is no mechanism for verification of biomethane to ensure its further supply to the gas transmission system and there is no definition of "biomethane". That is why the Verkhovna Rada on September 9, 2021 in the first reading supported the bill №5464 on the development of biomethane production.

The cost of biomethane in Ukraine has long been higher than natural gas. This created barriers to market development. Rising natural gas prices make it advantageous to supply biomethane directly to consumers.

Natural gas in recent years has cost, on average, \$ 200-300 per thousand cubic

meters. It's only literally the last few months that its price has gone up. The price of up to 700-750 dollars per thousand cubic meters is forecast for September. The cost of biomethane in Ukraine is from 600 to 700 dollars per thousand cubic meters. Therefore, when gas was cheap two or three years ago, it made no economic sense to replace it with biomethane.

The Regional Gas Company has recently started preparing gas distribution networks in Vinnytsia, Khmelnytsky and Chernihiv oblasts for the use of biomethane. This is the first such project in Ukraine.

In the framework of cooperation with the Bioenergy Association of Ukraine, four biogas plants are planned to be connected to the gas distribution network. The total capacity of the plants is about 50 million cubic meters of gas per year.

Access to the gas distribution system will allow biomethane production to realize its full potential. Our task is to ensure effective quality control of "green" gas and a mechanism of guaranteed gas supply in case of theoretically possible interruptions in biomethane supplies. Innovations will not affect consumers.

In Vinnytsia oblast, the GDN operator is preparing to connect two biomethane projects with a total capacity of about 20 million cubic meters of gas per year, which operate on poultry waste.

In Khmelnytsky and Chernihiv oblasts, two plants can generate about 30 million cubic meters of biomethane.

There are no technical or legal obstacles to the connection of biogas plants to gas distribution networks.

The law stipulates that biogas brought to the quality of natural gas can be pumped into the network. According to the same norms as the natural gas producer. No additional mechanisms are required.

They can quickly install equipment to clean biogas from CO₂. This is a commercial technology that is designed and installed in a few months. Biogas plants for methane production can be re-equipped in a maximum of six months. This costs about 20% of the cost of the biogas plant.

While maintaining the high price of natural gas, the biomethane market will

develop in Ukraine even without subsidies from the state. But even if the price decreases, potential consumers in market conditions can be export-oriented enterprises. For example, metallurgists.

After all, a significant part of the metal is exported to Europe, where from 2023 it is planned to introduce a tax on carbon footprint.

If the metal is produced in the traditional way, you will have to pay this tax at the border. If biomethane is used instead of natural gas for steel production, no tax is required. Exporters will be interested in "greening" their production so as not to pay additional taxes. They will be willing to pay a higher price for biomethane than for natural gas

The EU is a world leader in biomethane production. First of all, through the approved course to reduce carbon emissions. After all, when burning biomethane, the natural balance is not disturbed.

Today, biomethane production in Europe already exists in 18 countries. The sector is developing rapidly. In 2019 alone, biomethane production in the EU increased by 16% compared to the previous year (the largest increase since 2014).

Germany remains the leader in the European biomethane market, with about half of European biomethane produced at 200 plants.

In recent years, countries such as France, the Netherlands, Denmark, and Italy have led in the pace of development.

Biogas production is possible at agro-industrial processing plants. Waste in the form of bards, molasses, manure, straw can be processed in modernized distilleries and sugar factories.

According to Shevchuk G.V. it is quite necessary at present to modernize sugar factories focused on biogas production with further in-depth modernization to create alcohol production (Fig. 1) [157].

Creating a kind of production cluster based on sugar in the direct sugar plant, biogas plant, thermal power plant and distillery will allow:

- reduce the cost of sugar production because through the use of its own biogas you can give up expensive natural gas;

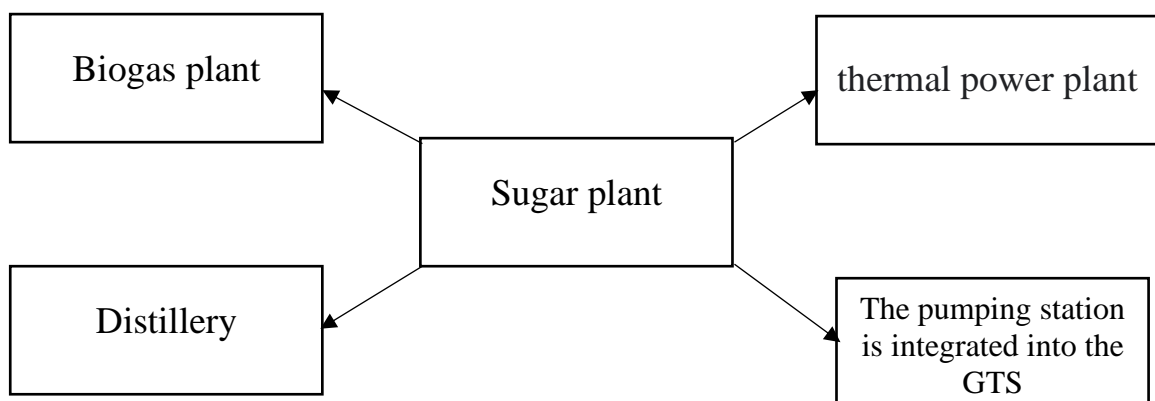


Fig. 1. Schematic diagram of a production cluster based on a sugar factory

Source: [157]

- to process waste from sugar factory (molasses and pulp) and alcohol (bard) for biogas and some waste from crop products (straw, husks, etc.);

- reduce the cost of alcohol production through the use of excess thermal energy from its own thermal power plant;

- to minimize wastewater pollution from alcohol and sugar production of the environment.

- to provide agricultural enterprises with high-quality organic fertilizer - digestate (the use of which will increase the yield of agricultural crops, including sugar beet and sunflower) [157].

Research of Kaletnik G.M. on the implementation of operating biogas plants on crop and livestock waste in households of Ukraine, is relevant and economically feasible. Biogas plants for processing animal manure are available the simplest and widely used throughout the world. Using biogas plants not only helps to solve the problems of agrochemistry, agriculture and energy. G.M. Kaletnik states that the introduction of biogas plants in households (as well as in agricultural enterprises) will allow in the future to achieve energy independence of rural areas and Ukraine as a whole. [158, p.18]

Development of production and consumption biofuels in Ukraine, whose economy is 80% depends on the import of petroleum energy, is relevant and strategically important. According to Kaletnik G.M. needed as a country that owns

huge potential of the raw material base for the production of biological fuels, to do so at the state level and scale [159, p. 174].

Today in Ukraine adopted the Law of Ukraine "On Amendments to Some Laws of Ukraine on the Development of Production and Consumption of Biomethane" is designed to create a legal basis for the development of the biomethane market in Ukraine and replacement of natural gas with biomethane in electricity and heat production [160].

As of January 1, 2021, there are 53 plants in Ukraine that produce energy from biogas and operate at a "green" tariff. The total electric capacity of these plants is 103.4 MW.

According to the National Renewable Energy Action Plan until 2020, the expected capacity of biogas by the end of 2020 should have been 290 MW, and therefore the expected implementation of the plan is only 36%. Thus, the pace of development of the electricity sector from biogas can be considered insufficient.

The total gross production of biogas in 2020 is estimated at about 100 million nm³ / year, and only 34% of the energy potential of this biogas is converted into useful electricity (156 GWh) and heat (128 TJ) energy.

Increasing the economic attractiveness of biogas projects is possible due to the useful consumption of thermal energy produced in cogeneration plants, in addition to the own needs of biogas plants. However, linking biogas projects to raw material sources, which are mainly manure, manure and corn silage, does not allow to find the required amount of heat in the immediate vicinity of the consumer during the year, and its creation may require additional investment in the project. can always be satisfactory.

The decision on the possibility of the fullest use of biogas energy may be the spatial separation of biogas generation and generation of electricity and heat from purified biogas (biomethane). One of the rational ways of such a solution is to supply biomethane to the gas transmission or gas distribution system, followed by its use in any place where there is a connection to the gas pipeline and where there is a heat consumer.

To date, biomethane is not produced in Ukraine. The main reason for this is the

lack of economic and legislative prerequisites, in particular the lack of a register of production and consumption of biomethane.

According to the second paragraph of the first part of Article 19 of the Law of Ukraine "On Natural Gas Market" and paragraph 2 of Chapter 3, Section I of the Gas Transmission System Code, approved by the NCRECP of 30.09.2015 № 2493, registered in the Ministry of Justice of Ukraine producers of biogas or other types of gas from alternative sources have the right to access gas transmission and distribution systems, gas storage facilities, LNG installations and to connect to gas transmission and distribution systems, subject to technical and safety standards in accordance with the law and provided that biogas or other types of gas from alternative sources in their physical and technical characteristics meet the standards for natural gas.

Thus, purified biogas, which in European practice is called "biomethane", is technically possible to submit to the gas transmission or gas distribution system, and the producer of purified biogas will be considered an independent producer of natural gas in the unregulated segment.

However, in the current legislation of Ukraine there is no mechanism for verification of biomethane to ensure its further supply to the gas transmission system and there is no definition of "biomethane".

The lack of a state mechanism for the development of the biomethane market is a barrier to the introduction of modern technologies for efficient use of biogas energy potential, which are actively developing in EU countries, which in turn reduces the rate of job creation, taxes and other fees to the state treasury. reduces the likelihood that Ukraine will meet its international commitments to reduce greenhouse gas emissions under the Paris Agreement, the goals of Ukraine's Energy Strategy until 2035, inhibit innovation, economic decarbonisation and sustainable development.

The mechanism proposed in the draft act to guarantee the origin of biomethane and the possibility of connecting biomethane to gas transmission and distribution systems will expand the capacity of biomethane producers to sell electricity and heat directly to consumers, and as a result increase energy efficiency of biogas. also increase the economic attractiveness of biogas projects for potential investors.

The issue that is proposed to be resolved as a result of the adoption of the regulatory act is important and cannot be resolved through market mechanisms, as it requires regulatory regulation.

Accordingly, the improvement of state regulation of economic entities engaged in biogas production is possible through the adoption of state standards that would establish mandatory requirements for biogas production, as well as state building codes governing the construction of biogas plants.

To date, the Law of Ukraine "On Amendments to the Law of Ukraine" On Alternative Fuels "for the Development of Biomethane Production" No. 5464 of 05.05.2021 has been adopted in the legal field. The law has solved two main tasks:

1. Introduces into the legislative field of Ukraine the definition of the term "biomethane" - a biogas that in its physical and technical characteristics meets the regulations on natural gas for supply to the gas transmission and distribution system or for use as motor fuel;

2. Creates the "Biomethane Register" – an electronic system of accounts designed to register the amount of biomethane submitted to the gas transmission or gas distribution system and selected from the gas transmission or gas distribution system, as well as to form guarantees of biomethane origin, their transfer, distribution or cancellation and cancellation biomethane [161].

In order to ensure food security in Ukraine, in our opinion, restrictions should be imposed on the use of biomass for food production. In particular, Art. 1 of the Law of Ukraine "On Alternative Fuels" of January 14, 2000 to add a new paragraph as follows: "non-food biomass - non-compliance of biomass with the established criteria of quality and safety, for food purposes and for the production of biofuels, and the use of which for the production of biofuels does not reduce the food security of the state. " In accordance with Part 4 of Art. 8 of the Law of Ukraine "On Alternative Fuels" of January 14, 2000, economic entities, as a result of which biomass is formed, are obliged to keep records of such biomass in the manner prescribed by the Cabinet of Ministers of Ukraine. As it is not currently adopted, we believe that its adoption should provide that economic entities, as a result of which biomass is formed, are obliged to keep

separate records of biomass for non-food purposes, and use it as a priority for biofuel production. . Why Part 4 of Art. 8 of the Law of Ukraine "On Alternative Fuels" of January 14, 2000 shall be worded as follows: in accordance with the procedure established by the Cabinet of Ministers of Ukraine ". In our opinion, such amendments to the legislation will prevent the deterioration of food security in Ukraine and will promote the use of biomass for the production of second-generation biofuels.

Crop products that are subject to legal relations for the cultivation and processing of agricultural raw materials for the production of biofuels also include energy crops such as miscanthus, poplar, willow, and others that are grown specifically for the production of second-generation biofuels. In Ukraine, the cultivation of energy crops for biofuel production is at an early stage, which is also affected by the lack of proper legal regulation. In particular, there is no list of crops that are considered energy, the definition of their concept, the features of state support for their cultivation. Ukraine's energy strategy for the period up to 2030 indicates only that crops have the greatest energy potential in Ukraine, without naming any energy crops among them.

In general, energy crops are divided into three groups:

- a) woody plants of rapid rotation (poplar, willow);
- b) annual cereals (millet, sugar sorghum);
- c) perennial plants that grow quickly (miscanthus, switchgrass).

According to experts, plants intended for the production of second-generation biofuels have high energy productivity and do not pose a threat to traditional agriculture, which reduces the risk of food security. In Ukraine today, only energy willow, poplar and miscanthus are grown. According to experts, miscanthus is a perennial rhizome herb that can be harvested annually for fifteen years or more after a single planting, which is fast growing and resistant to low temperatures, has little need for water. Energy willow is a tree-like densely growing crop, which is a shrub or bush-like tree, has a large number of shoots, which are quite easy to propagate. The degree of depletion of willow is 3-5 times lower than that of cereals, in addition, about 60-80% of nutrients are returned to the ground with fallen leaves. It can grow on different types of soils, wetlands and unproductive lands. Poplar is also a perennial tree-like

energy crop, resistant to pests, can grow on poor soils and contaminated lands, but it is less hardy than willow, requires virtually no pesticides or fertilizers.

In our opinion, in order to intensify the activity of growing energy crops, the Law of Ukraine "On Alternative Fuels" of January 14, 2000 should provide for the term "energy crops". However, the introduction of a new term should not be an end in itself, but should facilitate the interpretation of the content of legal relations that arise between the subjects in relation to a particular object. In addition, the term must accurately refer to the corresponding concept, which in turn should reflect the specific, legally significant, features of the phenomenon being defined. Therefore, to define the concept of energy culture, you should refer to the specialized literature. Thus, energy crops are proposed to mean plants that require low-cost cultivation and are used to produce biofuels, such as bioethanol, or are burned to produce electricity or heat.

According to other experts, energy crops are plants that are grown for use directly as fuel or for biofuel production.

European Union legislation in the framework of the EU's Common Agricultural Policy (CAP) also provides for the concept of energy crops. Chapter 5 of the EU Council Regulation № 1782/2003 "On establishing common rules for direct support schemes under the common agricultural policy and establishing separate support schemes for farmers and amending the EEC Regulation" of 29 September 2003, energy crops means crops grown for energy products: biofuels, within the meaning of paragraph 2 of Art. 2 of Directive 2003/30 / EC, and electricity and heat produced from biomass.

Analyzing the above definitions of energy crops, the following features of energy crops should be identified:

- 1) are grown specifically for energy purposes;
- 2) used for the production of biofuels or electricity and heat;
- 3) is biomass.

In our opinion, these features of energy crops are enough to highlight a separate term in the legislation of Ukraine. Thus, energy crops are industrial crops specially grown for the production of biofuels, electricity and/or heat. In our opinion, such a

definition of energy crops should be provided in Art. 1 of the Law of Ukraine "On Alternative Fuels" of January 14, 2000. In addition, the issue of improving the legal regulation of energy crops through the introduction of economic and legal mechanism to stimulate such cultivation through subsidies, as well as partial state interest on loans will be discussed in the following sections.

Among the objects of legal relations concerning the cultivation and processing of agricultural raw materials for the production of biofuels should also be distinguished products and wastes of livestock and fisheries. Such facilities include manure and other wastes from agricultural producers growing animal products, as well as algae. The production of biofuels from algae belongs to the third generation, and it is under experimental development. Algae are the fastest growing plants in the world, have a record amount of oil, and are a non-food biomass. It is believed that algae can produce both bioethanol and biogas and biodiesel. The importance of developing third-generation biofuels is also recognized in Ukraine. The concept of a new stage of the targeted comprehensive research program of the National Academy of Sciences of Ukraine "Biomass as a fuel raw material" ("Biofuels"), among other priority measures to develop biofuel production is the formation of new strains of microorganisms, fungi and algae, microbiological as well as the development of their resource genetic base. However, if livestock products and wastes are actually used in Ukraine for biogas production, the technologies of using algae for biofuel production are only being implemented.

Peculiarities of legal relations on cultivation and processing of agricultural raw materials for biofuel production determine their content, a subjective legal rights and obligations of entities engaged in cultivation and processing of agricultural raw materials, which express the specific inherent in the legal relationship as a special form of actual social relations.

In our opinion, the subjective legal right in the field of cultivation and processing of agricultural raw materials for biofuel production is enshrined in law or contract and guaranteed by the measure of permissible behavior, which provides the authorized subject of agrarian relations a set of legal opportunities and means allow to meet the

needs in the field of cultivation and processing of agricultural raw materials for biofuel production. A subjective legal obligation in this area is a measure of necessary behavior enshrined in law or contract, which is attributed to the subject of agrarian relations in relation to the cultivation and processing of agricultural raw materials for the production of biofuels.

The complexity of the legal relationship regarding the cultivation and processing of agricultural raw materials for the production of biofuels necessitates the classification of subjective rights and obligations of their subjects. In particular, rights and responsibilities should be divided into general and special.

The general ones should include land, property, organizational and managerial, environmental and others. The rights and obligations belonging to these groups are contained in the norms of agricultural, land, civil, economic, environmental and other legislation, and are general in nature because they are characteristic of many subjects of agricultural production. These include, for example, the right to manage the land independently, to dispose of products and income independently, the right to enter into contractual relations with any legal entity and individuals, the obligation not to harm the environment and others. In our opinion, special rights and responsibilities include those that are specific only to the subjects of legal relations in the field of cultivation and processing of agricultural raw materials for the production of biofuels. These include: the obligation to grow agricultural raw materials for the production of biofuels that do not reduce the food security of the state; adhere to the criteria of sustainability in the cultivation of agricultural raw materials for biofuel production; the obligation of economic entities, as a result of which the biomass used for biofuel production is formed, to keep records of such biomass in accordance with the procedure established by the Cabinet of Ministers of Ukraine; the obligation to reduce greenhouse gas emissions from the cultivation and processing of agricultural raw materials; adhere to environmental regulations.

A clear list of rights and responsibilities of economic entities and the consolidation of the mechanism of their implementation is one of the criteria for guaranteeing the right to free business. In this regard, in her opinion, it is expedient to

enshrine in a single legislative act general approaches to the powers of agricultural producers in the field of commodity agricultural production, and in legislation governing certain types of commodity agricultural production, by amending the rights and responsibilities depending on the specific activity.

However, in our opinion, the enshrinement in legislation of the list of rights and obligations does not contribute to the legal certainty of the relationship to be settled, but on the contrary, the creation of such lists may lead to conflicts in the law. Rights and responsibilities should be formulated by establishing a specific rule of conduct, the result of which is the emergence of the rights and responsibilities of the subjects for whom it is intended. This approach will help improve the quality of legislation, prevent conflicts in the settlement of legal relations, including relations on the cultivation and processing of agricultural raw materials for biofuel production. Therefore, given the above material, the following conclusions should be drawn and suggestions made:

Subjects of agrarian law that enter into legal relations concerning the cultivation and processing of agricultural raw materials for the production of biofuels are economic entities of various organizational and legal forms, as well as public authorities and local governments exercising statutory powers in the field of cultivation and processing of agricultural raw materials for biofuel production.

Entities of legal entities entering into legal relations for the cultivation and processing of agricultural raw materials for biofuel production should be classified according to the criterion of the method of establishing and forming the statutory fund into cooperatives, corporate and unitary, and according to the criterion of scope - carry out cultivation of agricultural raw materials for the production of biofuels, entities that provide services in the field of cultivation and processing of agricultural raw materials for the production of biofuels, and entities that process agricultural raw materials and produce biofuels.

In order to establish energy cooperatives in Ukraine for the cultivation and processing of agricultural raw materials for biofuel and energy, the Law of Ukraine "On Cooperation" of July 10, 2003 should be amended and the procedure for establishing and operating an energy cooperative as a special type of cooperative. It is

proposed to recognize individuals and legal entities as members of such a cooperative, to provide for the possibility of providing services and selling goods by such a cooperative not only to its own members but also to others, and the cooperative must carry out these activities for profit.

Thus, the formation of a clear mechanism of state regulation of the bioenergy market with the help of modern tools, methods and systems of legal regulation will achieve the effective functioning of the bioenergy market. However, state regulation of the market is carried out mainly through a system of laws and regulations.

Criteria for the sustainability of biofuels should be enshrined in Ukrainian legislation, in particular, criteria for reducing greenhouse gas emissions, biomass sustainability and social sustainability of biofuels.

The application of the criterion of reducing greenhouse gas emissions in Ukraine should include the creation of technical requirements for the production and use of biofuels with the reduction of greenhouse gas emissions, the development of which should involve the Ministry of Ecology and Natural Resources.

To implement the criterion of biomass sustainability in Ukraine, it is proposed to establish a ban on growing raw materials for biofuel production on lands included in the ecological network, except as provided by law, and to establish responsibility for such actions by supplementing the Code of Administrative Offenses of Ukraine with Article 915 as follows: "Growing biomass for the production of biofuels on the lands of nature reserves, biosphere reserves, wetlands and peatlands, entails the imposition of fines on citizens from nine to twenty-four tax-free minimum incomes and officials - from fifteen to three to fifteen non-taxable minimum incomes of citizens ".

The criterion of social sustainability of biofuels in the current legislation of Ukraine provides for the obligation of producers and processors of biomass to comply with land, environmental and labor legislation.

It is proposed to introduce criteria for the sustainability of biofuels by supplementing the Law of Ukraine "On Alternative Fuels" of January 14, 2000, Art. 6-1 of the following content:

Article 6-1. Sustainability criteria for liquid fuels from biomass and biogas

intended for use in transport.

Liquid fuel from biomass, as well as biogas intended for use in the field of transport, produced and/or sold in the customs territory of Ukraine, must meet the sustainability criteria set out in parts two, three and four of this article.

Production and/or sale of liquid fuel from biomass, as well as biogas intended for use in transport, must ensure a reduction in greenhouse gas emissions of at least 50% from January 1, 2018, if these biofuels are produced at facilities put into operation until October 5, 2015 inclusive, and not less than 60%, if these types of biofuels are produced at plants put into operation after October 5, 2015. The method of calculating the reduction of greenhouse gas emissions must be approved by the central executive body, which ensures the formation and implementation of state policy in the field of environmental protection and environmental safety.

At the present stage, it is necessary to improve the quality of Ukraine's environmental policy in this area, namely to increase the share of green energy in the economy through dialogue and achieving the optimal level of public-private partnership (communication). Despite some progress in reform and all attempts to optimize the legislation governing alternative energy, this sector of the legal framework remains spontaneous, incomplete and unsystematic. After all, if we compare the legal framework of the EU and Ukraine, the declared legal documents in our country are not supported by practical steps.