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ЕКОНОМІКА ПРИРОДОКОРИСТУВАННЯ І ОХОРОНИ НАВКОЛИШНЬОГО СЕРЕДОВИЩА

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STRATEGIC POTENTIAL OF BIOMASS IN UKRAINE – GUARANTEE OF THE STATE'S ECONOMIC DEVELOPMENT ©

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The article deals with the modern aspects of biomass use; the prospects of its use have been analyzed and the ways of improving the country's energy situation have been circled. The strategic directions, the implementation of which would assist in eliminating the crisis phenomena in the fuel and energy complex, have been developed and the energy security of Ukraine at the stage of switch to the sustainable economic development through the introduction of environmentally friendly innovative technologies have been grounded.

The state of the institutional environment of Ukraine's agrarian sector in the context of increasing its competitiveness on the European and world markets has been analyzed, and the obligatory measures for satisfying the demands of the rural development in Ukraine by the means of bioenergy have been offered.

The author's approach to applying the model of Ukraine's current agro-industrial production in the process of researching socio-economic processes in rural areas has been formed.

The essence, advantages and disadvantages of bioenergy development have been determined, realistic goals and scenarios of biomass production in Ukraine have outlined.

Key words: alternative energy sources, biomass, biofuels, energy security, energy efficiency, green economy, sustainable development, strategic development.

Fig. 1. Tabl. 6. Lit. 10.

Problem Statement. The significant energy intensity of the Ukrainian economy, the unjustifiably high proportion of natural gas in the energy balance, the directives and requirements of the European Union, as well as a number of international organizations, cause changes in the economy, first of all, its stabilization and sustainable development.

Nowadays economically developed countries of the world are trying to combine the solution of economic and environmental problems through active activities within the framework of implementing the sustainable development concepts and, in such a way, green economy. The doctrine of the green economy is considered as a system of long-term actions, detailing resource capabilities, justification of the importance of the "green growth", the economy of countries and the formation of favourable business environment both at the state and regional levels. Implementation of the relevant actions is aimed at forming a stable economic system oriented to ensure the "green" development of the economy of the country and its regions.

Previous Researches and Publications. Such researches as H. Heletukha, D. Hrechaniuk [7], D. Gelashvili, T. Zinkevych [5] G. Kaletnik [6], S. Kvasha, I. Kyrylenko, E. Kirieieva [1], V. Kravchuk, Z. Liulchak [7], G. Rosenberg, D. Taylor, A. Shpykuliak, I. Shuvar [10] and others devote their scientific works to the study of theoretical and practical aspects of the renewable energy sources' use, including problems of the alternative energy development's efficiency and expediency. It should be noted that all these studies are more generalized and deals with the disclosure of the concepts of innovative environmental production at the national level and, moreover, at the international and global levels. However, not enough attention has been paid to researching the possibilities of using non-traditional energy sources taking into account the specificity of the national economy of Ukraine.

The Aim of the Article. Develop urgent steps towards improving the energy situation in Ukraine, reducing its energy dependence, implementation of which would contribute to the the sustainable development of bioenergy and provide additional opportunities for agriculture.

The Essence of the Article. Ukraine occupies the 87th position among the countries of the world according to the Environmental Quality Index, with 1.2 million tons of waste on its territory, of which about 75% belongs to the 3rd class danger. According to the level of water use, it takes the 95th place among 122 countries of the world, and the level of technological load in the country as a whole is 4-5 times higher than similar indicators of another countries. Objectively, the Ukrainian economy is now uncompetitive, so its ecologization is necessary - the transition to renewable energy sources, the introduction of "green" technologies and a rational approach to the use of resources [7, p. 12].

Under the current circumstances, Ukraine must make a choice: either to continue to exhaust and pollute the natural resources or to choose a path that satisfies the needs of the present, and takes into consideration the needs of future generations.

We need to agree on the introduction of a new concept of "sustainable development", which will involve the coordination of the three components – the economic, environmental and social spheres. Now it is possible to distinguish a number of concepts of the country's economic development (Table 1).

Table 1

Concepts of the country's economic development

Name	Essence
Brown economy	Economic growth without taking into account the environmental safety, depletion of the available natural resources and environmental pollution.
Sustainable development	The development of the society that satisfies the needs of the present generation without making damage to the opportunities of future generations to satisfy their own needs.
Green economy	Optimized use of irreplaceable, complementary each other natural and human resources, taking into account interests of the whole society.
Blue economy	The evolution of the economy is generated by the environment, focused on process management, job creation.

Source: developed by the author on the basis [2, 7]

One of the most important means of enhancing Ukraine's energy security is the biomass use for energy needs. According to various estimates, Ukraine has a fairly high potential for biomass energy (Table 2).

Table 2

Energetic potential of biomass in Ukraine

Type of biomass	Energy potential, mln. t. / year
Straw of corns	5,6
Power plantations of willow, poplar, etc.	5,1
Stalks and corncobs for grains	2,4
Stalks and sunflower husks	2,3
Liquid fuel from BM (biodiesel, bioethanol)	2,2
Wood fuel, wood waste	2,0
Household wastes as fuel	1,9
Biogas from manure and organic waste	1,6
Peat	0,6
Biogas from waste landfill в	0,3
Biogas aeration stations and other treatment plants	0,2
Total	24,2

Source: developed by the author on the basis [10]

Analyzing the data in Table 1, we can conclude that the main components of the potential are agricultural waste and energy crops. Among the agricultural waste, the largest economic potential belongs to sunflower seed production (stalks, baskets, husks), then comes corn waste (grain stalks, leaves, roots). Straw of corns and rape straw occupy the third and fourth places, respectively. The economic potential of energy crops is even greater than agricultural waste. It includes not only biomass of crops, but also as in the case of rape and maize, it is also included in the volume of biodiesel (plus straw) and biogas.

Therefore, we have described in detail the main alternative energy sources that are very promising for Ukraine (Tables 3-5).

Table 3

Potential biodiesel (oilseeds)

RAW	AVAILABILITY OF BIOMASS			THE MAXIMUM ALLOWABLE BIOMASS POTENTIAL		
	available planting area, thousand hectares	Gross harvest, thousand tons	The resulting energy mln.t.c.l.	Scientifically based sown area, thousand hectares	The expected yield, thousand tons	Possible potential energy obtained, mln.t.c.l.
Rape	1013	1873	0,78	2500	6000	1,2
Sunflower	4192	6363		2500-2700	4500	
Soybean	622	1043		1500	3000	
Total	5827	9279	0,78	6600	13500	1,2

Source: developed by the author on the basis [9]

The problem of effective processing and burning biomass still stays actual in the world. This is explained by the fact that biomass is a low-grade product of a lubricating oil with a high fat content (up to 85%), has a low energy density and heat dissipation and non-uniformity of fractional composition. Therefore, for the spontaneous combustion of biomass, there is low efficiency that prevents formation on their base oil stable energy system. Among the well-known technologies of utilization of organic waste, the pyrolysis and gasification are attractive what allow the release of low price sustainable energy supplies. This determines the economical feasibility of a low level of development.

Table 4

Potential bioethanol production (sugar and starch crops)

RAW	AVAILABILITY OF BIOMASS			THE MAXIMUM ALLOWABLE BIOMASS POTENTIAL		
	Cultivation areas, thousand hectares	Number Try raw thousand tons	Received energy million, mln.t.c.l.	Research grounded sown area thousand hectares	Expected number obtained raw tons	Possible potential obtained energy, mln.t.c.l.
Corn for grain	2089	10486	2,33	2000-2200	11000	2,6
Wheat	7716	22342				
Wheat fodder	7853	23681				
Sorghum	15,4	335				
Sugar beet tops	319,7	10067		800	25000	
Sugar beet tops	x	10067		x	25000	
Molasses	x	380		x	850	
Total			2,33			2,6

Source: developed by the author on the basis [9]

However, we need to think about whether it is worth selling abroad what we have, in most cases, so molding or rotting? Is it better to use the nature that we have generously given to ourselves to increase our own energy capacities.

Power engineers and businessmen pay attention to the problem of enriching the resource of solid fuel at the expense of grown straw in the agrarian sector of the country requires a sensible, economically sound approach. If we consider straw only as an energy resource for combustion, one cannot leave aside at the current stage of the agriculture, which is one of the most important energy resources of the soil fertility of the country that is impoverished with nutrients. Moreover, besides the straw of grain crops, there are significant hidden reserves of energy resources.

In Ukraine, 4 million hectares of free agricultural land have remained uncultivated for decades. These are the worst lands, they are the least suitable for the traditional agriculture, but are very suitable for the cultivation of biomass [10, p. 112]. On this occasion early Chinese farmers came up with an exact statement that is relevant to our present: "The dull is grown by weeds, the clever harvests the crop, and the wise cultivates the land" [10, p. 110].

The development of domestic demand for biofuels is one of the important public goals of any country which has forest and agricultural biofuels. Ukraine is not an exception in understanding. This process

Table 5

Potential production of pellets and briquettes

RAW	THE VOLUME OF BIOMASS, MILLION TONES		POTENTIAL FOR ENERGY, MLN.T.C.L.
	ton	m^3	
1	2	3	4
Straw cereals	25		10,3
Straw rape	2,7		1,27
Potential energy crops (miskantus, willow, acacia, alder, shevnat other fast-growing annual and perennial crops)	16,5		14,58
Waste maize (stems, leaves, rods beginning)	9,8		5,7

1	2	3	4
Waste sunflower (stalks, husks, etc.)	6,7		4,27
Waste wood industry	0,5		0,37
Wood (Ahrolis)		0,36	0,12
Wood (forest community property)		0,57	0,19
Wood (Forestry State Committee)		7,9	2,69
Peat	1,84		0,77
Total			40,3

Source: developed by the author on the basis [9]

From these tables, the following conclusions can be drawn that biofuel production in general is a rather advantageous and necessary task. In our forests, field defense forests, in old gardens, running parks, old peat bogs it is clear to notice how many felled trees, dry branches and rot grass are there. And this is ecologically pure biomass and energy, which is so lacking in the population and the national economy.

Nowadays, only about 1 million tons of conventional fuel is used as biomass fuel, so a significant amount of biomass suitable for energy production is destroyed or taken to landfills. Ukraine belongs to countries with high bioenergy potential and growth rates of bioenergy [8, p. 74]. Based on current realities, the model of modern agro-industrial production in Ukraine has been proposed, which will become an important means of enhancing the state's energy security (Fig. 1).

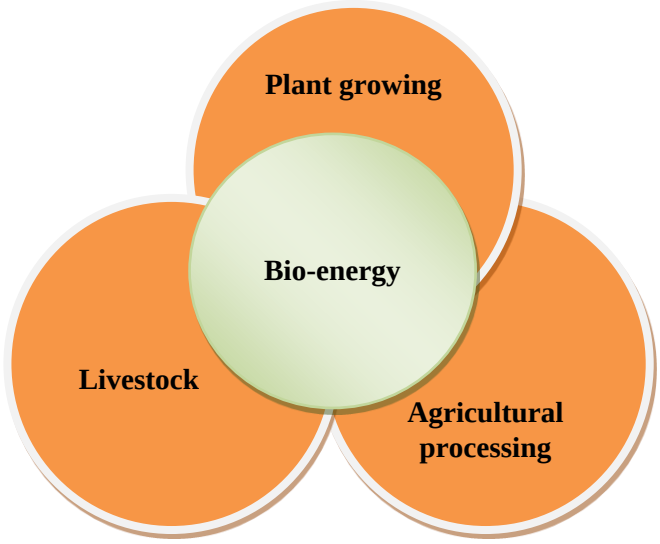

Figure 1. **Model of modern agro-industrial production**
Source: developed by the author

Taking into consideration Ukraine's potential in the quantity of raw materials for biomass production, our state has a good chance to take a leading position in the field of bioenergy.

Achieving of such goals is impossible without rapid increase of energy consumption of agrarian waste and biofuels from energy plantations (Table 6). Thus, this year it is necessary to solve all the problems that hinder the development of the bioenergy industry in Ukraine. Because this is a strategic issue, the solution of which directly affects the energy independence of our state.

Table 6

Prospects of bioenergy development in Ukraine

Opportunities:	Conclusions:
- supportive climatic conditions and sufficient amount of land resources; - biomass mainly for heating & biofuels; - electricity from biomass; - dynamical growth of oil crops production (first of all rape and soy); - high production possibilities of butyroid – lardaceous production at a time when deficient availability capacities; - large number of unused biomass; - incomplete development of legislative base, technical conditions, standards and norms; - long-term political unsteadiness in the past.	- rise of the bioenergy usage in the world is continually incremental and permanent process; - to follow the new rules of biofuel usage, world needs additional bioenergy sources; - investment appeal of Ukraine as all types of bioenergy producer raise each year; - political will in Ukraine is stable and consistent in renew energy sources for today; - permanently carry out the development of laws of biofuel production and standardization; - the first key question for today is agricultural and energetic spheres reference.

Source: Formed by the author by the synthesis of the materials

The development of bioenergy for the use of agricultural crops has its advantages and disadvantages. Prospects for bioenergy production as an alternative energy sector are possible only with the development of state regulation and financial and economic support. Creation of special state programmes on bioenergy development of the country.

The country's leadership should actively engage in the development of bioenergy in Ukraine. Then we will be less energy-dependent from other countries and improve our economic security. Waste wood, chemical production, processing of agricultural products, peat extraction, printing, food, and textile industries can be converted into high-quality fuel raw materials that can compete in the energy market.

Conclusion. In general, it should be noted that Ukraine has a great potential for biomass available for energy use. The main components of the potential are agricultural waste and energy crops. By involving this potential for energy production, about 13% of Ukraine's primary energy needs can be satisfied.

The use of biomass energy produced in rural areas can provide additional opportunities for rural development: increasing incomes of small and medium-sized commodity producers by growing energy crops and processing them on their own energy facilities; creation of new jobs in the countryside; increasing the volume of cheap, renewable energy resources to meet the needs of both rural households and the agro-food complex as a whole. However, the development of bioenergy also binds a number of new problems: rising food prices; increasing competition for land use in energy, food and feed crops; gepletion and degradation of soils; deforestation, etc. In this context, the indispensable condition for the development of European bioenergy is the observance by industry the criteria of sustainable development: reduction of greenhouse gas emissions at all stages of production; restrictions in the use of land (rich in biodiversity, high carbon content, peat lands); requirements of good business practice (rules for EU member states); social sustainability (issues of competition with food crops, possible negative impacts on working conditions, protection of land ownership rights, biosecurity, etc.)

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АНОТАЦІЯ
СТРАТЕГІЧНИЙ ПОТЕНЦІАЛ БІОМАСИ В УКРАЇНІ - ЗАПОРУКА ЕКОНОМІЧНОГО РОЗВИТКУ ДЕРЖАВИ

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У статті розглянуто сучасні аспекти використання біомаси, проаналізовано перспективи її використання, а також окреслено шляхи покращення енергетичної ситуації країни. Розроблено стратегічні напрями, реалізація яких сприяла б усуненню кризових явищ у паливно-енергетичному комплексі та забезпеченню енергетичної безпеки України на етапі переходу до сталого розвитку економіки шляхом впровадження екологічно чистих новітніх технологій.

Проаналізовано стан інституційного середовища аграрного сектору України в контексті підвищення його конкурентоспроможності на європейському і світовому ринках, та запропоновано заходи, які потрібно вжити для задоволення потреб сільського розвитку в Україні за рахунок біоенергетики.

Сформовано авторський підхід до застосування моделі сучасного агропромислового виробництва України у процесі дослідження соціально-економічних процесів у сільських територіях.

Визначено сутність, переваги та недоліки розвитку біоенергетики, встановлено реалістичні цілі та сценарії виробництва біомаси в Україні.

Ключові слова: альтернативні джерела енергії, біомаса, біопаливо, енергетична безпека, енергоефективність, зелена економіка, сталий розвиток, стратегічний розвиток.

Рис. 1. Табл. 6. Літ. 10.

АННОТАЦИЯ
СТРАТЕГИЧЕСКИЙ ПОТЕНЦИАЛ БИОМАССЫ В УКРАИНЕ – ЗАЛОГ ЭКОНОМИЧЕСКОГО РАЗВИТИЯ ГОСУДАРСТВА

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В статье рассмотрены современные аспекты использования биомассы, проанализированы перспективы ее использования, а также очерчено пути улучшения энергетической ситуации страны. Разработаны стратегические направления, реализация которых способствовала бы устранению кризисных явлений в топливно-энергетическом комплексе и обеспечению энергетической безопасности Украины на этапе перехода к устойчивому развитию экономики путем внедрения экологически чистых современных технологий.

Проанализировано состояние институционной среды аграрного сектора Украины в контексте повышения его конкурентоспособности на европейском и мировом рынках и предложены мероприятия, которые нужно употребить для удовлетворения потребностей сельского развития в Украине за счёт биоэнергетики.

Сформирован авторский подход к применению модели современного агропромышленного производства Украины в процессе исследования социально-экономических процессов в сельских территориях.

Определено сущность, преимущества и недостатки развития биоэнергетики, определены реалистические цели и сценарии производства биомассы в Украине.

Ключевые слова: альтернативные источники энергии, биомасса, биотопливо, энергетическая безопасность, энергоэффективность, зелёная экномика, устойчивое развитие, стратегическое развитие.

Рис. 2. Табл. 6. Лит. 10.

Інформація про автора

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