



Енергозбереження і альтернативна енергетика Energy saving and alternative energy

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Justification of the energy saving mechanism in the agricultural sector

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Recently, the problem of increasing energy efficiency in the agro-industrial complex and the implementation of energy saving policies for Ukraine becomes particularly relevant. The article noted the most significant problems of analyzing the factors of energy efficient agricultural technologies in modern economic conditions: the development of a systematic scientific and sound approach to the implementation of energy efficient technologies, an analysis of energy efficiency in the agro-industrial complex, the development and substantiation of recommendations for improving energy efficiency and energy saving, which would take into account the specifics of agricultural production. The causes of the high energy intensity of the products of the agro-industrial complex are determined: the low productivity of livestock enterprises and sowing, the lack of systematic control over the compliance of energy saving, lack of developed measures to ensure energy efficiency and energy saving, development and implementation of low energy-intensive technologies, as well as the use of alternative energy sources and secondary energy resources. The structure of the energy intensity of one ton of crop production and animal husbandry in Ukraine is given. The main directions of energy saving in agriculture are identified - organizational, technical, technological, energy, selection and presented activities in the context of each direction. The stages that should undergo the development of renewable energy in our country and the main areas of use of renewable energy sources in the agro-industrial complex are noted. The balance of the needs in the energy resources of the farm is given. To reduce the energy intensity of production processes, new technologies must be widely implemented, and energy saving organizations can be attributed to measures that are highly efficient and require minor costs. It is noted that for the rapid introduction of energy-saving activities, it is necessary to develop a number of incentives and find sources of financing. Developed a scheme for stimulating the energy saving system. Reveal the essence of the proposed stimulation methods: coercion, promotion and assistance.

Keywords: *agricultural sector, energy saving directions, energy efficient technology implementation, energy saving system organization, alternative energy sources.*

Formulation of the problem. In recent years, for Ukraine, the issue of increasing the efficiency of energy consumption, implementation of energy saving policy, the creation and improvement of energy market and increasing the efficiency of energy functioning in general has become special relevant. Unlike the countries of the event, where energy conservation is an element of economic and environmental expediency, for Ukraine it is a question of survival, since there are still no aspects of balanced solvent consumption - both domestic and imports of fuel and energy resources. For the economy of modern Ukraine, extremely low efficiency of energy resources is characteristic [1,2]. Today, national energy is characterized by increasing the use of traditional energy resources, insufficient modernization

of the existing energy equipment, lack of general practice of introducing energy-saving technologies. This situation requires a comprehensive approach to solving the problem, the use of all possible paths for the formation of balanced energy consumption and energy saving [3,4].

Among the most difficult problems of analyzing modern economic mechanisms of energy saving (both for the domestic agrarian sector) are, firstly, to ensure a comprehensive approach to energy saving, secondly, analysis and evaluation of the energy efficiency of leading agrarian industries, thirdly, Development of recommendations for improving economic structures and energy saving mechanisms taking into account the specifics of agricultural production [5,6]. The solution of the above problems involves

the substantiation of modern requirements for energy saving agrarian technologies and world-class equipment, as, for example, systems of precision agriculture, direct sowing, plant cultivation in structures of protected soil, the latest cellular technologies, etc. Existing methods include a general economic analysis without allocation in general or without detailed consideration of such factors as specific expenses of electrical and thermal energy, as well as energy per unit of production, specificity of agrarian technologies (compared to industrial technologies), macroeconomic characteristics of energy saving, models of restrictions on energy consumption in agricultural production, determination on their basis of savings of electricity and energy [7-10].

Analysis of recent research. The problem of energy saving development and its stimulation is in the field of vision of domestic and foreign scholars, in particular: B.M. Andrushkiva, Ye.A. Buzovsky, V.V. Vybitytsky, V.I. Gavrysha, G.O. Dzyana, V.A. Komeretsky, A. Komar, O. Skliar, O.O. Yerokhina, D.V. Zakalova, O.V. Kirilenko, D.F. Krysanova, V.V. Mikitenko, V.I. Perebinis, A.V. Practice, R. Skliar, T.V. Serdyuk, I.M. Sattyk, V.N. Statema, B.P. Fedishin, I. Manita, A.K. Shidlovsky, E. Podashevskaya, P.L. Shiyana et al. In the writings of these scholars, significant attention is paid to the formation of models of socio-economic systems that make it possible to take into account the influence of structural and technological factors for increasing energy efficiency. However, there are still many unresolved issues for energy saving in agriculture [11–16].

Formulation of the goals of the article. Determine the causes of high energy intensity of agricultural products, analyze the structure of energy intensity of one tone of crop production and livestock production and determine the directions of energy saving in agriculture.

Main part. The creation of highly effective agriculture is possible only with the wide introduction of achievements of scientific and technological progress. But at the same time, the costs of fuel and energy resources are dramatically increased. Agriculture belongs to energy-intensive consumers. The high energy intensity of agricultural products is explained by many reasons, including low performance of field and livestock farms, lack of proper energy control, not developing measures to save and reduce energy losses, new, low energy intensive technologies and the use of local energy sources [17,18]. The structure of energy intensity of one tone of crop production and livestock production in Ukraine is presented in Table 1.

In agriculture, Ukraine is spent annually about 29 billion kWh. Electricity, including in the industrial sphere - 68%, non-productive - 32%. More than half of electricity is spent on electric actuators of stationary installations, 1/3 - to electroplate, the rest - on lighting

and household appliances. The total number of electricity consumers (electric motors, heating and other installations) exceeds 6.5 million. However, the level of electrical accuracy of agriculture in Ukraine is 1.5-2 times lower than in developed countries [19,20].

Table 1. Structure of energy intensity of one tone of crop production and livestock production in Ukraine

Energy resource in terms of conditional fuel, kg c. f.	Crops	Forages, feed units	Milk	An increase in living mass of animals for fattening
Electricity	9,9	–	69,17	251,54
Teploenergy	–	–	27,81	690,25
Gasoline	68,1	271	28,49	128,42
Diesel	27,6	118	35,93	59,43
Fuel for production forage	–	–	465,6	3573,70
Total, kg c. f.	105,6	389	627	4703,34

The economic decline in Ukraine has led to a deterioration of the energy situation in the village. Studies show that in recent years, there have been trends for deteriorating electricity. Thus, on dairy farms of cattle electricity consumption, the average is higher than the normative 7%. The sharp decrease in fuel and energy costs was not due to energy saving, and due to a forced reduction of consumption, recession, reduce the number of animals and birds, the growth of vegetables in the closed ground. Studies on energy audit show that if the cost of energy exceeds 29% of the cost of production, the economy is on the verge of bankruptcy, 29-24% - unprofitable, less than 24% - profitable [21–23].

The growth of energy prices has led to the unprofitable range of industries. The price factor as a stimulant of rational energy use, in the absence of antimonopoly pricing policy, programs of investment of energy saving measures practically does not work.

Solving the problem of energy supply of agriculture is possible due to energy saving, the use of non-traditional energy sources, utilization of secondary energy resources, development and implementation of low-energy new technologies.

Therefore, before offering measures to save fuel and energy resources, it is necessary to establish such levels of energy for each production, in which the highest production effect is achieved. The consumption of fuel and energy resources, which corresponds to the maximum production effect, and will be the optimal level, the change of which, both in the direction of decrease, and in the direction of increasing the same extent, will be unprofitable for production. Thus, the problems of energy utilization and energy conservation are not so much energy, but economic problems, and it is necessary to solve them from economic positions. When searching for economically justifiable ways of energy saving, it is necessary to consider rural production as a single

commodity producing system in which energy use and energy saving are only auxiliary systems.

For an objective assessment of energy saving opportunities, it is necessary to consider full energy intensity of the final product, which includes investment, direct operational and indirect energy consumption.

When choosing methods for energy saving, it is necessary to distinguish between three components

of energy costs: to perform useful work, on technically inevitable losses in transformations and transmissions and unproductive costs due to violations of the regulations of power plants, mismanagement, theft, etc.

Thus, energy saving of agriculture is a large complex task, the execution of which is possible in five main directions (Fig. 1.).

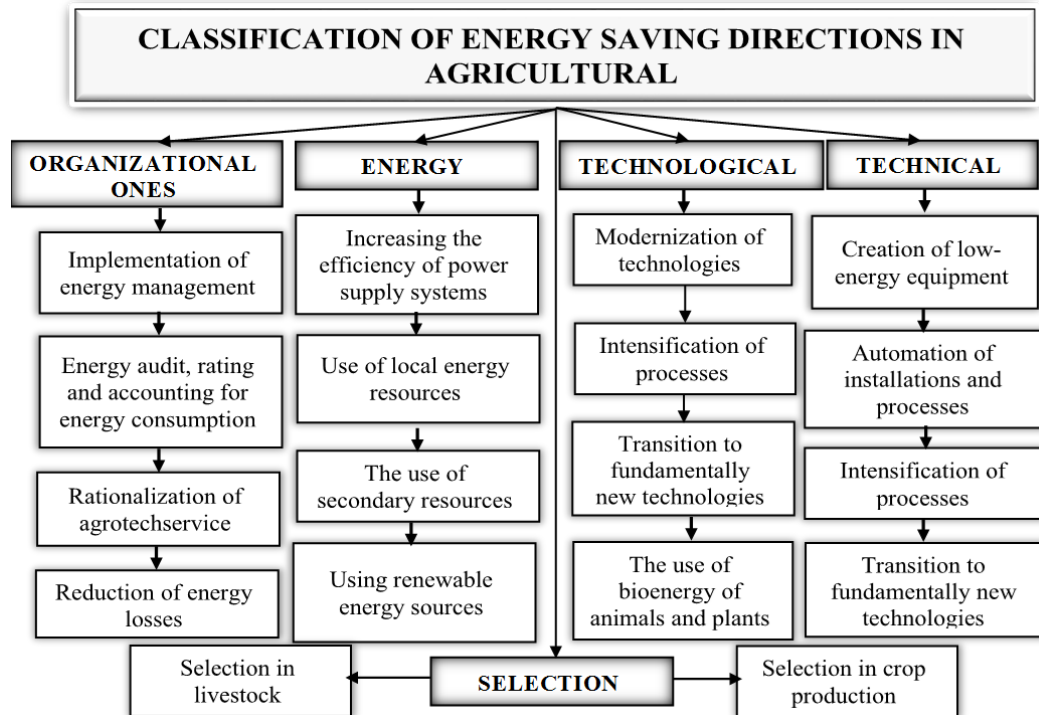


Fig. 1. Classification of energy saving directions in agroindustrial complex.

Technical and energy measures for energy saving are already at the stages of development of agro-technical tasks and feasibility studies, design and design, manufacture and installation of new power equipment.

An important measure of energy saving is the use of modern high-performance equipment and installations. In agriculture of Ukraine, about 65% of electricity is used for electric drive machines and mechanisms and up to 10% on lighting. The use of high efficiency electric motors, automation of electric drive modes, adjusting the speed of rotation of working bodies, loading of working machines, idle restrictions, etc. are able to save 20% of electricity spent on an electric drive.

Increasing the level of use of secondary energy resources (SER). Due to the disposal of emission heat on livestock and poultry farms, it is possible to reduce energy consumption by heating by 15-30%. In this case, the cost 1 kW of utilization equipment is 2 - 3 times lower than the cost of 1 kW at the power plant.

Replacement of traditional fuels and energy for non-traditional sources, the use of energy of the sun and wind, biofuels will find practical application only

when prices for these fuels will not be higher than the prices of fuels traditional. The implementation of this condition requires: increasing the efficiency of installations for the use of non-traditional energy sources, the search for effective raw materials of plant origin for biofuels, its warehousing, transportation, processing and distribution of biofuels and waste disposal.

Increasing the efficiency of the use of raw materials for biofuels can be achieved by:

- Increase in yield;
- effective organization of labor;
- Implementation of intergoater forms of cooperation in growing plants intended for energy needs.

If you take into account the global experience of using renewable energy sources and a transition period to a market economy in our country, then the development of renewable energy should undergo four stages. The first stage is deep (taking into account world experience) analysis and compilation of cartographic atlas of renewable energy sources of region, region, countries.

At the second stage, along with the implementation of the technology for developing technologies and the creation of technical means by industrial enterprises it is important to adopt a law on the environmental cleanliness of renewable energy.

The third stage is a wide demonstration of finished components, which allows you to use various renewable energy sources in progressive agricultural production technologies and everyday life.

The fourth provides a wide realization of equipment, the maximum replacement of traditional energy sources.

The following directions of use of renewable energy sources are possible:

- autonomous power supply of low-power remote consumers (cottage, home, farm, water supply or irrigation system, etc.);

- reduction of peaks or regulation of load in centralized energy supply systems (solar heat supply systems and air conditioning, heliosuching complexes, biogas thermal installations, solar power plants, etc.);

- Work as power plants is compatible with the power system (micro and mini hydroelectric power station, geothermal, wind power and solar power plants, etc.).

Table 2 Balance of farm energy needs in tones of conditional fuel

Energy resource	In total	including	
		on thermal needs	to perform mechanical works
Expenditure part			
Electricity	7,39	1,63	5,76
Fuel used on farms	10,25	6,26	4,0
Fuel for growing feed	23,96	–	23,96
In total	41,58	7,89	33,69
The arrival part			
Biogas energy	17,2	–	17,2
Solar energy	25,0	25,0	–
Wind energy	14,0	–	14,0
Utilization of milk of milk	2,5	2,5	–
Utilization of heat of ventilation emissions	3,9	3,9	–
In total	62,6	31,4	31,2

The most effective measures to reduce the energy intensity of production processes include a wide introduction of new technologies; The measures that require minor costs and are marked with high efficiency include the issue of organizing energy saving (Fig. 2.).

For the rapid introduction of energy-saving events, it is necessary to develop a number of incentives and find sources of financing.

General methods of stimulation, in principle, known for a long time, they are tested by practice

and generally correspond to the essence of the popular phrase "whip methods and gingerbread". The dubinka method, however, has recently been subjected to some improvement, the essence of which is well fit into the army formula "You can not - teach, you do not want to" make it, "although this is the essence of the matter does not change, still gives the basis to present a system of incentives in the form of three stiments: encourage - promotion - assistance. None of these links of the system will work in itself, and only in the complex it is possible to efficiently work the entire system.

Forced stimulus measures should begin with the introduction of rigid standards, such as the heat consumption of houses, supported by the positions of regulatory requirements over the entire nomenclature of the norms and rules relating to the new construction of houses, reconstruction and operation. This process should be continuous.

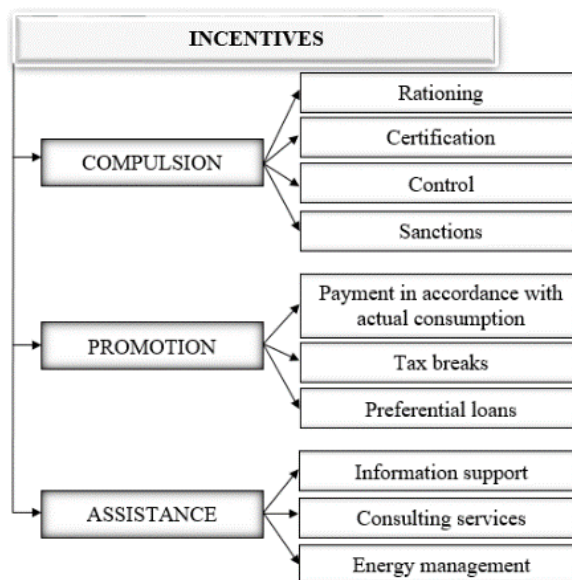


Fig. 2. Scheme of stimulating energy saving system

Of the measures of an incentive nature, the importance of payment for energy in accordance with the actual consumption is important. Here you will have to perform a large amount of work on the implementation of the electricity consumption accounting system and heat from top to bottom and payments for the energy corresponding to this costs. In the context of the ubiquitous use of branched systems of centralized heat supply, this work is difficult, but it is impossible not to perform it.

Introduction of tax benefits for those who save energy are the normal practice of many countries of the West. It is on the basis of tax benefits that develop technologies for the production of renewable energy sources in the United States and in other countries.

Not all energy-saving events have a low pay-back period. Some of them will require 10-15 years to return. Financing of these activities using preferential loans in many cases would contribute to attracting bank funds.

Assistance measures are auxiliary measures that are necessary when measures have already begun to work and encourage. You can, of course, engage in educational activities and persuade citizens save energy, hoping for their consciousness, but it is unlikely to count on the success of such a campaign, if it does not precede work on creating a regulatory framework, a system of control and sanctions, accounting systems and payments for They are all called the economic mechanism of energy saving.

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Аннотація

Обоснование механизма энергосбережения в аграрном секторе

Н.И. Болтянская, И.Ю. Манита, А.С. Комар

В последнее время проблема повышения эффективности энергопотребления в агропромышленном комплексе и реализация политики энергосбережения для Украины становится особенно актуальной. В статье отмечены наиболее значимые проблемы анализа факторов энергоэффективных аграрных технологий в современных экономических условиях: разработка системного научно-обоснованного подхода к внедрению энергоэффективных технологий, анализ эффективности использования энергии в агропромышленном комплексе, разработка и обоснование рекомендаций по повышению энергоэффективности и энергосбережения, которые бы учитывали специфику сельскохозяйственного производства. Определены причины высокой энергоёмкости продукции агропромышленного комплекса: низкая производительность животноводческих предприятий и посевных угодий, отсутствие систематического контроля за соблюдением энергосбережения, отсутствие разработанных мероприятий по обеспечению энергоэффективности и энергосбережения, развития и внедрения низко энергоёмких технологий, а также использования альтернативных источников энергии и вторичных энергетических ресурсов. Приведена структура энергоёмкости одной тонны продукции растениеводства и животноводства в Украине. Определены главные направления энергосбережения в сельском хозяйстве - организационные, технические, технологические, энергетические, селекционные и приведены мероприятия в разрезе каждого направления. Отмечены этапы, которые должно пройти развитие возобновляемой энергетики в нашей стране и основные направления использования возобновляемых источников энергии в агропромышленном комплексе. Приведен баланс потребности в энергоресурсах фермы. Для снижения энергоёмкости производственных процессов необходимо широко внедрять новые технологии, а вопросы организации энергосбережения можно отнести к мерам, которые являются высокоэффективными и требуют незначительных затрат. Отмечено, что для быстрого внедрения энергосберегающих мероприятий необходимо разработать ряд стимулов и найти источники финансирования. Разработана схема стимулирования системы энергосбережения. Раскрыта суть предложенных методов стимулирования: принуждения, поощрения и содействия.

Ключевые слова – аграрный сектор, направления энергосбережения, внедрение энергоэффективных технологий, организация системы энергосбережения, альтернативные источники энергии

Анотація

Обґрунтування механізму енергозбереження в аграрному секторі

Н.І. Болтянська, І.Ю. Маніта, А.С. Комар

Останнім часом проблема підвищення ефективності енергоспоживання в агропромисловому комплексі та реалізація політики енергозбереження для України стає особливо актуальною. В статті означено найбільш значимі проблеми аналізу факторів енергоефективних аграрних технологій в сучасних економічних умовах: розробка системного науково-обґрунтованого підходу до впровадження енергоефективних технологій, аналіз стану ефективності використання енергії в агропромисловому комплексі, розробка та обґрунтування рекомендацій щодо підвищення енергоефективності і енергозбереження, які б враховували специфіку сільськогосподарського виробництва. Визначено причини високої енергоємності продукції агропромислового комплексу: низька продуктивність тваринницьких підприємств та посівних угідь, відсутність систематичного контролю за дотриманням енергозбереження, відсутність розроблених заходів щодо забезпечення енергоефективності і енергозбереження, розвитку та впровадження низько енергоємних технологій та використання альтернативних джерел енергії та вторинних енергетичних ресурсів. Приведено структуру енергоємності однієї тони продукції рослинництва і тваринництва в Україні. Визначено головні напрями енергозбереження в сільському господарстві – організаційні, технічні, технологічні, енергетичні, селекційні та наведено заходи в розрізі кожного напрямку. Означено етапи, які повинен пройти розвиток поновлювальної енергетики в нашій країні і основні напрямки використання поновлювальних джерел енергії в агропромисловому комплексі. Приведено баланс потреби в енергоресурсах ферми. Для зниження енергоємності виробничих процесів необхідно широко впроваджувати нові технології, а питання організації енергозбереження можна віднести до заходів, що є вискоелективними і вимагають незначних витрат. Відзначено, що для швидкого впровадження енергозберігаючих заходів необхідно розробити низку стимулів і знайти джерела фінансування. Розроблено схему стимулювання системи енергозбереження. Розкрито сутність запропонованих методів стимулювання: примушування, заохочення та сприяння.

Ключові слова – аграрний сектор, напрями енергозбереження, впровадження енергоефективних технологій, організація системи енергозбереження, альтернативні джерела енергії

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