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## **FORMATION OF AGRICULTURAL ENTERPRISE ENERGY SAVING MECHANISM**

**Introduction.** *The article is concerned urgent problems that arise in agriculture sector of national economy Ukrainian concerning effective use of energy resources may be resolved by using such scientific and practical activity as energy management. Hereat the leading role granted to “energy efficiency” category.*

**Purpose.** *The purpose of the paper is to study energy use and energy conservation problems in the agrarian sector and to develop measures to improve the energy conservation and energy management mechanism of the agrarian enterprise.*

**Results.** *Agriculture enterprise potential of energy-saving is a totality of potential opportunities of enterprise concerning energy, resources and the means saving required for these opportunities to be realized taking into consideration specific levels of energy consumption in agriculture. Energy-saving mechanism is a combination of structures, standards, methods and means of managing energy preserving process that is based on rational consumption of energy resources.*

*Energy management as a component of organization management should be interpreted as: managerial activity aimed at providing effective functioning of organization energy system and achieving the goals as well; management of distribution and use of energy resources within the bounds of the specific organization which provide producing definite number of products or services; making managerial decisions to use energy resources efficiently as well as monitor implementation of these decisions.*

*Fundamental principles are of high importance for energy management. They help director to affect the controlled system more reasonably and expect possible feedback. Besides, the analysis of alternative variants of energy sources consumption, energy consumption management has to involve energy consumption planning and organization of its implementation.*

*We should take into account the principle of energy resources interchangeability choosing between several resources. Energy consumption gain is reasonable until the effect of last energy resources consumption equalizes with output.*

**Keywords:** *energy efficiency, energy-saving mechanism, energy management, energy use.*

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## **ФОРМУВАННЯ МЕХАНІЗМУ ЕНЕРГОЗБЕРЕЖЕННЯ АГРАРНОГО ПІДПРИЄМСТВА**

*У статті розглядаються нагальні проблеми, які виникли в аграрному секторі економіки України і стосуються ефективного використання енергетичних ресурсів, може такий напрям наукової і практичної діяльності, як енергетичний менеджмент. При цьому ключова роль відводиться поняттю енергетичної ефективності.*

*Визначено, що потенціал енергозбереження аграрного підприємства – це сукупність потенційних можливостей підприємства щодо економії енергії, ресурсів та засобів, необхідних для реалізації цих можливостей з урахуванням рівня специфіки енергоспоживання у сільському господарстві.*

*Встановлено, що енергетичний менеджмент як складова менеджменту організації слід інтерпретувати як: управлінські дії, спрямовані на забезпечення ефективного функціонування енергетичної системи організації та досягнення цілей, поставлених перед нею; управління здійснюваними в рамках конкретної організації процесами розподілу та використання енергетичних ресурсів, які забезпечують виробництво визначених обсягів продукції чи послуг; прийняття управлінських рішень та контроль за їх реалізацією, що забезпечують ефективне використання енергетичних ресурсів.*

***Ключові слова:** енергетична ефективність, механізм енергозбереження, енергетичний менеджмент, енерговикористання.*

**Introduction.** Urgent problems that arise in agriculture sector of Ukrainian national economy concerning effective use of energy resources may be resolved by using such scientific and practical activity as energy management. Hereat the leading role granted to “energy efficiency” category.

In agriculture production category “energy efficiency” shows the ratio between the production size of agriculture products that is in accordance with potent quality standards and the amount of overall energy expenditures in view of environment protection.

**Analysis of basic research and publications.** Theoretical basis for the research was the scientific works on energy management and energy saving management issues in agriculture V. Havrysha, V. Grishka, A. Medvedovsky, O. Moroz, V. Perebyinis, V. Rackstins and other researchers.

**The purpose of the paper** is to study energy use and energy conservation problems in the agrarian sector and to develop measures to improve the energy conservation and energy management mechanism of the agrarian enterprise.

### **Presentation of the main research material.**

Energy effective agriculture enterprise it is an organizing production of agriculture products that is based on energy and resources sparing, ecology-safe technologies with energy effective technical means application.

Agriculture enterprise potential of energy-saving is a totality of potential opportunities of enterprise concerning energy, resources and the means saving required for these opportunities to be realized taking into consideration specific levels of energy consumption in agriculture.

Energy-saving mechanism is a combination of structures, standards, methods and means of managing energy preserving process that is based on rational consumption of energy resources.

It allows enterprises to formulate a mechanism for implementing energy saving policy, through which rational use of fuel and energy resources is achieved on the basis of administrative and financial and economic regulation of their acquisition, storage, distribution and use (figure 1).

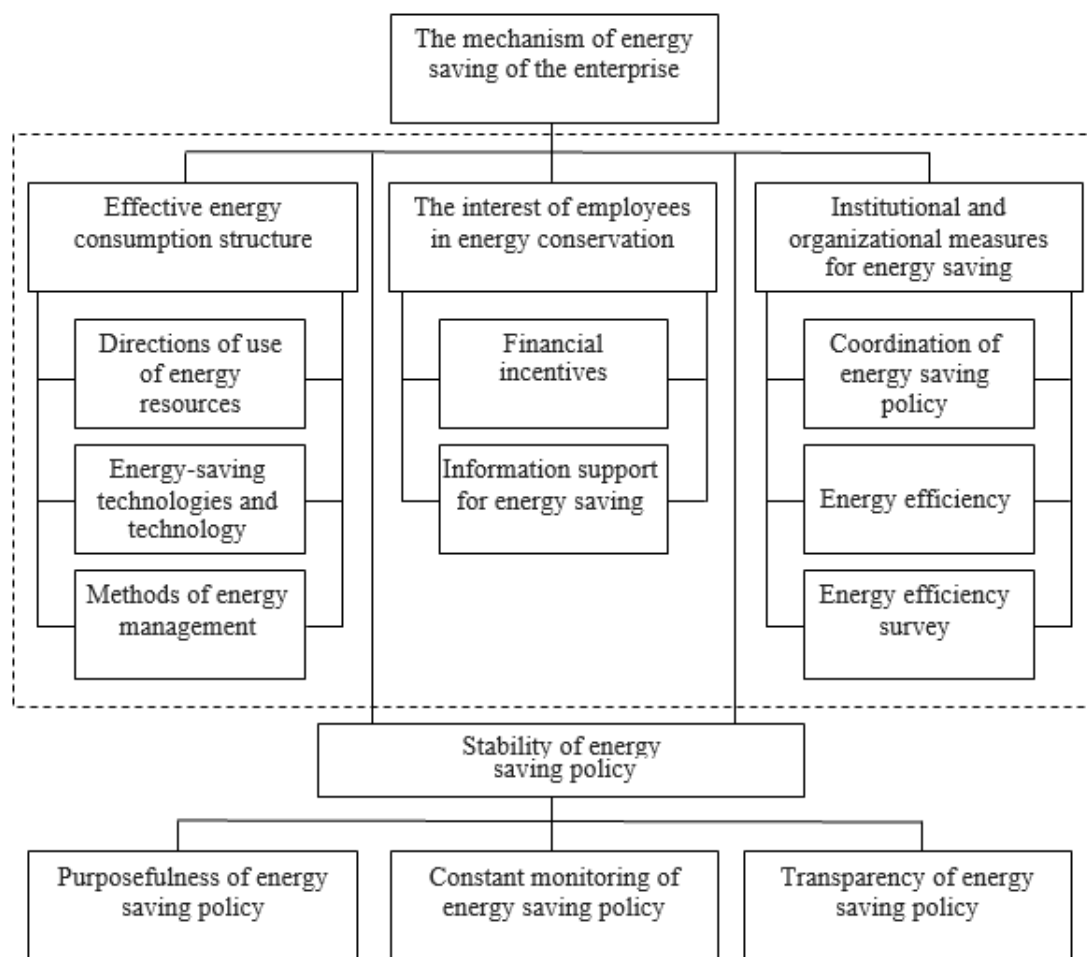


Figure 1 – Mechanism of implementation of energy saving policy of agricultural enterprise

Source: worked by authors

The main components of this mechanism are as follows. Firstly, the establishment and maintenance of an efficient structure of energy consumption. Market relations, through increased competition, are an environment that promotes and ensures the expansion of energy saving in enterprises. Energy management in agriculture business is a process aimed at defining and realization of optimal energy resources use and rational ways to be reached. The purpose of energy consumption rational using has to comply with the following requirements: precision, accuracy, accessibility, correspondence with economy development laws and purposes of higher order [5. p. 163 – 164].

Hereat the process of rational energy consumption should be viewed within bounds

of agriculture enterprise's energy management system functioning (figure 2).

Energy-saving management is a management system ensuring economic agent activity in which as much needed fuel and energy for production is consumed [2. p. 7]. Energy management is an administrative and technical activity of an economic agent's personnel directed to save energy taking into account social, technical, economic and ecological aspects [3. p.7]. Energy management system is a part of enterprise management overall system involving organizational structure, management functions, duties and responsibilities, procedures, processes, recourses for forming, introducing and achieving energy-saving targets [2. p. 9].

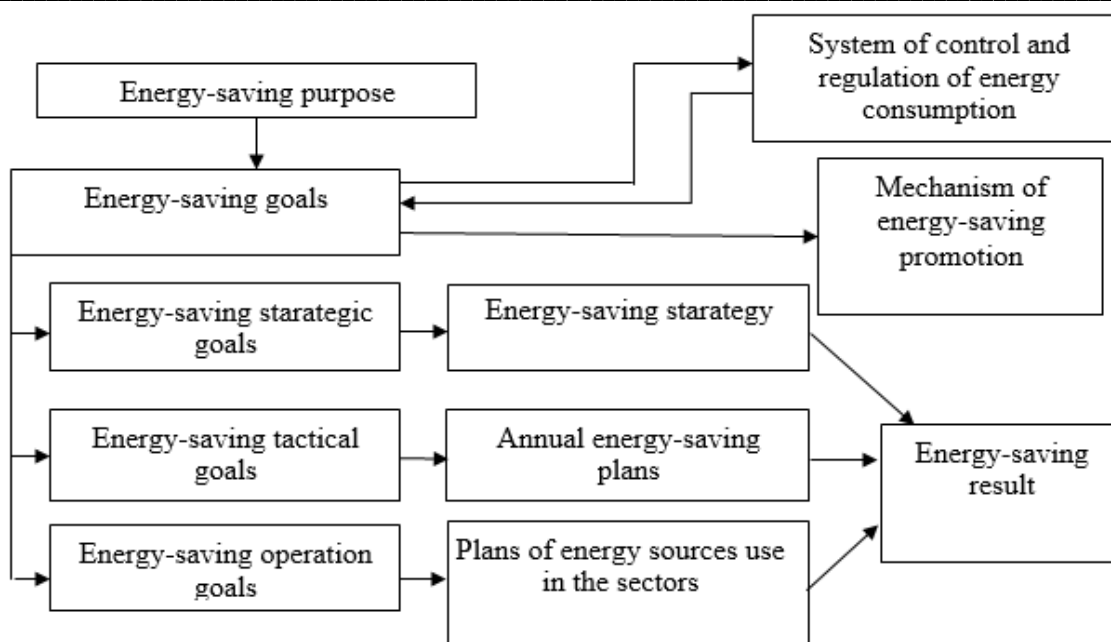


Figure 2 – Flow-chart of an agrarian enterprise energy management

Source: worked by authors on the basis of [5. p. 54]

On the other hand, energy management system of an agrarian enterprise is a complex of organizational, technical actions as well as software which enables to control production process in order to consume only minimal quantity of fuel and energy resources for producing definite number of products and services [3. p. 13].

Energy management as a component of organization management should be interpreted as:

- managerial activity aimed at providing effective functioning of organization energy system and achieving the goals as well;
- management of distribution and use of energy resources within the bounds of the specific organization which provide producing definite number of products or services;
- making managerial decisions to use energy resources efficiently as well as monitor implementation of these decisions.

Fundamental principles are of high importance for energy management. They help director to affect the controlled system more reasonably and expect possible feedback.

There are the following distinguished fundamental principles of energy management:

- correspondence between assigned purpose of energy system and provision with energy and other resources;
- correspondence of energy system efficiency and production energy capacity with cost effectiveness;
- correspondence of agrarian enterprise size to energy efficiency demands;
- correspondence of specialization and concentration with the conditions of effective realization of available energy potential;
- correspondences of realization of available energy potential to social and economical requirements [5. p. 90 – 91].

The main functions of energy management are the following:

- energy use planning is a process of acquaintance with objective cause and effect relationship between energy and other production factors in agriculture by modeling them for the certain period [5. p. 95];
- energy use organization is a process of division, grouping and coordination of tasks, activities and resources in order to achieve energy-saving and energy consumption goals;
- energy use motivation is a combination of internal and external driving forces which

motivate people to save energy, determine behavior, forms of activities as well as guide person to achieve organization goals concerning effective energy use;

– energy control (energy audit) – it is all forms of monitoring activity at the enterprise in order to provide analysis of high quality as well as energy estimation of energy system functioning [5. p. 114].

The tasks of energy management system are:

– to define specific goals in energy use of an agrarian enterprise;

– to reveal the priority of energy use and energy-saving goals and sequence of their achievement as well;

– to develop energy strategy of an agrarian enterprise, economic tasks and ways of their solving;

– to work out measures are to be taken in different periods of time in order to solve the problems of energy use;

– to determine necessary resources and their sources for energy strategy implementation;

– to monitor accomplishment of the assigned objectives.

There are three main distinguished levels of decision-making concerning implementing energy-saving measures in agriculture. Firstly, it is a macroeconomic (general) level that has influence on issues of structural reshaping of national economy. At this level state standards of energy consumption are formed. Secondly, sectoral and regional levels, where decisions are to be made about placing state order (contract) for agriculture produce considering energy efficiency of its production. Microeconomic (agricultural enterprises) is the third level, where concrete decisions are made at upper management levels, i.e. energy saving measures implements directly [1. p. 133].

First of all, decisions to be made about effectiveness of energy-saving management in certain sector by using methods of programming analysis because energy use processes in agriculture are very complex in view of end result dependency on many factors

(for example, weather-climatic conditions, energy means type, agriculture produce making technology and so on. Energy system functioning output does not fall under straightforward interpretation because there is a need to maximize produce output of unit of the land plot and minimizes energy costs. Energy system's single out as a subsystem of cattle breeding or tillage is complicated because of energy use processes are totally agriculture production ones (technology processes and operations. That is why, energy analysis of theirs is inseparable from analysis of these processes, meaning that energy system should be analysed as a whole.

Energy consumption programming analysis process consists of the following stages.

At the first stage concrete problems are outlined. The problem is hard to outline unless define the bounds of research. So, while studying the problem of supplying agriculture with energy resources, there is a need to figure out the state of oil, gas, coal production and processing in the state(region), energy production, world market of energy conjuncture [1. p. 134].

At the second stage the program's goals, metrics of its achievement and target groups of energy users are defined. The objective of the program of energy-saving may also be outlined in the form of energy consumption result that should be maximized (for instance, gaining the maximum of energy recovery) or an unwanted effect which influence should be got down to a minimum (for instance, not allowing overuse of energy resources). The program's objectives have to be outlined in numerical data and terms of achieving – specified. Indices of goals' achieving have to provide quantitative measurement of set goals.

Integral part of this stage is studying of energy consumer's totality, consumer division into groups according to gender, age, place of residence (work), social status, size of land use and number of cattle facilitates to both analysis improvement and reasonability of managerial decisions.

Alternative options of energy-saving are considered at the third stage. It is important to consider that too many of them impose some complicity on and choice as well but insufficient number is decreasing choice reasonability.

The fourth stage is to evaluate costs. All elements of options are estimated in concrete values, capital investments and current costs of each alternative are determined as well.

The fifth stage is to estimate energy-saving results which can be expressed by monetary units (for example, value of saved energy resources) as well as by physical units (for example, decrease of energy capacity of some kind of agricultural production).

The sixth stage is to compare alternatives. Two main methods: "costs – efficiency" and "costs – profit" are used for this purpose. The first method enables to assess programs in a quantitative form (for instance, increase of humus content in soil as a result of energy saving technologies application. The second method forecasts that results are granted conditional cost evaluation allowing compare profits and expenditures [1. p. 135].

In the conditions of market economy agriculture consumers must take into account scarcity of energy resources available for production and existence of a number of options for each kind of energy resources usage. Taking into consideration that energy is differed according to its quality characteristics it is necessary to choose energy resources of such quality that is matched with energy consumption nature.

Use of particular energy resources in the process of agricultural products output is a result of choice between several energy consumption variants. Choice efficiency can be estimated by the profit from the most beneficial alternative way of energy resources use that follows from the law of interchangeable factors. The law of interchangeable factors determines presence of several groups of factors which compensate each other. Thus, some kinds of energy resources can be replaced by others in the case

of deficiency. For example, in economically developed countries after fuel crisis of the 1970 s electrical energy began to replace fuel in some technological process [2. p. 135].

The last stage is to submit results of energy consumption alternatives analysis to the person responsible for decision -making and choosing proper variant of energy resource use according to the analysis.

Besides, the analysis of alternative variants of energy sources consumption, energy consumption management has to involve energy consumption planning and organization of its implementation.

It should be taken into account that output of agricultural products is determined by peculiarities of agrarian field:

1. Bioclimatic conditions (solar radiation; entropy; land resources; water resources; climatic and weather condition; biological processes of growth and development of crops and animals; biological properties of crops and animals; varieties of crops and breeds of animals; production seasonality; environmental production).

2. The level of production technologies development (technologies of production of plant growing and animal breeding products; application of organic and mineral fertilizers; system of weeding, pest and disease control, rotation system; part of agricultural products enters the next cycle of production; animal keeping and care; types of farm animals feeding; system of forage production; reproduction and structure of herd; system of animal disease control; system of production storage).

3. Technical support (system of machines and equipment; technical conditions of means of production; logistics).

4. Economic-organizational factors (tendencies of formation of production relationship in agrarian sector; peculiarities of labour organization; territory dispersion).

**Conclusions.** This decreases uniformity and density of energy consumption, increases duration of energy distribution system, determines necessity of great reserves of

energy in agriculture to meet energy requirements in the peak period.

Thus, the process of energy-saving management consists of three phases: 1) the analysis of alternative variants of energy consumption; 2) energy consumption planning

and 3) such plan implementation. We should take into account the principle of energy resources interchangeability choosing between several resources. Energy consumption gain is reasonable until the effect of last energy resources consumption equalizes with output.

#### Література:

1. Гришко В. В. Енергозбереження в сільському господарстві (економіка, організація, управління) / В. В. Гришко, В. І. Перебийніс, В. М. Рабштина – Полтава : Полтава, 1996. – 280 с.
2. Дзядакевич Ю. В. Енергетичний менеджмент / Ю. В. Дзядакевич, М. В. Буряк, Р. І. Розум. – Тернопіль: Економічна думка, 2010. – 295 с.
3. Енергетичний менеджмент: [навч. посіб.] / [А. В. Праховник, В. П. Розен, О. В. Розумовський та ін.]. – К.: Київська нотна ф-ка, 1999. – 184 с.
4. Паливо-мастильні матеріали, технічні рідини та системи їх забезпечення / В. Я. Чабанний. – Кіровоград: Центрально-Українське видавництво, 2008. – 353с.
5. Перебийніс В. І. Енергетичний менеджмент: [навч. посіб.] / В. І. Перебийніс – Полтава : ІнтерГрафіка, 2004 – 232 с.

#### References:

1. Hryshko, V. V., Perebyinis, V. I. and Rabshtyna, V. M. (1996), *Energy saving in agriculture (economy, organization, management)*, Poltava, Poltava.
2. Dziadakevych, Yu. V., Buriak, M. V. and Rozum, R. I (2010), *Energy management*, Economic Thought, Ternopil.
3. Prakhovnyk, A. V., Rozen, V. P. and Rozumovskyi, O. V. (1999), *Energy management*, Kyiv Music Factory, Kyiv.
4. Chabannyi, V. Ya. (2008), *Fuel and lubricants, technical fluids and their systems*, Central Ukrainian Publishing House, Kirovograd.
5. Perebyinis, V. I. (2004), *Energy management*, InterGraphics, Poltava.

