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# DIRECTIONS OF INCREASING THE EFFICIENCY OF ENERGY USE IN LIVESTOCK

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The strategic goal of the development of the energy base and agricultural energy supply systems is to increase the efficiency of agricultural production and including livestock based on electromechanization of technological processes, ensuring reliable and sustainable energy supply of consumers when reducing the energy intensity of production, and, consequently, its cost, creating comfortable socially domestic living conditions in the village. To achieve this goal, it is necessary to solve a number of organizational and legal, scientific and technical and production tasks for the modernization and re-equipment of power supply systems, efficient and safe use of electric energy and fuel in animal husbandry, in personal subsidiaries and in everyday life, creation of new electrotechnologies, technical means, and Energy equipment. Lifting livestock productivity, reduction of production costs, increasing its competitiveness are largely determined by technological modernization, development of new intensive technologies, reliable and effective energy supply, management of the production process. In view of the fact that in production costs a significant place occupy costs for fuel and energy resources - the implementation of ways of their effective use with higher efficiency acquires special importance. The introduction of new innovative technologies in livestock and other agricultural technologies requires new, more advanced means and energy supply systems, in some cases new technologies, processes can not be carried out at an old energy base [1-3].

Efficiency of energy supply of livestock and poultry objects, energy costs, and, consequently, the energy intensity of products are largely determined by the power supply system used by energy and magnitude of energy consumption. Therefore, the substantiation and choice of a rational system of energy supply of specific objects (or its modernization) is definitely the most important task for the implementation of energy supply systems for livestock. Recently, the interest and need to create and use decentralized (autonomous) energy supply of livestock enterprises has increased [4].

This contribute to this circumstance:

- excess of energy demand (in a number of regions has a deficit of energy);
- a sharp increase in value (tariffs) for electrical, thermal energy and fuel supplied by energy supply organizations, which causes a significant increase in the energy component in the cost of agricultural products;
- reducing the reliability of energy supply and energy quality - an increase in the number and duration of disconnections, which entails an increase in losses in agricultural consumers, especially in greenhouses, poultry farms, complexes, farms, storage facilities and processing enterprises;
- a significant increase in the payment for connecting a new power and ensuring the requirements of an energy supply organization that is becoming difficult for a number of consumers;
- the need for many agricultural objects to have a comprehensive power supply - electrical and thermal energy;
- availability in many regions and farms of local energy resources: biomass, livestock, crops, forestry, oilseeds, development of technologies for their processing in high-quality liquid fuel and gas, which can be used in decentralized systems to produce electrical and thermal energy, which increases the efficiency fuel use;
- use of the possibilities of reducing the cost of energy produced, the payback period of the capture and sale of excess energy;
- supernormal energy losses in its transmission;
- the possibility of operating energy equipment on various types of fuel, as produced on the ground, so that is delivered centralized (gas, diesel fuel, biofuels);
- the possibility of re-equipment available boilers in mini and small CHP.

Given these conditions, the introduction of decentralized systems of complex energy supply, the choice of one or another system and equipment depends on the needs of the object in volumes and types of energy, local conditions and the presence of own energy resources, renewable sources, distance to the system of centralized energy supply and is determined by the technical basis. Economic calculation of options [5,6]. These conditions require the development of various types of decentralized systems and equipment:

- according to productivity;
- by type of fuel used by the presence of local and renewable resources;
- according to the graph of seasonal and daily thermal and electrical loading of consumers.

Decentralized systems may include different power equipment (Fig. 1):

The main advantage of cogeneration plants in comparison with traditional boiler houses consists in the possibility of more efficient use of fuel that is burned, because in these systems, the largest economic effect is achieved in jointly producing electric and thermal energy at the place of consumption. In agriculture, mini-CHP with cogeneration may have a rifle scope (Fig. 2).

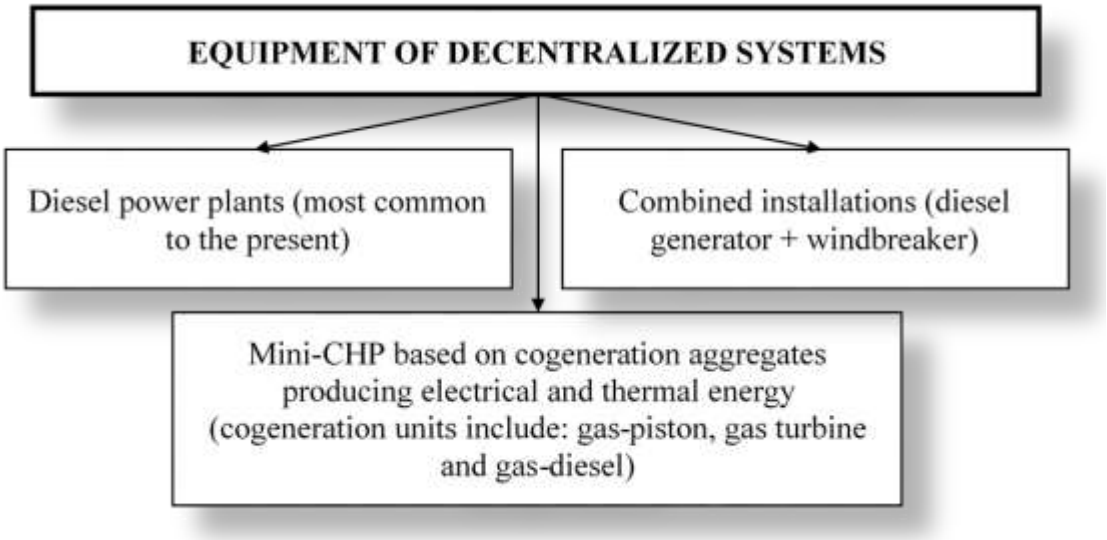


Figure 1. Equipment of decentralized systems

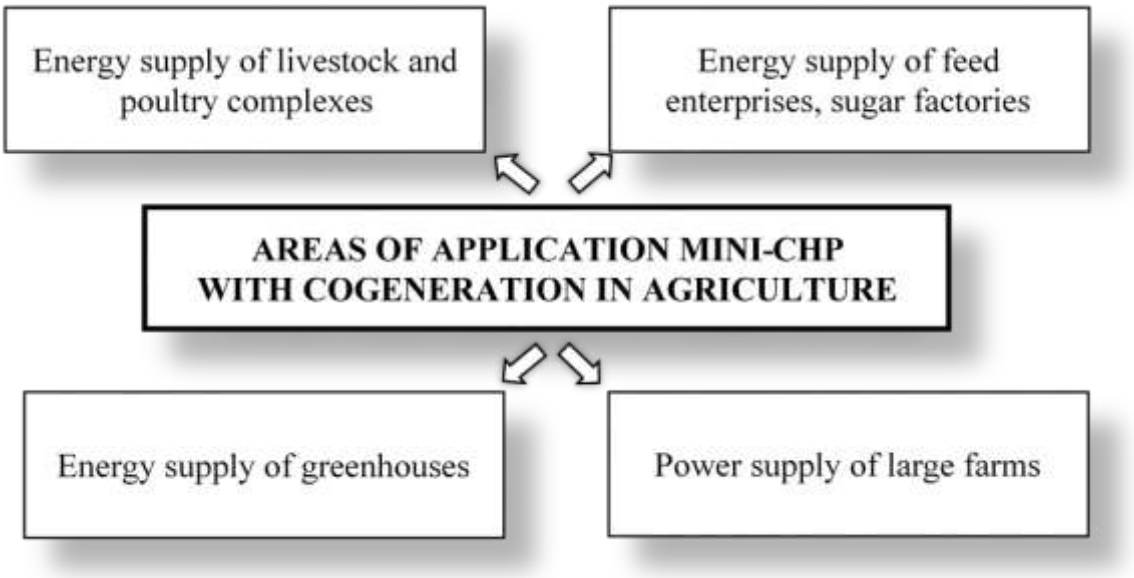


Figure 2. Areas of application mini-CHP with cogeneration in agriculture

In modern cogeneration units, when producing electrical and thermal energy under optimal conditions can be achieved by a total efficiency to 90% (to the useful energy of burned fuel). Technical progress exacerbated environmental, energy and economic problems associated with the gradual exhaustion of fossil resources and a significant increase in their value. To solve these problems, new sources of energy, new types of fuel are searched, including plant raw materials, for the production of liquid and gaseous fuels, new ways of transforming and using biomass in agricultural energy.

Effective use of local energy in the energy sector of the village - biomass, wood and plant waste, peat, manure, drains, etc. In many regions, it can cover a significant part (up to 30%) of the energy balance of a number of farms and enterprises, to reduce half the power of power supply. The creation of decentralized systems can reduce the dependence on centralized power supply, up to self-energy supply. In solving this problem, an important role is given to the development and development of technologies and sets of equipment for the processing of vegetable biomass, peat,

vegetable and wood waste in high-quality liquid, gaseous and solid fuel, bioconversion of manure in biogas and fertilizers, obtaining fuel from algae.

The presence of enormous annually renewable stocks of plant and wood raw materials causes the need to develop and use technologies and technical means of obtaining biofuels, alternative fossil fuels. Stocks of local species of vegetable and wood waste, manure, litter are huge, but their use as a fuel to date was insignificant, excluding the use of firewood, the volume of consumption of which were large to 1960-70 and then largely replaced by the use of electricity, gas, liquid fuel. The task of a significant increase in the volume of use of local and renewable energy in energy-balancing of rural consumers is placed [7,8]. Their special role in the energy insurance of autonomous consumers of a small power, a number of which can be completely transferred to local and renewable energy resources.

In the presence of effective technologies for the processing of various energy raw materials, including waste, in more valuable types of fuel agricultural producers have the opportunity to cover a significant part of the costs associated with the acquisition of fuel and electricity, due to own raw materials, as traditional - peat, firewood, waste crop production, So new converted - biofuels, biogas. The most famous and common are the following thermochemical methods of biomass transformation in energy, as direct combustion, gasification and pyrolization.

An important direction for reducing the consumption of hydrocarbon fuels, waste recycling, formed in agriculture and improving the environmental situation on the ground there is preparation and use of mixed biofuels. One of these promising directions is the preparation of mixed biofuels from wet manure (Waste of cattle, pigs, bird litter) and hydrocarbon fuels (oil sludge (oil sludge, oil, fuel oil) in a ratio of 4:1. Technical means of preparation of such biofuels include a block of crushing and mixing of the components, also a homogenization unit consisting of a rotary and pulsation apparatus and an ultrasonic generator, a storage capacity. The shop for preparing and storing mixed biofuels should be located directly near livestock farms or poultry farms.

An important direction of the use of wood waste is granulation and briquetting of wood and cropping products, while ensuring the convenience of storage, transportation and combustion of granular wood mass. The disadvantages are the high energy intensity of technology, which consumes up to 50% of the energy of the resulting fuel, and the high cost of the resulting pellets and granules [9]. Therefore, the production of wood pellets is currently and in the near future may be beneficial mainly when selling them abroad for export and for use in automated boiler houses and generators. In this regard, it is quite promising to cultivate and use as raw materials for the preparation of microvascular biodiesel, as evidenced by the US experience, Philippines and a number of other countries. One of the ways of rational use of manure and poultry farms of livestock farms and poultry farms their methane fermentation, methanogenesis, which is a good way to dispose of liquid manure and preserving it as fertilizers with simultaneously obtaining additional biogas energy. Currently, a new stage of development and improvement of biogas technologies has come. The block-modular principle of constructing kits of biogas equipment is being developed. At the same time, with the production of biogas, methane fermentation of manure provides its deodoration, degriminating, destruction of the ability of weed seeds to similarity,

transformation of nutrients in easily absorbed plants with mineral forms. In this case, nutrients of matter - nitrogen, phosphorus and potassium - are practically not lost.

The use of biogas sets on livestock farms provides additional energy in the form of biogas and high-quality organic fertilizers, and also allows you to significantly reduce anthropogenic load on the environment. Manure of animals and litter of birds as energy raw materials serves to produce fuel biogas by anaerobic methane fermentation. Of 1 t dry matter of manure as a result of anaerobic fermentation under optimal conditions, up to 340 m3 biogas can be obtained, or in terms of one head of cattle 2.5 $m^3$ per day, and for a year about 900 $m^3$. The resulting biogas is used in gas heat-power plants to obtain fuel and electric energy, and fermented manure is collected in a repository for further use in fields as fertilizers. Currently, installations of transformation of renewable energy (PVI) are developed in different types: electric and thermal, for use in agriculture. These are photovoltaic stations of modular type, wind power plants with a capacity of 0.1 to 1000 kW, micro mini-hydroelectric power station, etc. They are intended for electrical and energy supply of individual rural houses, small villages, industrial brigades, garden areas, small farms, etc. The most effective path is the creation of combined wind-solar-diesel units (or a combination of them with traditional), which guarantee uninterrupted power supply and diesel fuel economy (up to 60%). The use of renewable energy in agriculture will solve the following tasks: ensuring sustainable energy supply of the population and agricultural production in zones of decentralized electricity supply; reducing fuel imports into hard-to-reach places and areas; providing a guaranteed minimum energy supply of objects in centralized energy supply areas during emergency and technological disconnections; lowering in the long run in 2 and more times harmful emissions from thermal power plants on separate objects with a complex environmental situation.

For all kinds of equipment, the use of PVI in agricultural energy is scientific and project development. However, the realization of them is noticeably lagging behind, and the share of PVI in the energy balance of the village is up to 1%.

The principle of decentralization of energy supply of farms and other objects confirmed its efficiency - it is when energy plants are embedded in separate premises, directly providing the technological process. Most often, electrified or gasified installations are used. This allows you to get rid of extended electrical, thermal and gas networks, which significantly reduces energy losses. For such systems, energy equipment is developed and developed by infrared electric and gas heaters, capacitive and flow electromotive heaters, convectors, heat generators and utilizers. In high energy efficiency systems, high energy efficiency features such technological processes as the utilization of emission heat and the use of heat pumps. Results of research and testing of this equipment confirm their energy economics - their implementation will save up to 40% of energy costs for heating and microclimate of animals of animals. Their use is most effective and has a great prospect in the processes of ventilation of livestock premises, cooling milk and heating water.

An important energy efficient direction is to improve the systems of illumination of premises and irradiation of animals based on new lighting devices with high light lamps and a high term of service (compact luminescent, LED, metallogallogenic,

sodium), which reduce electricity consumption is 2-7 times compared with incandescent lamps.

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