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SELECTION CRITERIA OF GENERATION SOURCES FOR MIKROSYSTEM BASED ON RENEWABLE ENERGY SOURCES

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One of the strategic objectives of rural energy today is to reduce the energy intensity of agricultural production based on the use of new progressive technologies of production and consumption of energy resources. A promising way to solve the problem is to expand the use of renewable energy sources (RES). In this situation it becomes relevant organization independent power supply. However, the main sources of renewable energy-solar and wind - are impermanent in its manifestation are unpredictable interruptions in the flow of energy. This requires a powerful system accumulating and creating a backup power supply sources, which significantly increases the cost generated by the system. In addition, it is unlikely that one potential site of all kinds of renewable energy sources will be equally high, so an important task is the search for the optimal structure and composition of a particular generation group microgrids.

Creating scientific and methodological basis for the organization of practice mikrosetevyh power systems represents one of the ways to facilitate the introduction of new innovative approach heat-and electric power supply organization. Micronet - an integrated energy system with low power distributed throughout the network generators and consumers.

The optimal choice for a given generation sources Micronet is the key to its successful operation in the future. The concept of using microgrids supply problem is solved as follows: electric energy consumers provides connectivity to microgrids, and reliability of their power supply ensures reliable operation of generation sources and microgrids as a whole. The problem of heat supply in each location can be addressed in different ways, depending on the available capacity at the site. For these purposes can be used a variety of technologies ranging from direct combustion to heat pump systems of different types using a variety of low-grade heat sources.

The purpose of research - development of criteria for the selection of sources for microgrids generation based on renewable energy sources.

Materials and methods of research. Based on the experience of practical design and construction of microgrids, we can distinguish three types of energy microgrids. The first type of network provides power to one building, ensuring its independence from the central AC, and increases the efficiency by reducing electricity tariff for centralized power at the expense of the parallel use of renewable energy and energy storage. The network of the second type - the campus network, providing the energy complex of buildings in a particular area. In this area, to create an internal distribution network and domestic sources of energy with energy storage. Campus network, like the network of the first type can be operated both in parallel and independently of the central grid. "The network of the third type is a set of mutually connected microgrids. The above mentioned network may operate completely independently, and only in case of emergency to connect to external networks.

As international experience shows, in recent years, the installed capacity of microgrids in the world has increased steadily. The increase in electricity tariffs is forcing consumers to unite in microgrids, which confirmed the forecast of growth of installed capacity microgrids around the world (Figure 1).

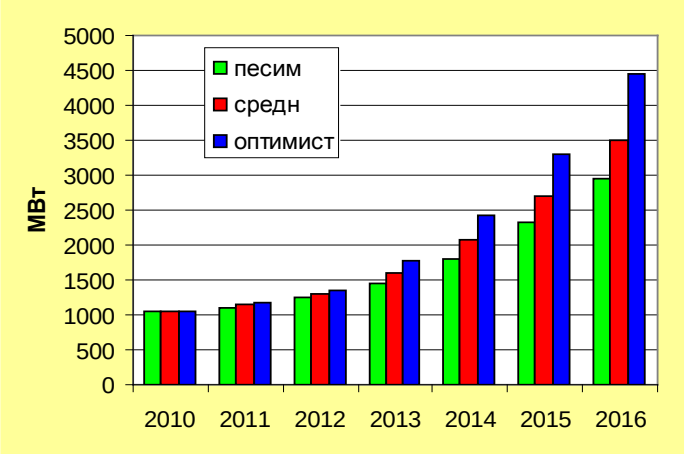

Fig.1. Forecast of development of microgrids to 2016

(Source: Pike Research)

Micronet divided into autonomous and connected to the central network. Standalone classified by type of generation.

Independent network with one generator running on traditional energy sources, ie distributed network with diesel or gasoline generators, gas turbine, etc.. is shown in Fig. 2.

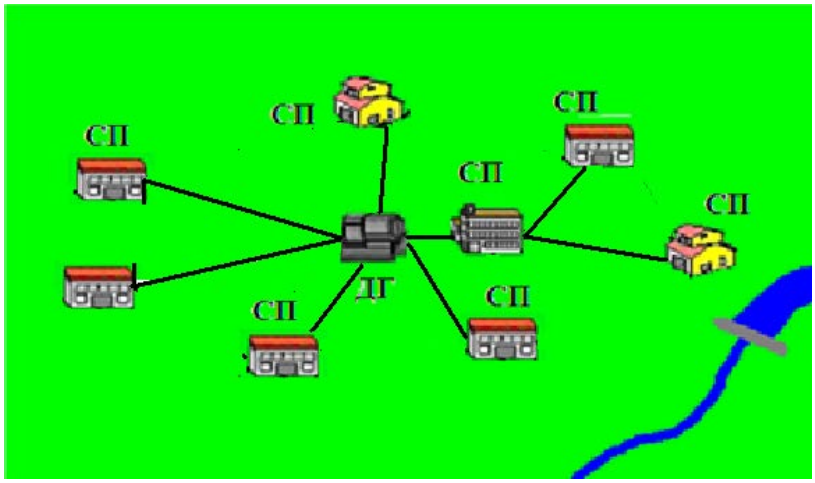

Fig.2. Independent micro network with a single source of generation:
DW - diesel generator; SP - rural consumers

Modern autonomous network with a single source of generation is an energy center with generator, air or cable transmission lines, transformer substations, electrical components and metering devices, by which is produced, transmitted to the realization of consumers and take into account the electricity. This network covers a certain territorial area with one or more settlements. Power networks varied from a few hundred kilowatts to tens of megawatts, the voltage - up to 35 kV, length - up to tens of kilometers.

The results of research. Analysis of the existing stand-alone power systems showed that the organization of uninterrupted power supply facilities for agricultural purposes in remote areas fraught with great difficulties due to significant costs for the construction of low-voltage distribution networks and to ensure their trouble-free operation.

Created by the same principle Micronet, it covers an area much smaller. This is due to the fact that the length of cable or overhead lines is limited by the voltage

drop in these lines, as well as the tension in microgrids is 380 V, the maximum possible range of coverage area is within 2 km, which corresponds to an area covered by 12,0-12, 5 km2. The greatest difficulty in the operation of microgrids with a single source of generation is that, working around the clock, a diesel generator could generate electricity much more of its consumption, the limited load curve. Because of this reduces the effectiveness of microgrids, and the cost of electricity increases. To improve the efficiency of the system is necessary to create conditions under which the consumer required amount of electricity would be produced with the least possible excess of the volume of production and minimum cost. This is possible if the network is set drive power. There are two options: to establish a common drive that runs on the entire network, or set the drive to each consumer. In any case the clock drives will provide the consumer with electricity, even in the moments off the diesel generator. The calculation of the balance of power in microgrids with a single source of generation should be done to the electricity needs were fully met.

Optimal scheme microgrids with a single source of generation is shown in Fig. .3.

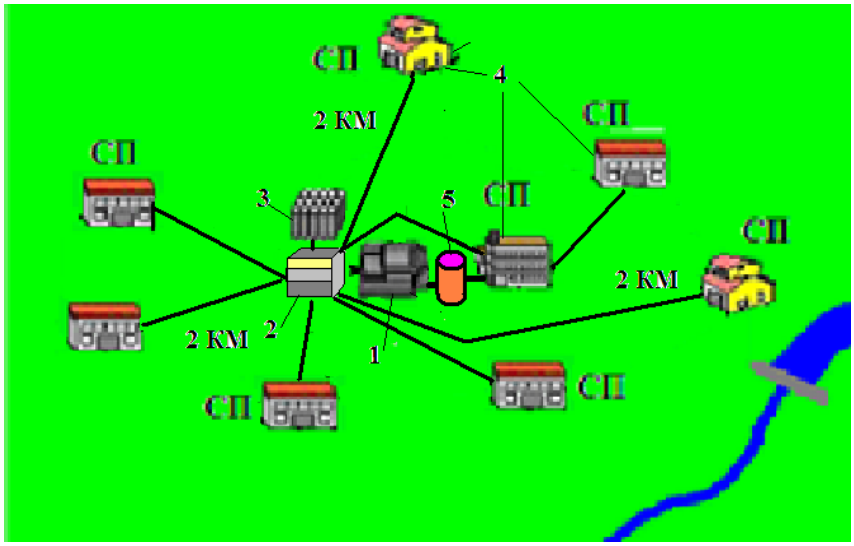

Figure 3. The optimal scheme of autonomous micro-network with a single source of generation:

1 - a diesel generator; 2 - inverter; 3 - accumulator station; 4 - rural consumers; 5 - recovery of thermal energy

Currently, the most efficient power plants are mostly independent power supply on the basis of the traditional diesel generators and solar panels as a renewable source of generation. This choice is not accidental. In recent years, seen a rise in prices of fossil fuels, which leads to increase in the cost of electricity produced by diesel generators. On the other hand, at the same time, the cost of solar modules significantly reduced, making the photoelectric conversion of the solar energy quite competitive with conventional power generation systems. Already today, the cost of electricity produced by photovoltaic power plants exceed the diesel generator sets. Therefore, their replacement in cases where this is possible, it is quite cost-effective step.

Fig. 4 shows a diagram of the enterprise, energy supply is based on the use of diesel generator systems.

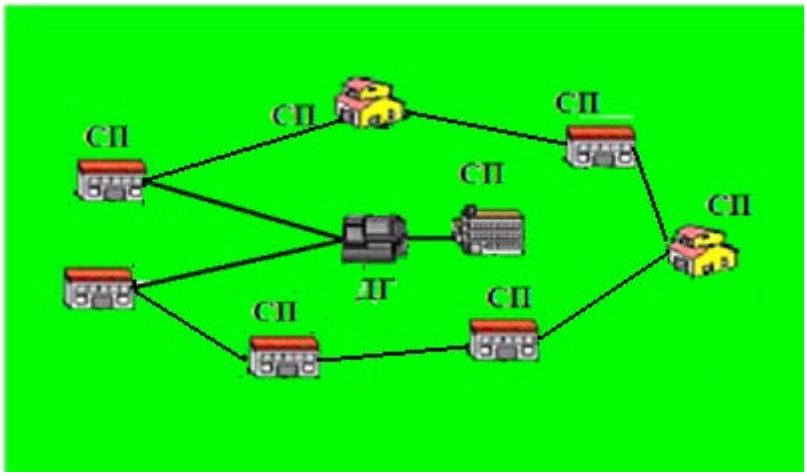

Figure 4. The company with electricity from a diesel generator

Available free at the site of such an enterprise allows you to install a solar power station small that due to the high potential of solar energy at the facility is expected to be effective, that means creating microgrids with two sources of generation and one consumer (Figure 5).

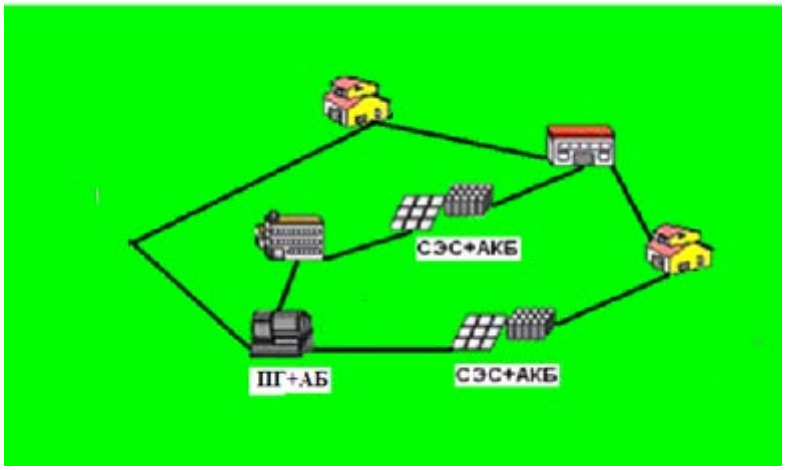

Figure 5. The company with electricity from the generator and photovoltaic modules

Adding a composition microgrids generate additional sources may be possible to replace power generated by conventional methods from renewable energy. But it is never consumed and generated energy generators of renewable energy will not be in strict conformity with each other. Power generation can either exceed the consumption or not fully cover the needs. In the first case there is a problem of search of application surplus energy produced (either directly in the process of developing or accumulating energy in its excess and delivering to the consumer in a given time). In the second case, an additional source of power must be continuously adjustable to cover a deficit arises. Possible interim option, when the periods of energy shortage the consumer (compared with the development of renewable energy generator) alternate with periods when the generators produce an excess amount of energy.

The right choice of a combination of renewable and traditional power resources represented an important task and can be determined by specific criteria that take into account a number of factors discussed below.

Fig. 6 shows a possible scheme of microgrids with multiple sources of generation from renewable energy sources.

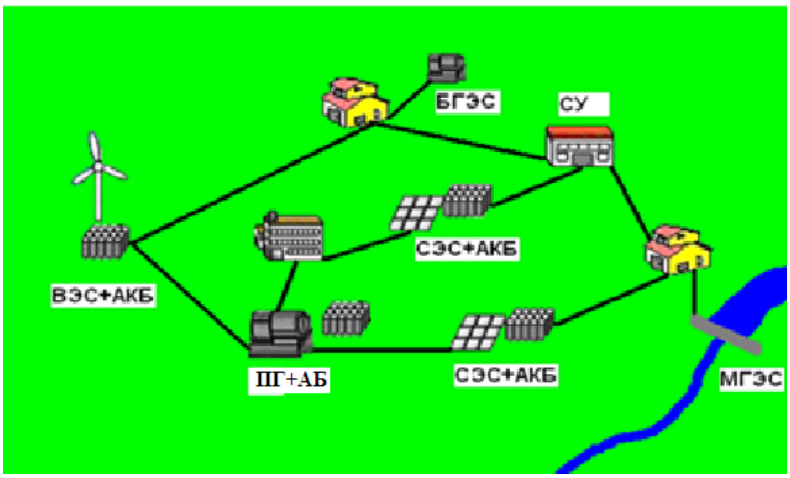

Figure 6. Independent micro-network with the generators of renewable energy:

PG - wood steam generator; Battery - rechargeable battery; WPP - wind power; SES - solar power; SHP - small hydro power plant (micro hydro); BgEs - biogas power plant; CS - Control System

Example microgrids combination shown in Fig. 7.

To calculate the energy balance of microgrids to conventional and renewable energy sources must take into account the instability of receipt of renewable energy throughout the year, so the calculation of the method of separation of participation, which consists in the fact that it is assumed the possibility of a situation where for a long time will not be entering the renewable energy and long-term emergency the situation with diesel or petrol generator.

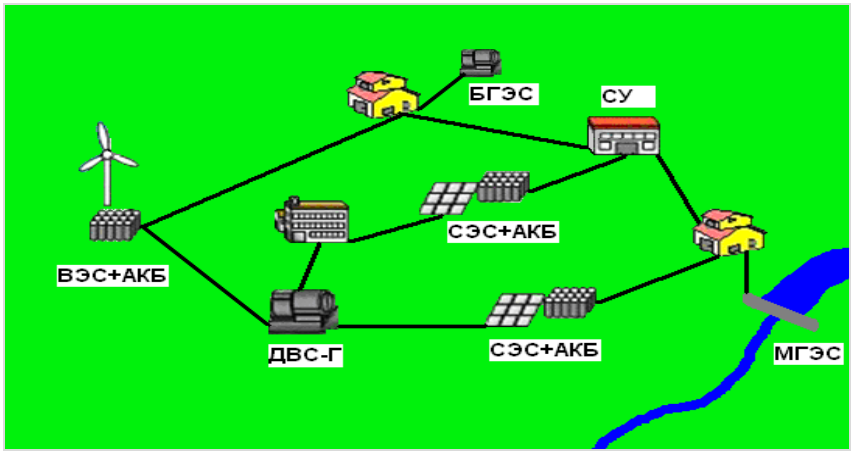

Figure 7. Independent micro-network combined with generators operating on traditional energy sources, and renewable:

ICE-T - an internal combustion engine - generator; Battery - rechargeable battery; WPP - wind power; SES - solar power; SHP - small hydro power plant (micro hydro); BgEs - biogas power plant; CS - Control System

Dramatically in a positive way the situation is changing when microgrids as generators include predictable energy sources such as micro hydro, biogas plant, steam plant, and similar sources of renewable energy.

Organization of a reliable energy supply in decentralized regions of Russia can only be based on an integrated use of traditional and renewable energy sources. The effective generation in a distributed power assumes that the preferential right to the production of energy is reserved for renewable sources. Non-renewable sources are reserved. Micronet must have a management system that will coordinate the respective connecting generators depending on the arrival of renewable energy, the degree of the charging station and the current load.

Conclusions

Proposed and developed the concept of microgrids on the basis of pre-emptive use of renewable energy, which is a new form of realization of the ideology of distributed power, it opens the possibility of efficient use of renewable energy sources to solve the problem of power supply remote, primarily in rural areas, low-rise construction and independent power supply separate disposable unit objects. Micronet based on renewable energy is considered as a separate group among microgrids implemented in practice. Briefly considered the scope of microgrids in the world. On the basis of analysis of the functioning of various configurations microgrids considered the most important task of creating the optimal composition and structure of microgrids created by optimizing the selection criteria developed by generation sources to be included in their composition. The possibility of using microgrids and in the traditional centers of power generation.