SCENARIOS OF GLOBAL ENERGY CONTEXT OF WIDESPREAD USE OF RENEWABLE ENERGY

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Development of renewable energy technologies and intensive growth in the use of renewable energy sources (RES) has a significant impact on the development trend of global energy. Therefore, the likely scenario of global energy development should be seen not only in the context of the latest developments in energy technology development, but given the pace of development of renewable energy technologies. It is also necessary to take into account the likely scenario for the global economy as a whole, on the one hand, and the vectors of world demographic processes on the other.

The growth of total energy consumption in the world from 1850 to the present time is approximately proportional to the square of population growth. Assuming that by 2100 the world population will grow by 10 times, the power consumption in this period of time may increase up to 100 times. In 1990, with a total capacity of 13.2 TWh in the average power per capita was 2.5 kW.

The purpose of research - analysis of the development of global energy in the context of large-scale use of renewable energy sources.

The results of research. Today it is possible to predict the following trends in the global energy sector:

- Creation of a global energy system;
- All-round development of distributed generation to supply local consumers.

The solution of these global challenges will be based on the widespread use of renewable energy sources.

1. Formation of global energy supply system

Currently, further developed the concept of a global system of power supply of the Earth by a consistent, gradual consolidation of existing and creating new regional

energy systems and their subsequent integration into the national grid. This concept, proposed in 1975 by R. Buckminster Fuller, the Institute is actively developing a global energy network GENI (Global Energy Network Institute). GENI President Peter Meissen during the work of the International Congress of the sun in Moscow (1997), made in VIESH a report on this issue, which sounded above ideology.

In accordance with this concept in the future projected creation of transcontinental systems that integrate transport and energy flows and combine waveguide cable lines, trunk lines, railroad tracks and highways. We consider, in particular, the possibility of creating a series of energy transportation routes, for example, from East to West (Lisbon - Vladivostok), from South to North (Australia, Indonesia, Thailand, Vietnam - China - Bering Strait - Alaska - Canada - America). along the Silk Road, and others. It is possible to predict the creation of highways through Cape Town - Oslo, West Africa - Republic of Ireland, as well as several others. Meridian energy line is also connected to South and North America. Latitudinal energy line in the equatorial zone (from 0 ° to 30 ° north latitude) connects Asia, Africa and Latin America.

Equatorial power line, as well as latitudinal energy line Lisbon - Vladivostok will be closed over the Pacific and the Atlantic Ocean, North and Central America. Meridional and latitudinal network of energy lines obra¬zuyut Integrated Power System Earth.

Today has created a sufficient technological reserve, operate and create new regional energy system.

2. Towards a global energy system

The task of creating a global energy system to be divided into two: the formation of large power generating centers and technology development of effective transmission of electricity over long distances. A huge role in the realization of global projects will be considered to play a widespread, large-scale use of renewable energy sources, especially solar energy. At present, more and more countries prefer solar energy. A number of large solar stations (SES), the largest of which is Perovskaya SES 100 MW (Crimea, Ukraine).

The total capacity of solar power plants in the world more than 100 GW (European Photovoltaic Industry Association).

SES can not be used as a basic component of the regional power system, due to the need of smoothing periodic, stochastic processes. It is considered that the installed capacity of the SES should not exceed 10-15 % of the total installed capacity of the regional power grid. Under these conditions, fluctuations in the power of solar power plants do not have a noticeable effect on the quality of power supply. Otherwise, requires special measures.

Creation of the world or even inter-regional solar power will minimize or even eliminate the daily and seasonal fluctuations in electricity generation and provide round the clock power supply to consumers.

Work to establish effective technology transfer large amounts of electricity over long distances are developing quite well (VIESH, Siberian Energy Institute, St. Petersburg State Technical University, VEI, ABB, Siemens and others.). The obtained results allow us to be optimistic about the possibility of solving this global problem.

On the basis of resonance energy transfer methods can be generated waveguide single-conductor cable lines with the consent and conversion device that will connect generators and consumers in each country in the world energy system. Resonance technology, being before the end of the developed and implemented in practice in full, allowing the transfer of power flows on the power of several TW distances of tens of thousands of kilometers.

In this case, it will be possible to link a network of solar power plants on roofs and facades of houses, as well as in the deserts of a single energy system, supplemented by a network of wind power plants (WPP), disposable, for example, along the coast, where there is a constant transfer of air masses. An important component of the future energy system will be united and hydroelectric power plants using biomass energy plantations.

3. Analysis of the potential global power systems of various configurations

The global energy system may consist of solar power plants and power plants using other renewable energy sources, interconnected and consumers of energy transmission lines of electric energy in a way that CEC same power installed in the latitudinal direction in Africa, North America, Europe and Asia at the same angularly spaced from each other longitudinally.

Basic solar power through high frequency converters and step-up transformers Tesla join the resonance line of single-conductor transmission of electrical energy, joined by other solar power, hydroelectric power, wind power, power, biomass, and electricity consumers around the world. The total capacity of power plants in the power base equal to the total capacity of all energy consumers around the world, connected to the grid on the day and side of the earth.

To ensure uninterrupted and reliable power supply and align daily schedule of production of energy in the solar energy system consisting of solar power plants, transmission lines connected to each other and to consumers of electricity. Solar power may be located in different hemispheres. The distance between adjacent SES longitude in degrees, shall not exceed degrees, and where - the length of daylight at the location of the station, expressed in hours, and - minimum daily amount selected from all days of the year.

According to the method developed in VIESH were conducted to assess the potential of electricity for a number of major regional power plants of various configurations, disposable in different territories. The results of estimating the parameters of a virtual global solar energy system consisting of three SES, established in Australia, Africa and Mexico (Fig. 1) and connected to power lines with small losses made by employees VIESH (Irradionov IO et al.) By computer simulation shown in Fig. 2.

In the simulation, we used data on solar radiation over the entire observation period. Efficiency SES was taken to be 25%. It can be seen that the SES can generate electricity around the clock and evenly throughout the year. Each of the three dimensions of SES is 190 × 190 km, electric power 2.5 TWh. Annual production of electricity (17300 TW • h) exceeds the annual global consumption of electricity.

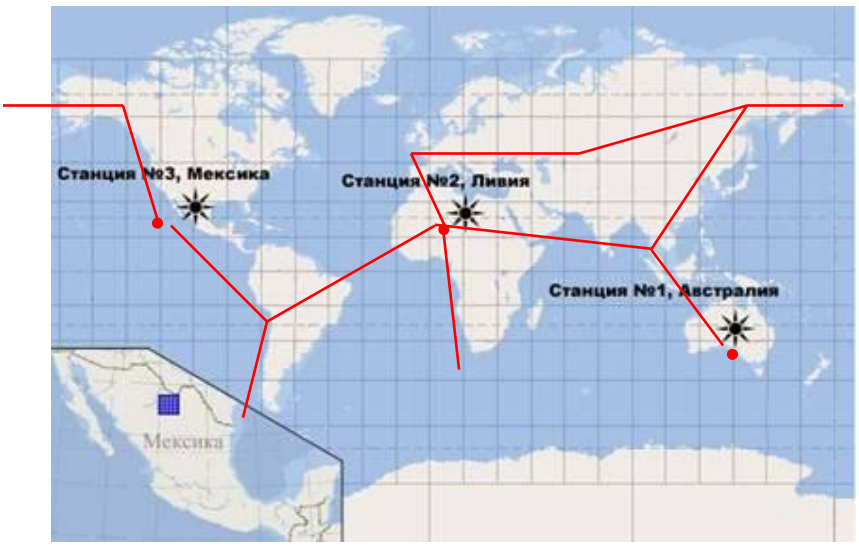

Fig. 1. Global Solar Energy System of the three solar power plants (on the map of Mexico on the scale shows the dimensions of the solar power plant)

Solar power plants in the system are distributed in a latitudinal direction such that the end surface of one photoactive lighting power coincides with the beginning of another lighting panels nearest the sun along the station. By changing the distance between stations in longitude, we can achieve not only the continuity of the diurnal variation of average output power of the system, but also significantly increase the uniformity of the production of electricity.

Monitoring and management of the global energy system includes geostationary satellites observing the cloud cover and predict power output of solar power plants, as well as actuators to run backup power and maneuverability with different power characteristics for covering of load power system.

Basic solar power plants of modular type can annually increase its capacity to 100-300 GW. The beginning of the global solar energy system is projected in 2050, reaching full capacity in 2090.

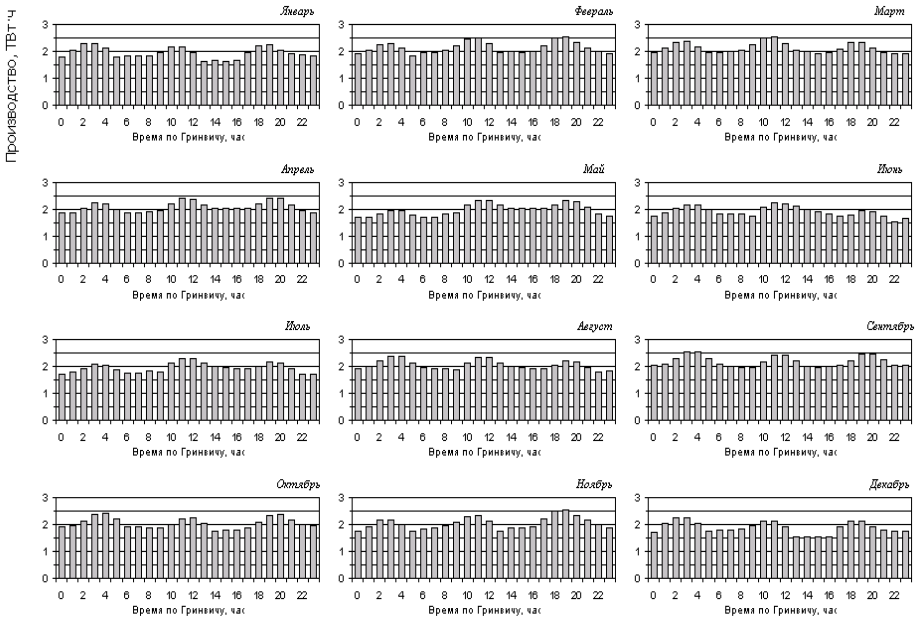

Fig.2. Electricity production of the global solar power system

As a result of this project the share of solar energy in global electricity production will be 75-90 %, and greenhouse gas emissions will be reduced by 10 times.

Placing solar power energy systems on both sides of the equator eliminates seasonal fluctuations in power generation - the winter decline in one hemisphere summer is offset by an increase in another generation.

Observation of cloud cover in the vicinity of solar power plants using geostationary satellites allows to predict the output power level and, if necessary, to determine the start of the preparation for the launch of certain spare capacity. This system allows you to completely eliminate or minimize the need for buffer storage of instant action.

4. Distributed energy production

Development of distributed energy actively growing attention of the scientific community and businesses, as it is one of the most important factors to improve energy security in countries such as Russia. About 2/3 of the country, with a population of about 20 million people, is not covered by centralized power, and a significant fraction of all there is no any source of energy.

Decentralization of power is a vital necessity for the people living in the vast expanses of the country and a powerful incentive for involvement of these areas in the economic activity.

One of the most effective ways to solve this problem is the development of new renewable energy technologies. Independent power supply - this is the niche where the use of renewable energy sources and, in particular, solar energy, today is economically justified.

In this field of energy are nascent basic terms and concepts, there is a distinction of small power generated by the type of energy and power. However, work in this direction have been developing quite rapidly throughout the world and in Russia in particular. Thus, in the Russian Federation approved among several technology platforms and the platform has "small distributed power" (TP "MRE"). Conducted two All-Russian conference "Development of small distributed power in Russia." Formulated a number of concepts, clarification of which is ongoing. Nevertheless, many problems still require careful design.

In the most general form of the distributed energy resource can be characterized as a collection of power generators, which can be distributed throughout the network, from both the consumer and the supplier side.

In recent years, for independent power supply remote, mainly rural, consumers have begun to use combined systems based on the use of two or more types of renewable energy. They can successfully complement each other, resulting in the need for accumulation and use of reserve sources of energy are reduced. Particularly successful stand-alone systems can be arranged if there is complete information about the potential of various renewable energy sources in the area, specifically on the subject.

However, it is often difficult for a single object, especially if it is a small farmhouse, realize the power system based on a number of potential sources. Furthermore, the ratio of on time and power, and power generation load, in most cases it is difficult to balance, and since the generation sources and consumers are scarce.

It is much easier to eliminate all these problems, and if the number of sources of generation, and the number of electricity consumers will be significantly larger and more diverse they are. These conditions are easy to implement, if you create a local micro-network, the provisions and principles of which are actively being developed.

Micronet - an integrated energy system with distributed small power generators and consumers of energy.

In microgrids can implement a broad integration of local fuel-free renewable energy sources in the first place, such as solar energy.

There are many options microgrids. They can not only operate autonomously and in parallel with the mains. Innovation in energy and electronics, control technology, information and communication create favorable conditions for the development and improvement of microgrids, optimal control with the maintenance standard and stable parameters of electric power, despite the integration of unstable power sources such as wind and solar power. In Micronet easier to implement balancing capacity and get a good relationship between generating capacity and volume generated and consumed energy. There can be applied dynamic spare capacity and efficient energy storage, whereas in a large power system is necessary to contain expensive and bulky spare capacity, so there are plenty of opportunities to set the price lower than the market for electricity. Micronet own and operate its owners are homes, businesses, Ltd., villages, towns, etc. Here consumers of energy at the same time can be and manufacturers who exploit their mikroelektrostatsii and / or energy storage. Integration of Northern Electric Networks and other renewable energy power plants in the Micronet occurs much less red tape than accession to power.

Currently, about 90 % of the existing electrical microgrids covers an area of 1 km2, and the total capacity of power generators in one such Micronet does not exceed 1 MW.

Good prospects for the construction of microgrids are in rural areas, where access to local primary renewable energy less limited compared to urban areas.

In Micronet generated electricity is mainly used by local consumers, which reduces the losses associated with the transmission and distribution of energy on the grid.

Conclushion

Intensive development of innovative energy technologies and transfer it over long distances opens up possibilities for the realization of the idea of a global energy system. Such a system could combine large generating capacity in various areas of the earth's surface in areas unused for economic activity, but high-potential renewable energy. It will ensure uninterrupted power supply to large areas around the globe. However, even with major regional or global energy stations will remain an area where there will be no centralized power supply. A number of areas for a variety of economic or technical reasons, will continue to remain outside the centralized energy supply. In these areas the problem of reliable energy supply will be solved with the help of distributed energy power systems. As we move to centralized power yet unexplored territory there created autonomous generating facilities can be operated in parallel with the network mode, and the network energy flows or, where appropriate, be absorbed by the large power systems.

Development and implementation of new renewable energy technologies will increase the role of renewable energy in the energy of the future to 60-70 % in energy up to 80-90 %.