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Alternative sources for power supply of coastal objects

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Abstract

The article contains the analysis of alternative sources and the perspectives of application low-powered nuclear thermoelectric power stations for electromagnetic compatibility on distance oil and gas fields with mesh power networks from 6 to 35 kV.

Keywords: Floating nuclear power station, generating unit, electric heat supply, electromagnetic compatibility.

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1. Introduction

Expansion of production on oil and gas fields in Northern regions of the European and Asian parts of Russia, increase in the reconnoitred fields on the shelf of the Caspian Sea both in the Russian Federation, and in the Republic of Kazakhstan, induce the necessity of expansion of their power supply. The mesh power networks (further networks) from 6 to 35 kV of these objects in the greatest measure, in comparison with the networks of 110 kV feeding from remote electrical power systems (EPS) and above, are connected with features of technological processes and the nature of influence of the environment. In these networks levels of electromagnetic compatibility (EMC) of technical means for conductive electromagnetic hindrances (EMH) according to requirements of GOST 13109-97 have to be provided. It is necessary: for providing actions for protection of life and health of citizens, property of natural and legal entities, the state property, on environmental protection; for increase in technical and economic indicators of productions and quality of products which are turned out by them.

2. EMC problems

Suppression of the conductive EMH extending on networks is the constructive scientific direction of the solution EMC problem of technical means in regional EES.

However, the problem EMC caused by interaction of electromagnetic processes of production, transfer, distribution and electricity consumption by various receivers is rather many-sided and constantly develops therefore not all scientific tasks connected with features of electric networks and operating modes of the distorting loadings are solved. In particular, there are no recommendations about definition of rational places of disconnection of the closed networks from 6 to 35 kV at conductive EMH and to suppression of hindrances. The solution of similar tasks provides new knowledge to areas Ems of technical means and increase in efficiency of power supply of objects [1], remote from regional EES.

The above mentioned allows to consider the features of electro heat supply of the industry, household needs of the population of Siberia, the Far East and other remote areas including:

- high requirements to uninterrupted operation of electro heat supply of consumers because of severe climatic conditions and the considerable extent of power lines;
- big charges of production and social infrastructure.

Power supply of the remote regions is an example of the fact that for increase in its quality it is expedient to use non-traditional power sources. However, continuous power supply of the enterprises and country people only from some renewable sources difficult because of an inconstancy of energy flows. It is necessary to mark at the same time efficiency of use of accumulators of energy. For example, from drives of energy the inductive are

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widespread electromechanical, molecular, and electrochemical. Due to the shortcomings of rechargeable batteries connected to small energetic parameters development and use of the close class of instruments in parameters extends the two-layer condensers, ultracondensers known according to the name as ionistors. Use of nanoporous carbon (decanter) in similar condensers and for manufacture of composition resistors [3] is perspective. Capacity of such condensers in several cells times more capacities of widespread condensers (tantalic, film, ceramic, electrolytic). Use assemblies of supercapacitor modules as main source of energy of mobile and stationary objects. Therefore it is more effective to use combined diagrams of electroheat supply, one of which is figured in a figure 1 [2, 3].

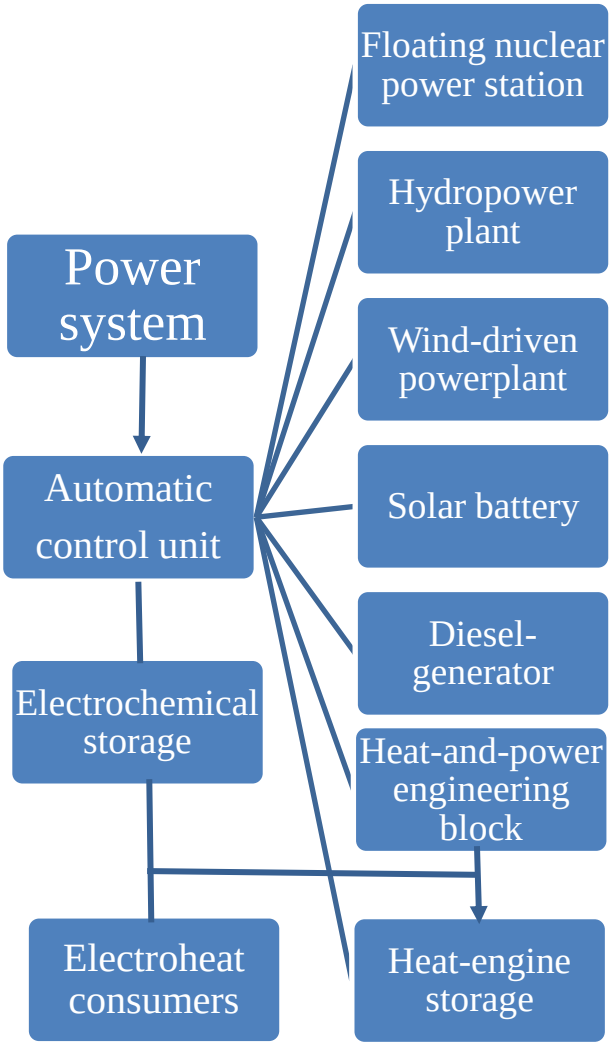

Figure 1. The combined electro heat supply of consumers

2.1. Renewable and nonconventional power sources

We will emphasize that in the majority of the above-stated energetic devices as the resistive load resistors are used some different types, for example, metal and resistors from composition materials on the basis of silicate, polymeric or phosphatic sheaves.

Operation of electrical power systems, including with use of RNPS, has to consider also electromagnetic compatibility of the technical means subject to action of electromagnetic hindrances. During the work of local electric networks from 0,4 to 35 kV influence linear isolation of power lines (PL), electric equipment of power plants and substations, electric isolation of the power and household equipment different electric an overstrain.

In the last decades there is a continuous intensive aging of the operated power equipment. Therefore relevance of studying of an electromagnetic situation (EMS), definition of various type of electromagnetic hindrances, ensuring electromagnetic compatibility of technical means increases in the operating electric networks.

Ratio changing of hydro carbonic raw materials and nuclear fuel costs when comparing technical and economic indicators allow to be guided by application of the floating nuclear power plants (FNPP) with power from 50 to 100 MW that is the most urgent for power supply of the oil and gas extraction and overworking complexes [2,3].

Nuclear power plants of low power (the NPP of MM) include stations with electric and thermal power from 5,0 to 500 MW. Such stations have long (from 5 to 50 years) the period of autonomous work and high degree of factory readiness.

Recently were handled issues of application of reactor installations on the basis of technologies of ship block reactors for a construction of atomic thermal power plants (TPP) and the floating NPPs of MM which together with small power units on traditional fuel and on RNPS would improve living conditions and economic activity in Siberia and in the Far East.

They can be of interest to the international aid programs to developing countries in the solution of electric power problems, and granting them to the developed countries on a commercial basis. For developing countries with their growing population and economy at insufficient economic infrastructure, including power, small AE – one of solutions of a problem of power supply [3,4].

According to the Russian project, the floating nuclear power plant of low power (MM APEC) consists of the flush deck not self-propelled vessel with two reactor installations of the icebreaking KLT-40S type developed by JSC OKBM im. Afrikantova. Vessel length – 144 m, width – 30 m and displacement – 21,5 thousand tons. In 2015 the 170 MW reactor block especially for floating nuclear power plant is released.

The floating station can be used for obtaining electric power and thermal energy, and also for desalting of sea

water. It can give from 40 to 240 thousand tons of fresh water, per day. The established electric power of each reactor – 35 MW, thermal power – 140 Gcal/h. The useful life period of the station will make at least 36 years: three cycles for 12 years between which it is necessary to carry out an overload of active zones of reactor installations. A complex of atomic thermal power plant of low power (MM APEC) includes: the floating power unit (FPU) with two reactor KLT-40S installations, hydraulic engineering constructions, the coastal platform on which auxiliary buildings and constructions of the station (table 1) [4].

Table 1. Main characteristics of low power atomic thermal power plant

Name	Parameters
The maximum electric power to the condenser mode, mW	2x38,5
Nominal heating mode: electric power, mW thermal power, gkcal/h	 2x35 2x35
Максимальная мощность для теплофикации, gkcal/h	2x73
Self-power consumption, mW	4-6
Self-heat consumption, mW	3, 2
Area of the coastal territory, ha	0,8-1,5
Area of the waters, ha	3-6

At design of floating nuclear power plant were considered seismic conditions of regions where such stations are supposed to be used. A big advantage of the floating NPP consists that it can be loaded with fuel at the plant and to tow off to the place of operation, having left for several years. When fuel is completely fulfilled, the station is just towed back on the plant for a recharge, and on its place put another. It is one of options of use of this technology. This method is much safer for ecology, than combustion of coal, fuel oil, oil or gas.
RosEnergoAtom concern has estimated the cost of creation the floating atomic power unit “Academician Lomonosov” at 21.5 billion rubles.

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