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A.R. Gaffanova, A.V. Ishalin
Academic advisor: Vlasova A.U., candidate of technical sciences, associate professor
Kazan State Power Engineering University, Kazan, Russia

SOLVING THE PROBLEM OF POWER LOSS AT A GAS TURBINE USING RENEWABLE ENERGY SOURCES

The relevance of this article is that today the main goal of any work of the gas turbine electric plant is to generate thermal and electrical energy environmentally and safely. Therefore, it is important to control the CO and NOx emissions of the group at the outlet of air filters for GTU in order to increase environmental friendliness. It is also necessary to ensure the failure-free operation of the gas turbine plant due to the effective operation of air cleaning devices so that erosion wear does not occur on the blades of compressors, turbines and other flow parts of the plant.

It is quite clear that in the future, small energy based on renewable energy sources (RES) will develop more actively, its share, in the total installed capacity of power plants, will undoubtedly grow. Today, it is clear to everyone that the main non-renewable energy resources, sooner or later, will be exhausted. According to one forecast, coal will last for 1,500 years, oil - for 250, gas - for 120 years. According to other forecasts, the prospect is worse. Oil should end in 40 years, gas - in 80, uranium - in 80-100 years, coal can last another 400 years. The share of renewable energy sources, in general, the volume of energy consumption, is constantly increasing in the world.

In accordance with the strategy for the development of energy in Russia for the future until 2020, renewable energy sources will still account for a small share due to their high cost and low reliability. In this regard, small-scale renewable energy needs to be considered in the near term, above all, as a means of solving the problems of energy supply in remote and inaccessible regions, as a means of solving environmental problems that are increasingly aggravated, and, finally, as a means of energy conservation.

Today, the most promising sources of thermal and electrical energy. We are talking, first of all, about small modular power plants based on domestic PSU and GTU (2.5, 4.0, 6.0, 8.0 and 12.0 MW) using gas, of course, where it already exists or where it is possible and economically profitable to lay a gas pipeline.

GTU is a useful installation with a large number of advantages such as high maneuverability, small dimensions, reliability, decent work on variable loads. However, there are a number of disadvantages such as dependence on

external conditions, not the highest efficiency. In regions with hot climates, external conditions impose great restrictions. If we increase the normal temperature + 15 C to + 35 C, then our GTU can lose about 25% of the power. Absorption Bromolytium Refrigerators (ABHMs) are usually used in this situation. However, this is an additional energy load, which does not affect its environmental parameters in the best way. Since currently GTU uses methane as fuel. It is worth noting that recently a more environmentally friendly methane-hydrogen mixture (MVS) has been considered.

The solution to the temperature problem in hot countries is the combination of GTU with solar panels, the energy of which will go to ABHM. So, at the Astrakhan state district power station there are 2 gas turbines installed LM6000PF with an output capacity of 47.5 MW each. Attached to them are 2 ABHM Shuangliang HSA 1157 consuming 4 MW each, in the hot season, which is about 8% of the gas turbine capacity.

Fig. 1. Gas turbine LM6000PF

Table 1. Main turbine perfomance LM6000PF

Parameter	Units of measure	LM6000PF
Output power	MW	47,5
Specific heat consumption	KDc/kVtch	8649
Exhaust gas mass flow rate	Kg/s	133
Exhaust temperature	C	446

It is proposed to supply ABHM with solar energy, this will reduce fuel consumption, which will affect the environment on the positive side.

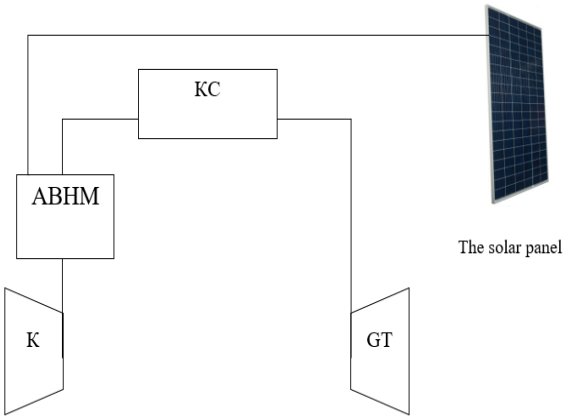

Fig 2. Schematic diagram of a gas turbine unit with an ABHM and a solar panel

The reduced designations: KS - the combustion chamber, To - the compressor, GT - the gas turbine, ABHM refrigerators.

In the field of solar electricity, photovoltaic installations with direct conversion of solar radiation to electricity using solar photobatars are recognized as the most promising. Photovoltaic modules converting solar energy into electricity are based on crystalline or amorphous silicon and, depending on the area of the module, its power can reach 80-1000 or more W, and the releasable voltage is 12, 24, 48 V.

Currently, there is a real boom in the production of photocells for the direct conversion of solar energy into electric energy. Their annual growth rate in recent years has been 30%. In the USA, their annual production reached 60 MW, in Japan - 80 MW, in Germany - 50 MW. Germany and the United States have successfully implemented special programs in this area of electricity. The use of solar energy in gas turbine plants will increase the resulting power by 6-10%, without increasing fuel consumption. And this will also speed up the process of introducing renewable energy in Russia's energy industry.

Based on this, it can be concluded that solar energy is a promising area, both separately and in conjunction with GTU, therefore, more and more promising projects should be introduced in Russia in order to strengthen their distribution, as well as increase the environmental friendliness of energy.

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