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Cogeneration in Modern World

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The global energy problem is the problem of providing humanity with fuel and energy. The main reason for the emergence of this problem should be considered the rapid growth in consumption of mineral fuels in the 20th century. On the supply side, this is due to discovery and exploitation of huge oil and gas fields in Western Siberia, Alaska, on the North Sea shelf, and on the demand side, an increase in the fleet of vehicles and an increase in the production of polymeric materials. The increase in the extraction of fuel and energy resources has led to a serious deterioration of the environmental situation. And the growth in demand for these resources has intensified competition both between fuel exporting countries for better sales conditions, and between importing countries for access to energy resources [1].

Cogeneration can partially solve these problems. Cogeneration (from the words “combined generation of electricity and heat”) is the process of joint generation of electrical and thermal energy. In the Soviet technical literature the term cogeneration is common – district heating based on the combined production of electricity and heat [2].

Over time, technologically advanced countries also applied the term cogeneration. The advantage of the internal combustion engine was the high maximum temperature of the working fluid. Today it reaches 2500-2700 K for engines operating on the Otto cycle, and 2000-2300 K for diesel engines. For gas turbine plants, the temperatures approach

1800 K. Such a temperature level of the technological operation makes it possible to sufficiently fully use the hydrocarbon potential of the fuel [3]. Unlike large centralized power plants, which also use combined heat and power (further – CHP), cogeneration is used in own power plants in enterprises, infrastructure facilities and residential facilities. The heat that is generated in the process of obtaining electricity by centralized stations does not reach consumers and is released into the atmosphere. Cogeneration allows more efficient use of energy resources. The heat that is generated during the production of electricity is used at the facility. And if we compare it with the use of two separate sources of electricity and heat, then the fuel energy savings when using a single cogeneration system will be about 40% [4].

Of paramount interest for the application of cogeneration technologies is the area of municipal energy. Here, almost any boiler house can be turned into a mini-CHP by adding a gas turbine or a gas piston engine to an existing boiler.

Theoretically, the use of cogeneration plants in municipal energy should lead to a significant increase in the efficiency of fuel combustion. In fact, the situation is the same with other technical installations for the direct combustion of gaseous fuels used in enterprises. These are various kinds of furnaces, heat generators, dryers, etc., in which the thermal efficiency is much lower than in boiler houses. By simply burning fuel and not using it to the full, enterprises incur large energy, economic and financial losses. The way out of this situation is the combined joint generation of electricity and heat in one modern heat engine – gas piston or gas turbine, installed in a convenient place for maintenance on the site of the enterprise.

The research, development and projects carried out over the past 25 years have resulted in significant improvements in technology that are now truly mature and reliable. The level of distribution of cogeneration in the world allows us to assert that

this is the most efficient (of the existing) energy supply technology for a huge part of potential consumers.

The cogeneration plant consists of four main parts: primary mover, electric generator, heat recovery system and control and management system. To improve the performance of the thermal part of the cogeneration system, the recuperator can be supplemented with an economizer. Cogeneration systems are classified according to the type of prime mover, generator, as well as the type of fuel consumed [5]. Depending on existing requirements, the role of the prime mover can be performed by a piston engine, steam turbine, gas turbine.

If we talk about the advantages of cogeneration plants, then they include complete independence from monopolized regional energy networks, and, consequently, from unreasonable tariff increases. No costs for the construction of supply and distribution networks and connection fees, since the CHP plant is being built next to the facilities. Combined generation also provides an efficiency of about 90%. As for the terms of construction of cogeneration facilities, they are 4-6 times less than at electric power facilities. This is due to the high factory readiness of cogeneration units, low weight and dimensions, as well as a small amount of construction and installation work.

Cogeneration plants also have a short payback period. It ranges from 1 to 3 years. And only for one-shift enterprises it reaches 4-5 years. Moreover, with the increase in fuel prices, these periods are reduced. In the electric power industry, thermal power plants are built within 5-6 years, and the payback period is from 8 to 12 years.

Observing the difficult process of introducing cogeneration, we can conclude that in order to accelerate this process, it is necessary to take new active actions both on the part of interested government agencies and on the part of the business community, in particular, manufacturers of

cogeneration plants. Against the backdrop of undoubted benefits for the consumer in the form of fuel savings, the main factor preventing the mass replacement of heating boilers at CHPs is the too high price of existing CHPs, despite their high payback.

With joint and productive work in this direction by both state development structures and scientific and industrial communities, there is every reason to believe that the development of cogeneration will take on a new breath and society will receive significant results in the form of a large-scale reduction in emissions and consumption of fuel resources.

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