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ECONOMIC AND ECOLOGICAL ADVANTAGES OF COGENERATION USE IN POWER INDUSTRY

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In the developed countries, the main source of the environmental contamination is industry. There is a set of plants, factories and other industrial facilities, which pollute environment in various ways. One of the key industrial sources of environmental pollution is the energy sector. At extraction, processing and combustion of fuel, pollutants and redundant heat are released into the air and contaminate water and land resources. According to the expert estimations, Ukrainian energy sector provides about 30% of all environmental pollution volumes in the country. The world average for this figure is 20% [1].

Partially it is possible to solve the problem of environmental pollution by applying technologies of the combined production of heat and electricity named as cogeneration. These technologies have been existed for a long time, but till today all their advantages are not widely used. However, the use of cogeneration is justified from both an economic (significant reduction in fuel use, reducing the need for new generating capacities, saving operating and capital costs in energy production) and environmental point of view (reducing the energy facilities burden on the environment).

Conventional thermal power stations generate additional heat pollution because they throw out in atmosphere the heat generated in the production of electricity. The result of overheating of the atmosphere is aggravating the greenhouse effect. Technical efficiency of traditional power generation technology for thermal power plants is about 35%. A similar situation is observed in the production of the thermal energy, where the losses reach 20% or more. If we compare separate production of electricity and heat with the cogeneration technology, then the generation of the same amount of energy by cogeneration power plant can provide fuel savings of about 40% and, respectively, reduce emissions of harmful substances into the atmosphere [2]. Important advantages of cogeneration technology are the high fault tolerance that allows not to interrupt the process of power generation and almost complete automation that considerably reduces costs of operation and maintenance. In addition, cogeneration plants can run on

alternative energy sources, such as peat, wood wastes and biogas obtained by recycling or from water treatment plants. This allows the use of cogeneration technologies not only in the central heating systems and electrical grids, but also as an independent source for individual households.

By the end of 2014Y in Ukraine about 20% of all thermal energy was produced at combined heat and power plants – usually large thermal facilities citywide that use cogeneration cycle. The average power of 23 domestic cogeneration plants was about 200 MW which compared with an average power of conventional thermal power plant of 2000 MW is relatively small [3]. In Europe, utilization rate of cogeneration plants is also close to 20% of total energy production. Such a low percentage of application of cogeneration technologies is explained by the relatively low power of these installations that can not always fully meet the needs of the consumer. It is caused by the design features of cogeneration systems, which generally use gas and steam turbines with capacity of 30 MW and above. At low powers there are used gas-piston engines. They have larger term of operation compared with turbines and several times wider load range, in which high efficiency is not lost. Apart from this, the system with gas-piston engine has a smaller size and can be installed in close proximity to the consumer [4].

Thus, the strong growth in use of cogeneration plants in the world is now tempered by their relatively small power and high price. For today, with all their technical efficiency and environmental friendliness, these facilities are too expensive to operate and repair. Because of these problems, the cogeneration is not widely used in the world and in Ukraine in particular.

Nevertheless, today the cogeneration is one of the most environmentally and technically efficient technologies of heat and electricity production. Despite the significant capital costs and relatively low power, the cogeneration facilities have a number of indisputable advantages over conventional thermal energy production, such as:

- average payback period of the installation within 3 years [5];
- high efficiency;
- eco-efficiency;
- reducing the fuel consumption in comparison with conventional technology;
- increased reliability and safety of the installations;

- cost savings in energy transportation.

All these advantages give reason to believe that solving the problem of low power of cogeneration installations by increasing the number of turbines or by increasing the overall plant efficiency and reducing capital and operating costs make possible to apply cogeneration as the primary method of energy production in Ukraine and in a whole world.

References:

1. Sources of environmental pollution, 2011 [Electronic resource]. – Mode of excess: <http://environments.land-ecology.com.ua/uchrezdenija-kieva/1709-istochniki-zagryazneniya-okruzhayushhej-sredy.html>.
2. Combined heat and power, 2008 [Electronic resource]. – Mode of excess: <http://www.2g-cenergy.com/pdfs/more-chp/CHP%20Report%20-%20International%20Energy%20Agency.pdf>.
3. List of the companies - Thermal power plants – Ukraine, 2014 [Electronic resource]. – Mode of excess: <http://ua.kompass.com/a/электростанции-тепловые-теплоэлектростанции/0731001/>.
4. Cogeneration gas-piston combined heat and power plants (MWM), 2014 [Electronic resource]. – Mode of excess: http://www.ges-ukraine.com/maininfo_20.html.
5. Vorontsov S. What is cogeneration? / S. Vorontsov // Business and safety. – 2002. – No. 6. – P. 25–27.