PRODUCTION OF ELECTRICITY AT THE ACCOUNT OF DISPOSAL OF THERMAL WASTE AT INDUSTRIAL ENTERPRISES

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Industrial enterprises provide the widest opportunities for the use of thermal waste for the production of electricity. Part of the thermal energy consumed by industry is released into the atmosphere or the cooling system in the form of heat loss. These losses are the result of the imperfection and impossibility of using and utilizing all thermal flows in the current process. A significant part of them is thermal waste that cannot be used or distributed in the form of radiation. Disposal at the current technical level is neither practical nor economical [1, 2].

The efficiency of generating electricity from thermal waste largely depends on the temperature of the heat that is removed. As a rule, the economic feasibility of this process is achieved only through the use of high-temperature and medium-temperature waste. New technologies, such as the organic Rankine cycle, make it possible to overcome this limit, and the further development of alternative cycles makes it possible to produce electricity even from low-temperature thermal waste [3]. In addition to the Rankine cycle, at the level of research and development, many other modern technologies are known that allow the production of electricity from thermal waste, which can provide an additional advantage of such a conversion process in the future. Such technologies include thermoelectric, thermophotoelectric, and piezoelectric devices.

At the design level, in order to economically substantiate the possibility of generating electricity from thermal waste, in addition to the temperature level of the waste heat, the following factors must be taken into account [4]:

– availability of thermal waste – constant, cyclical or periodic;
– composition of thermal waste – gas, liquid;
– coefficient of use of thermal waste;
– temperature constancy of thermal waste;
– thermal waste flow rate;
– reduced or excessive pressure of thermal waste;
– the composition of the flow of thermal waste.

The use of thermal waste for the production of electricity is the process of collecting the waste heat of the technological process and using this heat for the production of electricity. Energy-intensive industrial processes carried out in steel mills, blown glass production, oil refineries and cement kilns can be used in modern electricity generation technologies [5].

Utilization of thermal waste for such purposes is a combined energy production using a single source of energy (fuel) (Figure 1).

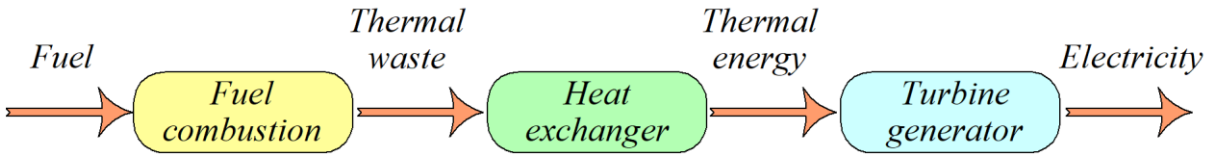

Figure 1 – Scheme of using thermal waste for electricity generation

The cogeneration system consists of a primary source, a generator, a heat removal system and an electrically interconnected device and is assembled into an integrated system. Combined power generation is characterized by higher efficiency and the possibility of preventing or reducing losses during energy transportation from the source to the consumer, reducing the consumption of primary fuel and the emission of harmful substances into the atmosphere.

The most common variant of combined electricity production is carried out according to a cycle in which the fuel is first used to produce mechanical or electrical energy in a heat engine, and then the waste heat of the main device is used to produce thermal energy. For example, gas turbines and reciprocating engines burn fuel to produce electricity, while recycling plants harvest useful thermal energy from waste streams and cooling system streams. Similarly, steam turbines use high-pressure steam to generate electrical energy from boilers to generate electricity, after which the low-pressure steam that has been exhausted is used for technical purposes or to provide heat. The main advantage of such systems is that they use heat from existing processes to produce electricity, rather than throwing it into the environment.

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AUTOMATIC CONTROL SYSTEM OF VOLTAGE AND CURRENT FOR ELECTRIC CAR CHARGING STATION

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The efficiency of energy use in industry is assessed by the distribution of specific costs based on the construction and analysis of the energy balance of industrial and economic facilities. The main goal is to provide appropriate services for achieving high energy efficiency of economic activity, optimal use of all types of resources and ensuring the functioning of facilities during planning, organization, coordination, accounting and management [1, 2].

In recent years, there has been a steady transition from vehicles equipped with internal combustion engines to electric motors. Given the potential to reduce air pollution caused by cars, especially in large cities, the spread of electric cars is very promising. The technology of hybrid electric vehicles has made it possible to obtain effective economic solutions with higher characteristics and a lower level of emissions compared to traditional vehicles. Electrification of road transport is currently one of the main trends in the development of the global automotive industry. According to forecasts, by 2040 the share of electric cars in the world fleet will be about 30 % [3].

Manufacturers and researchers pay a lot of attention to the development of electric vehicles. Another important issue is the creation of energy efficient charging stations