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TRANSITION OF LARGE THERMAL COAL-OIL POWER PLANTS TO ALTERNATIVE FUEL – BIOMASS

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Abstract

In world practice, the technology of mixing coal with biomass for combustion in power plants is used. It is widely practiced to create special plantations of fast-growing trees of poplar with further wood chipping for processing pellets. The area around the Novo-Angrenskaya's Heat power plant in Uzbekistan, operating low-quality brown coal is the preferred area for planting energetic plantations. Biomass energy plantations prevent soil erosion and improve the ecology of environment near HPP.

Aim

To present the prospects of technology of mixing coal with biomass for combustion in power plant

Tasks

1. Analysis of the existing development of this technology
2. Perform a technical-economical study the implementation of biomass power plant

Materials and methods

In the scheme of the technological process of generating electrical energy by specially grown fast-growing phytomass, it is necessary to solve the problem of recycling / neutralizing secondary waste (effluent) that appeared in this process. Solid gas cleaning products and bottom ash (sludge) can be used in the production of building materials (ash gravel, asphalt concrete, cement mixtures, concrete, insulation, etc.) and products (bricks, blocks, paving and facing tiles, etc.) , applied to the soil as fertilizers, deoxidizers and stabilizers, used in landscape construction and for other purposes.

Results

The design value of the power plant on wood efficiency is only 29%. At the same time, coal-fired power plants, which are now closed all over the world, including due to low efficiency, have an average efficiency of 37%, and power plants operating on natural gas - 60%.

In Germany, there are 270 power plants (PP) and thermal power plants that use solid biofuels, mainly wood (chips, pellets, etc.). The total capacity of these plants is about 1400 MW, and among them there are both classic power plants with a capacity of up to 20 MW, where energy is generated by a steam turbine, as well as stations with ORC-modules with a capacity of 1-5 MW and gas-generating stations up to 1 MW. In total, there are about 1,100 such stations in the EU, and another 130 coal-fired thermal power plants use biofuel (pellets) for combined combustion.

Table 1

Comparative characteristics of biomass thermal power plants, offshore and onshore wind farms and solar power plants in the world

	Unit measurements	Biomass thermal power plant	Wind farm (on land)	Marine wind farm	Power plant on a photo-electric cell
Electric power	MW	20	3	5	>1
Investments	Euro/kW installed power	2100-3350	950-1300	1100-3500	1000-2000
Duration of the operating period	Days per year	182.5-313.9	53.7-98.5	91-175.2	32.8-65.7
Lifetime	Years	20-40	12-30	12-30	15-30
Construction duration	Years	0.7-3	0.2-1	0.5-2	0.2-1
Production and exploitation expenses	Euro/kW/year (average)	150	fifty	120	33

Solid fuel from wood raw materials (pellets) in Uzbekistan is used mainly for heat generation. Unfortunately, there are no systematized statistical data on the number of solid fuel boilers operating on biofuel installed in Uzbekistan yet.

The US Department of Energy (DoE) and Ameresco in South Carolina inaugurated a new $795 million biomass power plant. The energy service contract, signed in 2009 for a period of 20 years, has become the most expensive in the history of the United States with the participation of the state, and its operation during this period will save up to 1 billion US dollars. According to calculations, the payback period for such biomass-fired plants will be in case of a discount rate of r=10%, capital investments K=795 million $, economy E=1 billion $, operating life T=20 years

$$C_{ok} = \frac{\ln(1 - r \cdot K/(Э/T))}{\ln(1+r)} \approx$$ 18 years

Fig. 1. Biomass power plant

The area around the Novo-Angrenskaya's Heat power plant in Uzbekistan, operating low-quality brown coal is the preferred area for planting energetic plantations. Biomass energy plantations prevent soil erosion and improve the ecology of environment near HPP.

Conclusion

1. To produce one of the power plant units at a capacity of 66 MW, an annual consumption of 190 thousand tons of biomass is required.
2. This will require the planting of energy forests within a radius of 100 km around the plant.
3. The operation of the station will reduce annual CO_2 emissions by 144,000 tons

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