BIOMASS MICRO-SCALE COGENERATION UNIT WITH STIRLING ENGINE

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The development and testing of an experimental prototype of a micro-scale cogeneration unit based on the Stirling engine, with a vortex two-stage combustion chamber of granulated biomass, recuperation and heat recovery of the exhaust gases were carried out.

The facility includes a two-stage combustion chamber, a Stirling engine with a heat exchanger located in the secondary combustion chamber, a heat exchanger-recuperator and a waste heat exchanger. The combustion gases are first supplied to the Stirling engine heat exchanger, and then enter the counter flow recuperator, in which the combustion air is heated. The residual enthalpy of the flue gas is spent on the water heating. A two-stage, vortex-type combustion chamber provides a high level of biomass combustion.

A tests were carried out with the measurement of basic parameters of cogeneration unit. Wood pellets with a calorific value of 15.3 MJ / kg were used as fuel. The thermal capacity of biomass combustion was 12 kW. The electric power of the Stirling engine was 500 W. The total efficiency of the unit was 90%.

Tests have shown that the combustion chamber provides steady-state combustion. Due to the use of the vortex combustion technology in the secondary chamber, intensive mixing is provided, the tars are completely burned out. The required level of temperature in the primary chamber is provided by a reliable heat insulation and recuperative heating of the combustion air. Flue gases were completely transparent, indicating a sufficient level of completeness of biomass combustion. Also, there was no ash particles in flue gas, which allows us to hope for a long lifetime of cogeneration unit, without frequent prevention and cleaning.