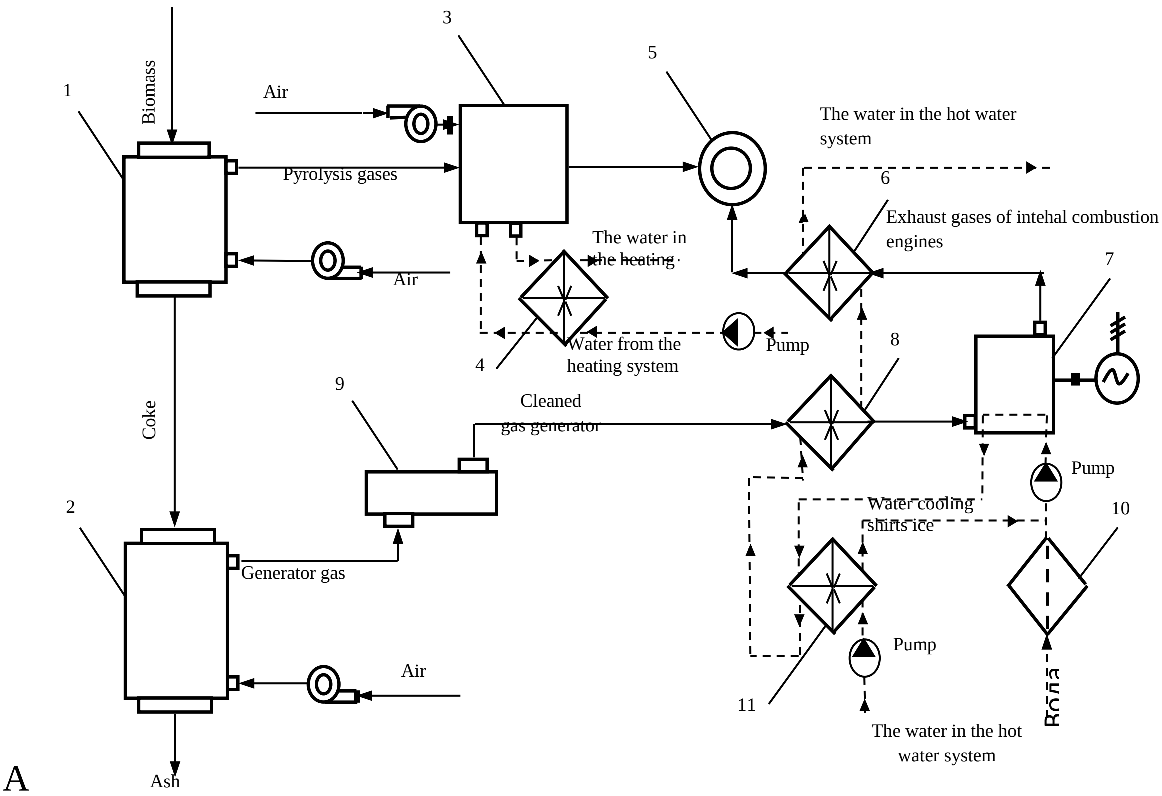
Maryna Kuznietsova
K.V. Kremneva, research supervisor
I.P. Nikitina, language advisor
National Metallurgical Academy of Ukraine, Dnipro

Comprehensive Utilization of Forestry and Agricultural Waste in order to Produce Heat and Electric Energy

Improving the technologies of energy supply based on renewable sources is a global task, which is of great importance in economic and ecological sense for all regions without exception. Biomass energy use does not violate the carbon balance of the environment, therefore, in domestic realities and the enormous potential of agro-industrial complex, popularizing of this direction of energy saving is a priority. Such decisions are demanded, primarily in private countryside houses, farms and small food processing enterprises.



1-pyrolyzer, 2- gasifier; 3- hot water boiler; 4- the heat exchanger of the heating system; 5- chimney; 6- the cooler exhaust gases; 7- internal combustion engine; 8- cooler generator gas; 9- gas purification; 10- chemical water treatment; 11- cooler shirts engine.

Fig. 1 – The scheme of the cogeneration unit with the air gasification of the coke residue

That is, the places where there is free access to raw materials (resource) base have benefits from the implementation of such projects.

Special attention is required for the development of cogeneration plants of small capacity (up to 1 MW) based on internal combustion engines (DVS). The use of biomass gasification technologies for such systems ensures production with maximum energy and environmental benefits. This paper presents the study results of two-stage gasification process of particulated biomass (brushwood, sunflower and buckwheat husk, etc.). The technology is based on two sequentially occurring processes: oxidizing pyrolysis of biomass and air gasification of coke residue.

As a result of experimental and theoretical studies of two-stage gasification process of particulated biomass in a dense layer, the main parameters of the unit were obtained. Power inflator for the source of the biomass amounted to 0,025-2,5 MW. Pyrolysis gas output was 0, 99...of 1,33 m^3/kg, heat of combustion of the pyrolysis gas was 8,1 MJ/m^3. The output of coke 0, 23…0,25 kg/$kg_{biomass}$ the heat of combustion of coke was 32,8 MJ/kg. The efficiency of the process of oxidative pyrolysis with the use of sensible heat of pyrolysis gas was 97%.

Also as a result of experimental studies the coke residue gasification indicators of the process were determined. Specific consumption of air for gasification amounted to 445,3 $m^3/(m^2 \cdot h)$. The temperature of the gasification process was 950...1000° C. The yield of producer gas was 4,5 m^3/kg_{khoksa}, the heat of generator gas combustion made up 5,15 MJ/m^3. The efficiency of the coke residue gasification process with the use of the generator gas physical heat was 96%.

In accordance with these results the technological scheme of a cogeneration plant to produce thermal and electrical energy were developed, as it is shown in Fig.1.

Electric power cogeneration plant was 85,9 kW. Thermal power was 386 kW. The value of fuel utilization rate was 91, 2%.

The value of the energy efficiency is76,4%.

For this cogeneration unit value of the total energetic efficiency is 47,8%.