Contemporary solutions in power generation

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In XXI century coal processing plants (into liquid fuel, methane, hydrogenium or other important products of organic synthesis) and coal-powered combined-cycle plants became main consumers of coal alongside steam-power plants.

The concept of multistage combustion of low-quality fuels at IGCC plants with the purpose of electric-power generation in combined cycle leads to significant prospects in growth of power and ecological efficiency of coal power plant.

Developments of CCGT units on a solid fuel, patented in the sixties of XX century, changed from demonstration stage to commercial one by the beginning of XXI century. Possessing great opportunities for efficient use of resources, CCGT units on a solid fuel projects are included in the power generation development projects of all leading world powers and Russia among them.

However, wide implementation of gasification technology at power plants may be held back because of the complexity and low efficiency of technological part (expensiveness of oxygen, low chemical efficiency, lack of high-temperature cleaning), low efficiency of technological combustion in comparison with energetic one (chemical efficiency of circulating fluidized-bed unit is 50-60%, of flow units – 70-83%) and unsolved thermophysical problems of energetic part CCGT in respect to low-emissive technologies associated with combustion of hydrogenous fuel in oxygen.

Combined coal conversion scenario is more actual, when the technological production output (based on not perfect but reliable equipment) is combined with own power generation. Several countries have the experience of such kind of work in their oil- and coal-processing sector; chemical plants with CCGT units on a solid fuel are being built in North America, China, and India.

In the report there are materials on the analysis of the efficiency of well-known coal gasification projects running and results of calculation and experimental researches of the possibility of low-grade fuel-and-power resources conversion into conditioned gas process efficiency increase for power units (gas-turbine unit, internal-combustion engine), which makes it possible to state and test some engineering decisions on blowing, process decomposing, chemical and physical heat regeneration, increasing chemical efficiency by 12-15% and gross efficiency of prospective CCGT unit on a solid fuel by 8-10%.

The technology is prospective for the purpose of frontier areas development (for example, Polar and Nether-Polar Urals). Considering the wide spread occurrence of condensation power plants based on local fuels, it can be demanded during the modernization of power generation in North-West Russia and Eastern Siberia.