ENERGY SAVING

ORGANIZING ADDITIONAL ELECTRIC POWER GENERATION AT PLANTS IN THE METALLURGICAL AND MINING INDUSTRIES

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Metallurgical, chemical, and mining companies founded during the Soviet period have experienced significant changes in the energy balance of their main production operations since the advent of a true energy market after the breakup of the USSR. In some cases, the demand for steam with parameters of 2.5–14 atm has dropped substantially either due to the loss of outside customers or to changes to new, more conservation-oriented technologies.

In addition, market competition has made it necessary for plants to reduce their expenditures on energy resources (energy costs at some factories had reached levels ranging from 30 to 40%).

Taken together, these factors have forced companies to look for ways to generate their own electric power from recycled energy resources (when available). Among the possible approaches here are improving the thermal design of the factories’ own electric power plants and replacing worn-out or obsolete equipment in the plants.

Discussed below are several variants for organizing the production of electric power and heat. Each variant has been successfully realized as part of a project undertaken by the company Lonas Technologia. Companies in the mining-metallurgical complex often already have the resources needed to generate electric power without the expenditure of additional fuel (Fig. 1).

Use of the steam-generating capacity of different waste-heat boilers. To cite one example, the coke and coal chemicals plant at the Nizhniy Tagil Metallurgical Combine (NTMK) utilizes waste-heat boilers (WBs) with a steam pressure of 26 atm. This steam was previously throttled to a pressure of 9 atm and then used in production operations. The existing thermal design of the equipment was modified so that steam from a WB is sent to an R-5.7-2.7/0.9 steam turbine (introduced in 2003). Undergoing expansion in the turbine to a pressure of 9 atm, the steam produces 6 MW of electric power before being sent elsewhere in the factory for further use. The same plan is now being implemented at the Chelyabinsk Zinc Plant, where a 6-MW turbine is being installed.

Reconstruction of existing electric power plants, steam injectors and air blowers, and boilers – this is the most practicable approach to generating additional electric power (Fig. 2).

Use of steam from unused adjustable pressure taps and the back pressure of existing steam turbines. When a power generator loses customers for steam delivered at pressures of 5–14 and 2.5 atm, it can improve the performance characteristics of its electric power plants and increase its total output of electric power by modifying the thermal design of the plants and installing additional condensation turbines. The new turbines operate on steam diverted from unloaded district heating systems and bled from the taps of existing turbines.

For example, the combination heating and power plant at the Sokolovsk-Sarbaisk Mining-Concentration Combine (in Rudnyi, Kazakhstan) turned out to have excess steam at a pressure of 25.5 atm. In 2002, the plant installed two 17-MW turbines of type K-17-2.5 (made by the Ural Turbomotor Plant) to load the taps of district heating systems. The same technology was used by the heating and power plant of the firm Uralmetprom, which in 2003 installed a K-21-2.5/1.5 steam...
Electric power generation

- Steam from WBs at coke and coal chemical plants and plants that make sulfuric acid
- Steam from the cooling systems of metallurgical furnaces and other furnace facilities; the heat of the flue gases
- The pressure drop at gas pick-up points and gas distribution stations delivering natural gas to factories

Fig. 1. Approximate classification of the methods available to factories for generating their own electric power.

Electric power generation

- Excess 2.5–14-atm steam available after loss of customers. Improvements that could be made to the thermal design of electric power plants
- Installation of steam turbogenerators in place of steam compressors not needed after the reconstruction of air blowers and oxygen injection system
- Excess steam pressure on boilers in industrial and heating boiler rooms

Fig. 2. Technological capabilities of existing electric power plants, steam injectors/air blowers, and boiler rooms that make it possible to organize the generation of additional electric power.

Fig. 3. Diagram of the use of 2.5-atm steam generated by back pressure to produce additional electric power at the Rudnyi Heating and Electric Power Plant.