ADVANCED TECHNOLOGIES AND POWER INSTALLATIONS FOR THERMAL AND ELECTRIC ENERGY GENERATION

6.3. Heat and power supply units of low capacity

6.3.7. Influence of construction of small CHPPs on reduction of losses in electric networks

Ilyin E.T. CJSC "Complex energy systems"

A significant factor, contributing in essential improvement of efficiency of small combined heat power plants (CHPPs), applying gas turbines and backpressure steam turbines, is reduction of electric losses in power networks. Heating boiler-houses and replacing them small CHPPs are themselves relatively large consumers of electric power. Thus, for steam-turbine CHPPs of low capacity (replaced by boiler-house), combusting gas, 20 … 25 % of the generated electric power will be consumed by the heating system pumps, used for heat supply to the consumers, and at oil or coal combustion it can reach 35 %.

Table 6.26. **Fuel saving at operation of small CHPPs by means of reduction of losses in electric networks**

Plant type	Fuel saving due to reduction of electric power for feeding the auxiliary needs of a boiler-house, million tons of reference fuel/year	Fuel saving due to reduction of electric power losses in local electric networks, million tons of reference fuel/year	Total fuel saving due to reduction of electric power losses in power networks, million tons of reference fuel/year
Steam turbines (N_{ins} = 14,26 thous. MW)	5,51	1,653	7,163
Gas turbines (N^{tot}_{ins} = 24,7 thous. MW)	6,213	3,7225	9,935
GTU and steam turbines (N^{tot}_{ins} = 28,6 thous. MW)	6,934	3,9385	10,8725

All the part of the generated electric power can be consumed at generator voltage without electric power losses in power networks (it should be noted here that electric power losses in power networks of RAO "UES of Russia" currently makes 12 … 14 % of all electric power supplied from power plants). For small CHPPs on the basis of gas turbines (replacing boiler-houses) the share of electric power, used for pumping of a heating system water, will be slightly lower and will make 9 … 12 % of the generated electric power, depending on capacity of the replaced boiler-house as well as capacity and type of a gas turbine. Besides, all electric power, generated at CHPPs is directed to local power networks and consumed locally. As a result, a part of electric power losses in transmission lines is reduced approximately twice. Thus, use of small CHPPs, operating only on thermal consumption, allows to reduce considerably losses in networks and obtain additional fuel saving. Below are results of the fuel saving estimation due to reduction of power losses in networks. Decrease in fuel consumption can be estimated, using the following expression:

$$\Delta B_n = N_{aux} b_{anw} \tau_y + \sum_{i=1}^{I} k_i Э_г b_{anw} \qquad (6.20)$$

where ΔB_n — annual fuel saving due to reduction of electric power in networks, tons of reference fuel N_{aux} — average annual auxiliary needs of the replaced boiler-house, kW; b_{anw} — average power system fuel consumption for electric power supply, kg of tons and reference fuel/(kW·h); i — quantity of small CHPPs (gas and steam turbine); k_i — coefficient of electric power losses in local power networks at supply of electric power from low-capacity CHPPs (k_i = 0,06); $Э_г$ —annual electric power supplied from small CHPPs, kW·h.

The results are summarized in Tab. 6.26.