Abstract

Thermal Power plant is one of the designated consumers for mandatory energy auditing as per Energy Conservation Act 2010 (amendment) mandate of Bureau of Energy Efficiency. Assam Gas Based Power Plant (AGBPP), Kathalguri, Assam with installed capacity of 291 MW which is a combined cycle power plant and Agartala Gas Thermal Power Plant (AGTPP), Ramchandra nagar, West Tripura with installed capacity of 84 MW which is operated in an open cycle mode are the major designated consumer in Thermal Power Plant (TPP) sector in North Eastern Region. The objective of this study is to find out the areas of energy conservation and effective utilization of energy for both the gas based thermal power plant. This study has been carried out for both the plants for which, data are collected and analyse to find out the effective utilization of thermal energy. In this study an attempt has been made to evaluate the energy performance of various equipments and systems like gas turbine compressor, gas turbine, heat recovery steam generator, steam turbine, steam condenser, cooling tower and auxiliaries. The study is based on the as run performance data with performance guarantee or design data. The key finding related to various energy conservation opportunities available for both the plants are presented below.

AGBPP

Major results for performance improvement includes cooling towers and fill replacements to achieve 5-6 ^{0}C Cooling Tower approach, as against over 16 ^{0}C Cooling Tower approach in present situation. Setting in place, a suitable Cycle of Concentration (COC) improvement required for Cooling Water system to optimize the evaporation & blow down losses. Regular de-scaling of all the three condensers deploying chemical and mechanical methods and leakage elimination as warranted. It is envisaged that these improvements could help to achieve 3 to 4 MW increased generation for each Steam Turbine module totaling to about 10 MW additional Station output with attendant PLF improvement and heat rate optimization. The FRS pressure drop in feed water circuit is about 35 KSCM which accounts for half the BFP consumption. It is required to limit FRS pressure drop to max 10 KSCM. A saving of 132 kW is envisaged per BFP, i.e. 396 kW among three BFPs of 3 STGs,8000 hr working amounts, annual savings of 31,68,000 KWh is envisaged. At 2666.08 station heat rate and 9400 Kcal/SM^3 GCV, Natural gas saving would amount to 898525 SM^3 worth Rs. 50, 31,744 per year.

AGTPP

At present the AGTPP is operated in open cycle mode where the exhaust flue gas from gas turbine is released to atmosphere at 480-500 ^{0}C which may be converted to combined cycle mode by using heat recovery steam generator. By converting from open cycle to combined cycle mode, 50% additional power can be generated by utilizing the same amount of fuel i.e. the specific fuel consumption will be reduced from 0.409 SM^3/kWh to 0.263 SM^3/kWh. This will also reduce the environmental impact of the plant. The auxiliary power consumption in present level in open cycle mode is found to be 12.628MU during the year 2010-2011, which can be increased up to 16.8 MU annually for combined cycle mode.

It is observed that the motor loading of the cooling tower fans for all units is in between 50% to 59%. By installing fans of 10KW instead of existing 15KW, at least 75% of the motor loading can be achieved. The total saving for 8000 hours operation annually will be 4, 80,000 kWh (i.e. 120000 kWh unit wise). The total annual saving including all four units (including three fans in each unit) & considering unit rate of Rs. 3/- would be Rs. 14, 40,000. The simple payback period will be only 3 months by considering total investment for changing the motor of Rs. 4, 80,000.

The percentage of motor loading of the cooling tower fans (Gas Turbine) no. 2 for gas turbine units 1 and fan no. 2 of gas turbine unit 3 are 54.46 % and 54.51% respectively. To achieve at least 75% of the motor loading, it is required to replace of these fan motors. It is envisaged that by replacing the 15 kW cooling tower fan motors for the GTG 1 & GTG 3 to 10 kW the total saving for 8000hrs operation annually will be 80,000 kWh. The total annual saving would be Rs. 2, 40,000. The simple payback period will be only 3 months by considering total investment for changing the motor of Rs. 80,000.

Motor loading of the turbine compartment fans for all units is in between 54% to 55%. To achieve at least 75% of the motor loading, replacement of these fan motors are needed. It is envisaged that by replacing the 30 kW motors for the GTG 1, GTG 2, GTG 3 & GTG 4 to 20 kW, the total saving for 8000hrs operation annually will be 3,20,000 kWh. The total annual saving considering would be Rs. 9, 60,000. The simple payback period will be only 6 months by considering total investment for changing the motor of Rs. 1, 60,000.