Advanced thermal efficiency diagnosis system for power plants

-TEPCO heat balance analysis method-

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Abstract

Recently, it has been attracting more interest to maintain the thermal efficiency of thermal power stations, which is the ratio of generated electric output and fuel input, since it concerns with saving fuel resources that leads the reduction in generation cost and CO_2 emission.

When the thermal efficiency is reduced at a thermal power station, it is very important to identify which equipment caused the loss. At present, overall plant performance as well as individual equipment performance is obtained by means of taking daily data measurements. On the other hand, it is difficult to know how precise some of these data such as feed water flow rate. As a result, the errors in the data could affect the diagnostic result of the plant performance.

In order to perform more accurate diagnosis of the plant efficiency, a "thermal efficiency diagnostic technique to which the heat balance analysis method is applied" has been developed. This method makes it possible to determine the optimum heat balance of an operating plant. This optimization process starts by means of inputting the actual measured plant data into a computer. Then, iterative calculation is converged to minimize any deviations in data of overall plant. This analysis is characterized by taking the most precise data among the equipment data, the generator output for example, as the standard value.

Furthermore, the heat balance during the operation determined by this method is compared with that at the design condition for analysis. As this comparison enables us to know how large the degree of reduction in the performance of individual equipment is, it becomes possible to quantitatively compute the contribution of the each equipment to thermal efficiency. At last, we can identify the equipment that causes the performance reduction.

The technique has been applied to two thermal power stations whose outputs are 1000 MW and 600 MW, respectively of Tokyo Electric Power Company, TEPCO. In each power station, the repair-plan based on the diagnostic result was determined in advance of the periodic inspection. And the repair work during the inspection led to the recovery of the plant performance. Therefore, it has been verified that this method is effective.