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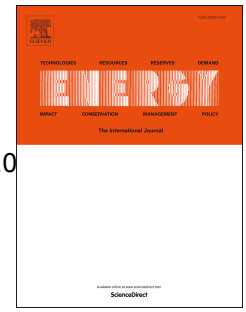

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Modeling for the performance evaluation of 600MW supercritical unit operating No.0 high pressure heater

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ABSTRACT: Adding the No.0 high pressure heater to raise feed water temperature has been proven to be an effective way to increasing input rate of selective catalytic reduction device (SCR) under low load in coal-fired power plant. However, the method has heavy influence on the operation economy of unit. To quantitatively evaluate the influence of feed water temperature on the operation performance of unit, a simplified one-dimensional nonlinear model for a 600MW super critical unit with No.0 high pressure heater was presented based on methods of furnace heat balance, differential deviation and thermodynamics, and validated by the field operation parameters. Meanwhile, the impact of feed water temperature on the performance of unit was discussed, and the influence mechanism of it was obtained. The results obtained from incurrent study could provide useful guidance in choosing the optimal process that can help increase efficiency and acquire a reasonable Start-Stop of SCR system in super critical units with No.0 high pressure heater.

KEY WORDS: super critical unit, feed water temperature, inlet flue gas temperature of SCR, boiler thermal efficiency, economy, performance analysis model

1 Introduction

In the energy field, energy saving and environmental protection issues are two major themes that have attracted the attention of the world [1].

In commercial operation or commissioning operation of coal-fired power plants, the coal-fired installed capacity of supercritical and ultra-supercritical power units (600 MW and above) accounts for almost 40% of the overall coal-fired installed capacity in China [2] with prominent performances, such as higher thermal efficiency (up to 46%), and lower pollution emission. Therefore, supercritical power plants would play a significant role in the reduction of coal consumption and pollutant emission of worldwide electricity generation industry [3].

Thermal power plant is not only the main coal consumption enterprises, but also a major source of pollutant emission of nitrogen oxide (NOx). It is reported that NOx emissions from coal-fired power plants occupy about 45% of the total number. In China, with the increase of haze, NOx is compulsively restricted for its emissions from coal-fired power plants [4]. Besides, due to the involvement of various renewable energy power generation, such as power generation from wind energy, solar energy, etc, which makes most of the ultra (ultra) critical parameters of thermal power units generally participate in peak load [5]. Even more serious, the operating load of thermal power units continues to reduce owing to the economic recession. For those reasons, large thermal power units frequently run at low load, in other words, the partial load running time accounts for a large part of the total operating time of the unit [6].

In coal-fired power plant, the SCR system is mainly utilized to reduce the NOx emission, since most of the denitration devices of thermal power units are arranged between the economizer and air pre-heater; the economizer outlet flue gas temperature is the inlet flue gas temperature of SCR. When the thermal power unit is running at low load, the inlet flue gas temperature of SCR is below the optimum reaction temperature range of catalyst for denitrification (ranges from 320 to 420□) [7]. If the coal-fired power plant runs in a low load operation for a long time, it would easily lead to permanent deactivation of SCR catalysts, and then NOx emissions would seriously exceed the national criterion, which would cause great economic losses to the power plant. Therefore, to protect the catalyst, the coal-fired power plant must cut off SCR system under low loads [8]. As for the heat exchanger of economizer, with the increase of feed water temperature, the inlet flue gas temperature of SCR will