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# Thermal System Simulation Study of Wide-Load Out-Of-Stock Technical Transformation to Reduce SCR Inlet Flue Gas Temperature of 300MW Subcritical Boiler

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## Introduction

At present, China's coal-fired boilers generally use the SCR process for flue gas denitrification treatment. For coal-fired boilers that use SCR denitrification, the SCR inlet flue gas temperature will decrease as the unit load decreases. The denitration system catalyst requires a flue gas temperature of 300～400℃. When some power station boilers have low load, the SCR system is forced to withdraw from operation due to the inlet flue gas temperature not meeting the operation requirements, this will cause a significant increase in the NOx emissions of the unit. According to statistics, about 30% of coal-fired boilers in China have problems in the low-load conditions that the SCR system cannot be put into operation due to insufficient smoke temperature.

Aiming at the low temperature of SCR inlet flue gas under low load, several kinds of wide-load denitration transformation schemes are proposed without affecting the combustion of the furnace, the steam parameters and the stable operation of the medium and high load SCR system. The thermal calculation software BESS is used to calculate the thermal calculation of several schemes, analyze and compare the effects of different schemes, and determine the optimal scheme.

## Wide load denitration technology transformation plan

The wide load denitration technology is to increase the flue gas temperature at the outlet of economizer at low load to ensure the chemical reaction temperature of catalyst, so as to achieve the minimum technical output, stable denitration at full load and all time, and meet the requirements of clean emission.

In this paper, three feasible schemes have been selected after actual field tests and preliminary calculations.

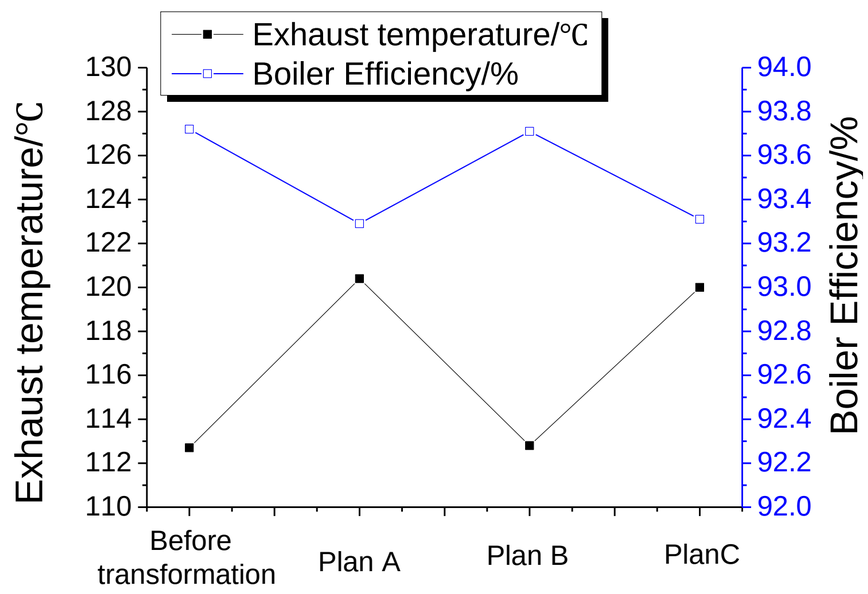
- Three Plans
  - Scheme A, the bypass at the water side of economizer
  - Scheme B, the hierarchical economizer arrangemen
  - Scheme C, the flue gas bypass modification

## Calculation results and comparison of wide-load denitrification technology transformation schemes

Under the 25% rated load condition, the calculation data of the thermal system after the three transformation schemes and before the transformation are compared and analyzed, as shown in the Table .

| Item | Before transformation | Plan A | Plan B | Plan C |
|---|---|---|---|---|
| Working fluid temperature at the outlet of the final reheater (℃) | 481.03 | 483.35 | 480.91 | 482.36 |
| Working fluid temperature at the outlet of the final superheater (℃) | 511.52 | 514.13 | 511.56 | 509.99 |
| SCR inlet flue gas temperature (℃) | 279.76 | 301.15 | 302.62 | 300.15 |
| exhaust temperature (℃) | 112.73 | 120.42 | 112.83 | 120.05 |
| Boiler efficiency (%) | 93.72 | 93.29 | 93.72 | 93.32 |
| Working fluid temperature at the outlet of the economizer (℃) | 230.77 | 310.03 | 230.67 | 226.11 |

The changes of flue gas temperature and thermal efficiency of three kinds of wide load denitration transformation schemes and before transformation are shown in the Figure.




Finally, the program C flue gas bypass modification program is selected for wide-load denitrification modification. After the transformation, under ultra-low load conditions, the inlet flue gas temperature of the SCR can be increased to over 300℃ through bypass flue adjustment, and at the same time, the safety and economy of the unit under high load conditions will not be affected.