FLOWNEX®
SIMULATION ENVIRONMENT

CASE STUDY

RECOVERING GENERATION LOSSES DUE TO FAULTY AIR HEATER OPERATION

This case study highlights how Flownex helped detect a fault in a power plant's Draught Group, improving generation load by 5% after correction. By comparing the Flownex model with plant measurements, abnormal readings were identified, prompting an investigation that revealed a thermocouple failure in an air heater causing a 20.1 MW loss. The early detection, combining Flownex data with plant measurements, led to a positive financial impact.

FOSSIL FUEL POWER GENERATION

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Challenge:

Faulty systems operation is a major factor which results in significant generation losses. The air heater is one system that recovers waste heat and increases the performance of the power station, thus making it one of the mayor components that contribute to the amount of power generated. It requires the proper operation and maintenance of individual systems and the plant as a whole to ensure the ability and availability of plants to reliability and safely generate power at a maximum. This case study will focus on the draught group of a power plant and show the impact of a faulty air heater operation on the generated power.

Benefits:

Combining on-site measurements with expected results from a model such as Flownex assist with the early detection of faults and abnormal process behaviour in plants. Early detection offers the ability to act fast and recover power generation losses. This together with increased systems performance as a result of proper maintenance and operation offers the benefit of increased power generation which inherently leads to minimized operation expenditure and increased capital income for the power plant.

Solution:

A power plant Draught Group network was developed in Flownex. For comparison, plant data was obtained from flow measurements taken at the induced draught (ID) fan inlet. Abnormalities in the measurements triggered an investigation of the performance of upstream systems. On Flownex, the operations of upstream components were varied until the same results as the plant measurements we obtained. In doing this, Flownex provided a tool which enabled the identification of the component that caused the problem. In short, combining the measurements with the Flownex model results narrowed down the under-performing system which gave rise to the root cause. In this case, it was a failure in the operation of an air heater.

Power plants are expected to reliably and continuously generate power.

INTRODUCTION

Combining on-site measurements with expected results from a model such as Flownex assist with the early detection of faults and abnormal process behaviour in plants. The purpose of this case study is to communicate a case where Flownex served in the detection of a fault that resulted in an improvement of 5% in the generation load of a power plant after correcting the fault. This case focuses on the Draught Group of a power plant that was developed in Flownex.

Combining on-site plant measurements with expected results from a plant model assists with the early detection of faults and abnormal process behaviour in plants.

CASE STUDY

As mentioned, in this case study, a network of the Draught Group of a power plant is developed in Flownex. Figure 1 shows the schematic representation of the draught group.

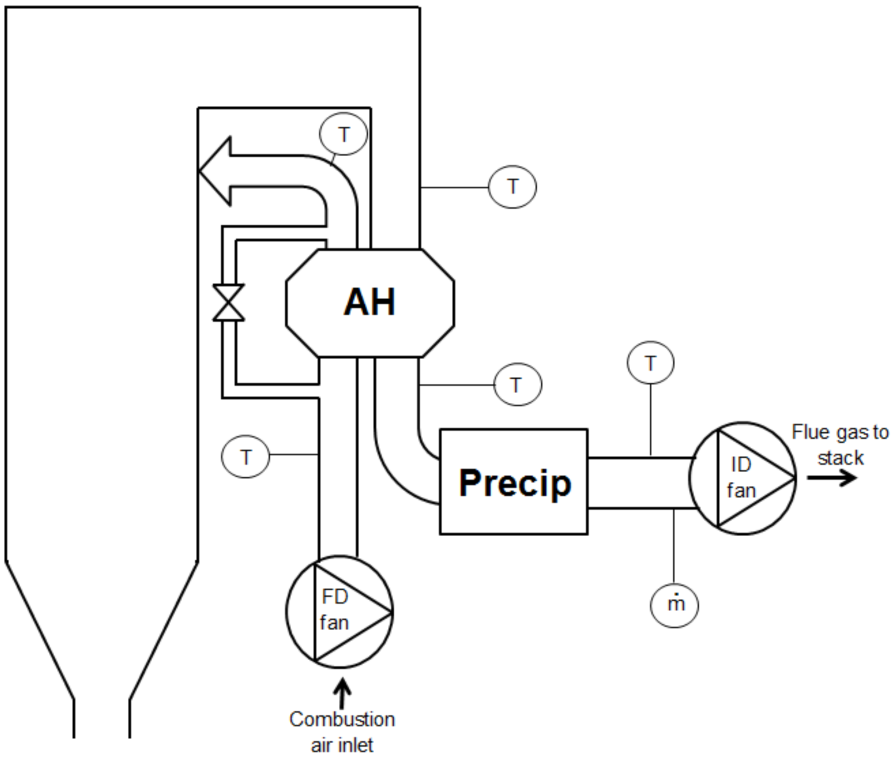

Figure 1: Draught Group of a coal-fired power plant.

Flownex results were compared to plant data obtained from flow measurements taken during the performance and testing procedure to obtain the mass flow rate through the ID fan. Differences between the Flownex results and the plant measurements were detected which triggered an investigation of the performance of upstream systems. The differences included a high temperature reading at the AH outlet and ID fan inlet. Looking at the temperature reading downstream of the air heater on the combustion air side, it was found that the thermocouple measurement at the boiler exit (AH inlet) indicated zero, which is not possible. Figure 2 shows the historian plant data which encapsulate the behaviour and will be further explained below.

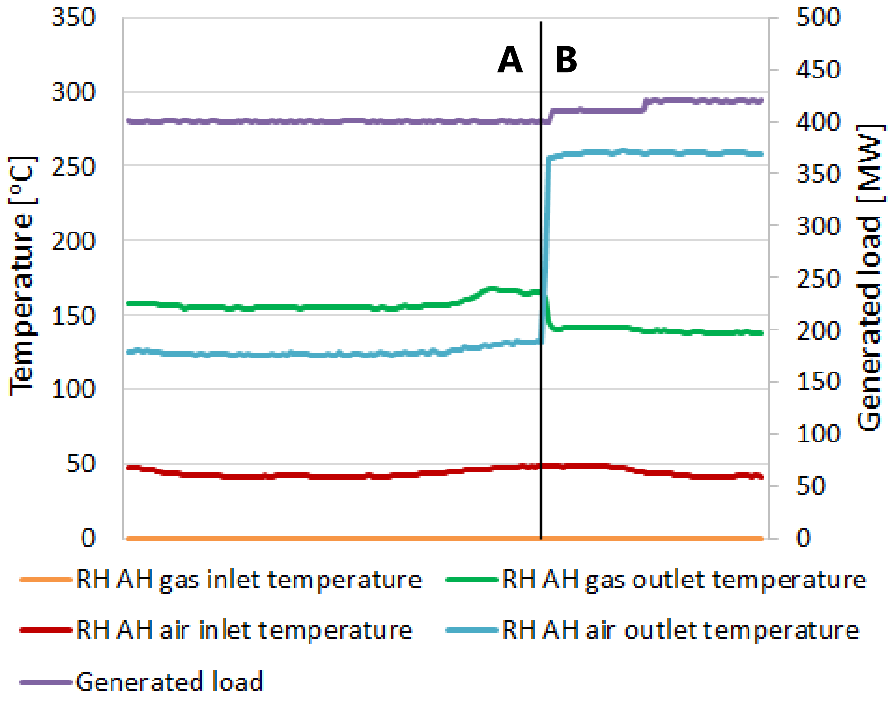

Figure 2: Historian plant data.

The graph shown in Figure 2 has two occurrences to it. These occurrences are distinguished by 'A' and 'B'. The air heater gas inlet temperature thermocouple indicated in orange has failed which resulted in the opening of the air heater bypass valve on the air side, but the opening of the bypass valve was not immediately realised. Occurrence 'A' shows the readings with the bypass valve open. It was during this time that the plant measurements did not correspond to the Flownex model. The air heater gas outlet temperature was too high and the air outlet temperature too low. After considering different possibilities, it was postulated that the bypass valve was open, and the plant operator was notified thereof. The operator confirmed that it was indeed the case and responded by closing the valve. Occurrence 'B' is what happened subsequent to the closure of the bypass valve. The air heater gas outlet temperature started to decrease and the air outlet temperature increased. This increased the efficiency of the plant and

It was postulated that the AH bypass valve was open.

improved the plant generation load (indicated by the purple line). The generation load increased by 20.1 MW which is a noticeable 5% increase in the load.

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SUMMARY

The purpose of this case study is to communicate a case where Flownex served in the detection of a fault that cost the plant a significant amount of power. It was a faulty operation due to a thermocouple that has failed which resulted in the opening of the air heater bypass valve. With the assistance of the draught group network developed in Flownex, the fault was detected and the bypass valve was closed. The generation load then started to increase and added a load of 20.1 MW which was a noticeable 5% increase in the load.

It is thus clear that combining on-site plant measurements with expected results from a model such Flownex permits the early detection of faults and abnormal process behaviour in plants. It is without a doubt that the benefit of recovering power generation losses was found in increased power generation load which inherently lead to increased capital income for the power plant.