CASE STUDY

OMNI™ Condenser Identifies Operational Issue and Increases Megawatt Output at a Combined Cycle Power Plant

ANNUAL SAVINGS

PRODUCTIVITY

1,100 MW/hr increase in turbine output

$91,300

TOTAL VALUE DELIVERED

$91,300

BACKGROUND

Surface condensers are at the heart of a Power plant's production efficiency. It is essential to keep the condenser at design performance to maximize profitability while minimizing fuel costs and CO_2 emissions.

The 125 MW combined cycle power plant in Thailand contributes electricity to a power grid and steam to industrial customers. The power plant consists of two identical blocks with natural gas as fuel. The cooling water treatment for this plant was under the care of a competitor since its commissioning. However, Nalco Water was engaged to conduct an extensive survey of the plant that led to securing the plant's supply and service contract.

While conducting the survey, a discrepancy in vacuum pressure between the two condensers was found, despite similar operational conditions. The difference between the condensers resulted in back pressures (BP) penalties that adversely affected heat rate and power output—leading to decreased revenue and increased operational costs for the plant. Previous plant engineers were not able to determine the cause for this issue, but Nalco Water's experts were able to find the reason for this discrepancy.

To address the issue further, Nalco Water introduced OMNI Condenser Analytics as an innovative solution to evaluate condenser performance and pinpoint underlying issues.

SOLUTION

The OMNI Condenser digital service was implemented by the customer to enhance plant production and efficiency. This service combines plant condenser data, advanced analytics, and Nalco Water's water treatment expertise into a digital platform which produces actionable insights. This technology was crucial to conducting the plant survey and identifying underlying issues in the condensers.

The issue was found to be in the vacuum pump system of the condenser. The customer had two vacuum pumps, one operating and one on standby. Nalco Water noticed that vacuum pump B caused more condenser back pressure than vacuum pump A. Upon recommendation, the customer agreed to stop using vacuum pump B and only use vacuum pump A for a two-month trial. OMNI Condenser was applied to monitor and analyze performance, confirm the root cause, and quantify the economic impact.

The trial confirmed that vacuum pump B had a negative impact on the back pressure performance. When vacuum pump B was in operation, the back pressure increased significantly and, when they switched to vacuum pump A, the back pressure returned to normal levels. It was also observed that the back pressure trend was more stable when only vacuum pump A was running throughout the trial. Therefore, it was concluded that vacuum pump B had degraded performance (see Figure 1).

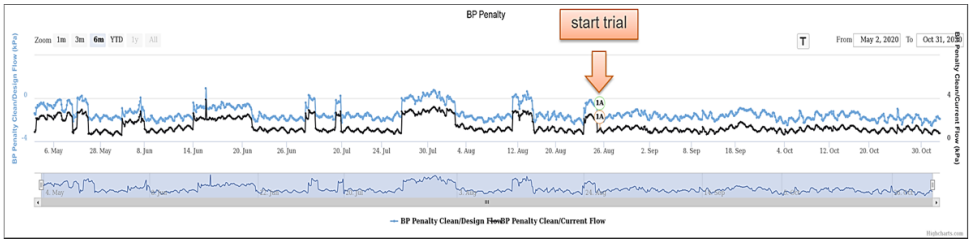

Figure 1: BP Penalty Trend Before vs After Trial

NALCO Water
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RESULTS

The results of the OMNI Condenser analysis indicated that the average BP penalty was reduced by 0.5 KPa during both off-peak (70% load) and on-peak (full load) operations, as shown in Table 1.

Period	Before	After	Gain (BP Penalty, KPa)
On Peak	1.6	1.1	+0.5
Off Peak	2.1	1.6	+0.5

Table 1: OMNI data showing differences in back pressure penalty.

Nalco Water collaborated with the plant efficiency engineer to estimate the actual MW increase during the trial for both on-peak and off-peak periods. The turbine curve performance method (see Figure 2) was used to compute the MW increase. Based on this analysis it was estimated the plant could increase output by 1,100 MW/hr per year, which equates to $91,000 in revenue increase per year.

The plant operation team used this revenue gain projection to persuade management to fix vacuum pump B.

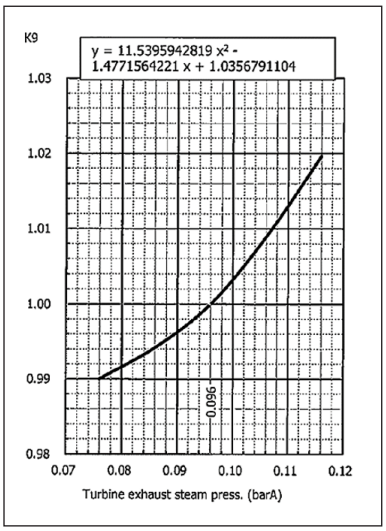
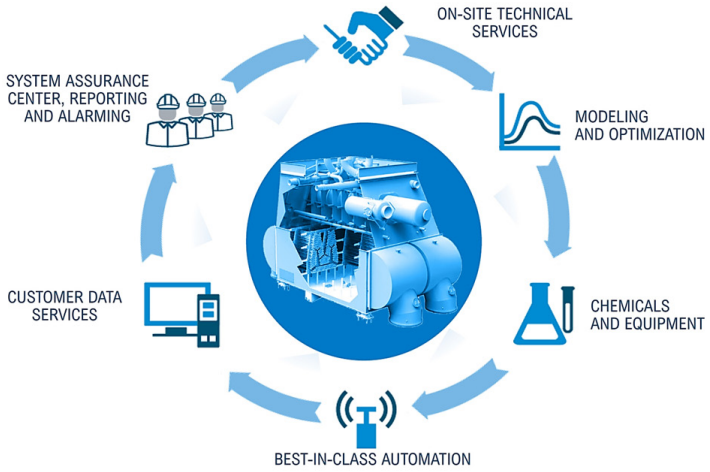


Figure 2: Steam turbine performance curve

CONCLUSION

In today's competitive Power market, extracting the maximum energy out of the fuel is crucial for power plants and particularly for combined cycle plants using natural gas. It requires optimal condenser performance to achieve maximum energy output.

OMNI Condenser Analytics is a digital solution that helps Power customers monitor and improve their condenser efficiency. It can detect and diagnose issues, quantify potential improvement and ensure the best plant performance possible.



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