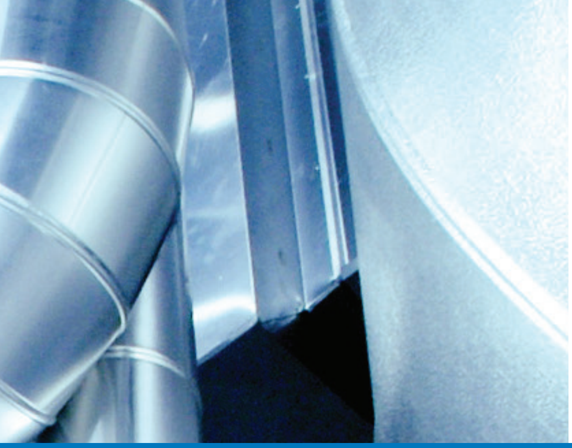

Nalco Water's OMNI™ Condenser Performance Program Documents $1 Million in Savings at Seminole Electric

NALCO Water
An Ecolab Company

CASE STUDY - POWER

CH-2064

BACKGROUND

At Seminole Electric Cooperative's Richard J. Midulla Generating Station in Bowling Green, FL, condenser cleanings are planned events. This natural gas-fired, combined cycle plant utilizes pond water, and macrofouling is a known and understood phenomenon. Every year, in the spring or early summer, the condenser is cleaned in preparation for the high demand summer months.

SITUATION

In mid-June 2016, the plant conducted a condenser cleaning. The cleaning was scheduled in advance, and part of routine operations. The goal: bring the condenser back up to design performance prior to the peak demand season.

The plant utilizes Nalco Water's OMNI Condenser Performance program. Applying EPRI and power industry standard calculations, the program uses data from a power plant's data historian to help users better understand what's happening in the condenser.

In this case, the OMNI Program reported a 0.2% reduction in the plant's Heat Rate Penalty following the cleaning.

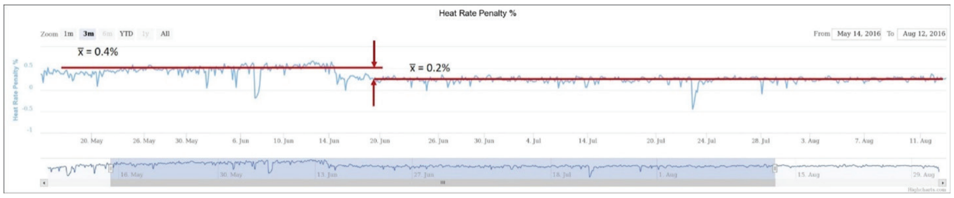

Figure 1: Average Heat Rate Penalty % decreased by 0.2% following a condenser cleaning.

ENVIRONMENTAL INDICATORS	eROI℠	ECONOMIC RESULTS
Reduced fuel costs (Fuel usage reduced by 3 million therms over seven months)	ENERGY	$1.0 million
Avoided condenser cleaning cost	ASSETS	$15,000

eROI is our exponential value: the combined outcomes of improved performance, operational efficiency and sustainable impact delivered through our services and programs.

Heat Rate Penalty % is directly related to condenser backpressure.[1] EPRI has established some norms for changes in backpressure and the OMNI program applies those norms to produce graphs like those shown in Figure 1. In this case, a 0.2% decline in Heat Rate Penalty % represents a 0.2% efficiency gain for the plant.

EPRI NORMS FOR CHANGES IN CONDENSER BACKPRESSURE

A 1" Hg change in backpressure represents a:

- 1% efficiency change in a combined cycle plant
- 2% efficiency change in a coal-fired plant
- 3% efficiency change

Coupling the data used by the OMNI program with other operational data shows the impact of the cleaning in financial terms.

The savings associated with the cleaning were over $338,000 for the two-month period after the cleanings in 2016.[2] The cleaning itself cost about $15,000.

In addition to showing the benefits of the 2016 cleaning [3], the OMNI program predicted that these gains might be realized for the future. The OMNI program showed clearly how these cost reductions would accrue to the plant immediately.

Following the cleaning, the plant adopted a cooling water dispersant program to keep the condenser clean longer. The cost associated with the program – about $50,000/year – was justified because, based on the prior experience, a 0.2% change in Heat Rate Penalty represented a cost savings of about $169,000/month. Since OMNI proved this was already achieved once, the odds were good the results could be repeated.

RESULTS

A restorative project – like a condenser cleaning – is relatively easy to justify because the gap between current (degraded) performance and design performance is clear. Preventative programs are more difficult to justify without quantified evidence. In this case, using the OMNI Program allowed the plant to justify costs associated with maintaining the gains from cleaning the condenser, because OMNI had already proven and quantified in terms of savings.

The May 2017 Heat Rate, the overall metric of power plant performance, was 2% lower than in May 2016 before the implementation of the dispersant program. The monthly fuel savings associated with maintaining the gains was $145,000 [4], compared to the prior May. Data from the OMNI program indicated continued excellent performance through the summer of 2017 [5]. The total fuel savings for the initial 9-month period was $1 million.

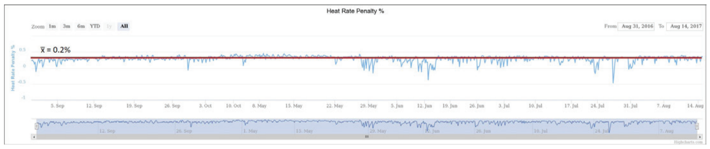

Figure 2: The dispersant program held the gains through the summer of 2016.

CONCLUSION

Through a period of high fuel costs and high demand, this power plant maintained a low Heat Rate and avoided the cost associated with a condenser cleaning by utilizing a dispersant program to keep the condenser clean. The Nalco Water OMNI program's quantification of efficiency gains enabled decision makers to see the value in and justify the costs of the dispersant program, which yielded further gains that would have gone unrealized without the help of OMNI.

[1] *Heat Rate (Btu/kWh) is a fundamental power plant metric. It summarizes everything going on in the plant down to one, simple measurement: heat energy input to electric power output.*

[2] *Cost savings were based on a weighted average cost of natural gas of $3.50/Mcf, weighted based on net generation. The average fuel cost per MWh for the May/June period (prior to cleaning) was $26.01. The average fuel cost per MWh for the July/August period (after cleaning) was $25.44, a reduction of $0.57/MWh. Applying those savings to the lower net generation in the May/June period gives a savings of $338,343 for a two-month period, $169,000/month.*

[3] *From May to August 2016, net generation increased 5% per month. Fuel costs increased 4.1% per month. Heat Rate declined by 0.71% per month.*

[4] *$145,000/month in reduced fuel costs/MWh x (3 months in 2016 + 4 months in 2017) = $1,015,000.*

[5] *Fuel costs rose in May 2017 to $4.12/Mcf, higher than during the summer of 2016. Electricity demand also increased. During May 2016, the plant's capacity factor was 72%. In May 2017, it was 82%, an increase of 14%.*

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