CUSTOMER CASE STUDY

Tucson Electric Power mitigates DCS upgrade risk with high fidelity simulator from AVEVA

Tucson Electric Power - www.tep.com
Industry - Power and utilities

Goals

- Replace original Leeds and Northrup analog control system and ABB Turbotrol turbine control system with Foxboro DCS.
- Use high-fidelity simulator to do DCS control checkout, DCS HMI validation and plant procedures verification with new controls.
- New simulator to replicate the actual dynamic response of the operations and without any significant loss of megawatt production.
- Repurpose simulator for operator training, continuous improvement and knowledge capture.

Challenges

- Validate the control logic against actual operations.
- Build operator knowledge and confidence in the new DCS prior to going online in the actual unit.
- Eliminate unplanned downtime or emergency shutdowns.

Results

- Reduced lost generation costs by $250,000 to $500,000 a day.
- Identified and fixed numerous errors using Simulator Factory Acceptance Testing saving unplanned downtime.
- Reduced commissioning time by seven days due to the operator's familiarity with the new controls.
- Smoother unit startup due to repeated testing and training in the simulator.

Arizona, United States - Tucson Electric Power is an electric utility company serving over 375,000 customers in southern Arizona in the United States. The Tucson Electric Power (TEP) Springerville Station consists of two 380MW net combustion engineering drum boilers that are coal fired with an ABB steam turbine. Constructed in the early 1980s, the plant was still using the original Leeds and Northrup analog control system and ABB Turbotrol® turbine control system, which was nearing obsolescence. Furthermore, the unit required an upgrade to include overfire air, low NOx burners, and new hydraulic actuators for the turbine stop/control valves in 2004.

Challenge

Like all major plant upgrades, there are inherent risks with any DCS upgrade project. In this case, control system errors, even minor, could delay the unit startup and return to service. In extreme cases, control system errors could cause catastrophic equipment damage.

Therefore, the decision to include control checkout on the simulator was justified with a simple economic analysis. Assuming lost generation costs of $250,000 to $500,000 a day, saving two to four days of outage time will pay for the cost of the simulator project.

However, the benefits of the simulator do not end there. As the unit returns to service, the simulator will become an invaluable training tool.

AVEVA Solution

TEP chose Foxboro I/A Series® system as its new automation system. This new Distributed Control System (DCS) was a major shift from the existing, bench-mounted analog control. With TEP's main operator workforce approaching retirement age, TEP selected AVEVA to provide a high-fidelity simulator for operator training and detailed control system checkout prior to the unit coming back online.

AVEVA pioneered the Virtual Stimulation approach by simulating the control system with its FSIM Plus™ simulation of the I/A Series control system. This approach uses the actual I/A Series controller algorithms, man-machine interface, and DCS configuration tools to provide the most accurate representation of the I/A Series system. TEP now has the capability in the to move the controls and graphics back and forth between the simulator and control room at east, making the simulator a complete I&C workhorse.

"I can't believe how smoothly the actual unit startup went; especially with this complex interaction between IPS and Alstom."

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Mike Puzzi,
Project Manager, DCE upgrade project, TCP

As the project unfolded, a unique challenge emerged. In order for the new Alstom turbine control valve actuators to be guaranteed, an Alstom turbine control system had to be part of the configuration.

This led to questions about interfacing to the I/A Series system, I/O, turbine protection, and operator controls. Using FSIM Plus, the project was modified to include a connection to GE Fanuc PLC 90-70 and 90-30 controllers, which ran the Alstom turbine control system programs.

The simulator and DCS design went through concurrent development with major DCS loops tested and pre-tuned in the simulator. Feedback from operators using the simulator was then used to fine-tune graphics and make control function changes based on TEP's operating procedures.

Results

Simulator Factory Acceptance Testing identified and fixed over 350 errors before going into the plant. The majority of problems found were minor, such as graphics configuration errors, simple point misconnections. However, without the simulator, these errors would have been found during critical testing on the live unit.

Even simple configuration errors take significant unplanned downtime to find and fix; especially in that high-pressure environment.

The real value in the simulator was merging the I/A Series system and Alstom control systems. Even though the running turbine and AVEVA simulator were not connected, initiating the Alstom turbine using AVEVA' simulator uncovered dozens of interfacing problems, saving valuable time and money. One error in particular could have caused repeated turbine trips or damage on startup as the initial control valve demand caused runaway turbine roll-up.

According to Mike Puzzi, DCS Administrator for the DCS upgrade project, "I can't believe how smoothly the actual unit startup went; especially with this complex interaction between Foxboro I/A and Alstom."

The simulator was on site for six months of testing before the new DCS was put into Unit 1. As a result, TEP uncovered over 300 necessary changes and will now use the simulator for more than just training.

Rex Brown, TEP Project Manager for DCS Retrofit Project said, "The simulator saved at least one week of startup time due to the operator's familiarity with the controls and advanced understanding of how they should interact with the unit." Further, Plant Manager, Andy Hoekstra, commented that the simulator paid for itself because his operators went through simulator training during their normal training cycle, and in addition, they all feel more confident about unit startups.

As a result, TEP will experience fewer unit trips in the future now that operators fully understand how the unit and controls react using Foxboro I/A Intelligent Runbacks.

> "Use of the simulator shortened commissioning by at least a week. This translates into substantial cost savings, since each day of loss generation could mean $250,000 to $500,000 per day."
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> **Andy Hoekstra,**
> Project Manager, TEP Springerville

To learn more, please contact your AVEVA representative or visit us online at aveva.com/en/industries/power-utilities