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# Simulation Evolves in Power Plants

**Long a tool for training operators, power plant simulation platforms find a growing role in advancing financial and operational goals.**

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Just as businesses in the manufacturing, retail, and other sectors are tightening their belts and looking for opportunities to optimize their operations, the electric power industry is taking a long, hard look at its operations. Like never before, utilities are keeping a close eye on the bottom line, looking for opportunities to boost profitability without sacrificing safety, reliability, and availability. Increasingly, simulation is one of the solutions power generators are using to help meet their financial and operational goals.

Surprised? It's understandable, since simulators have been used as a training tool in the power generation industry for decades. While they certainly served their purpose well, they admittedly left much to be desired from a practical perspective.

For one thing, they were somewhat difficult and costly to maintain. Consider for a moment that if a utility wanted to use a simulator as an effective training tool for its power plant operators, it was necessary to acquire controllers, workstations, and associated logic identical to that used in the actual control system. Then, in order to keep the simulation accurate and realistic, every time the DCS (distributed control system) was expanded or upgraded, a similar investment had to be made in the simulator. And because the simulator had a full set of duplicate hardware, raids by control system engineers looking for spare parts happened from time to time.

## Then vs. now

Technological advancements—combined with today's market realities—have coalesced, fueling

simulation's expanded role and subsequently, its contribution to enhanced operator performance, more efficient workforce deployment, and increased plant efficiency.

The adoption of virtual technology is one of the key technological developments that has significantly changed the simulation equation. Now it is possible to create a virtual simulator in which the actual control system application software can reside on a desktop PC. For example, a few years ago Emerson was able to emulate up to five controllers on a single PC. Today, the company can emulate as many as 20 controllers per PC, and this should expand as computing power continues to increase. With its virtual architecture, a simulator is now far easier and less expensive to maintain than ever before, making it a more practical and valuable asset.

Eager to take full advantage of this technology and the benefits it offers, more power generators are specifying simulation capability with their DCS. They are harnessing its capabilities as a training tool, using simulators to teach operators to understand plant control more fully. This is extremely beneficial, as it gives plant personnel the confidence and ability to maneuver through changing plant conditions, respond appropriately to alarms and handle even the most unlikely operational events. By training staff to operate the plant more efficiently, a simulator can save millions of dollars in downtime, waste, and inefficiency through the reduction of unplanned trips.

Reflecting one of their earliest purposes, simulators are frequently used to qualify new employees for safe and efficient plant operation. This is particularly important as older, more-experienced operators with institutional knowledge and years of experience retire, handing over the reins to "greener" personnel. In addition to training new employees, utilities are using simulator technology for ongoing education of existing employees as well as for training operators on a completely new system before startup to ensure a smooth transition without interruption to service or performance.

In addition to its considerable merits as a training tool, simulation offers other opportunities for operational improvements. Simulators are now commonly used for engineering analysis—to verify control system logic prior to system startup and to test control system changes before actually implementing them on the DCS.

## Working in New York

Con Edison's East River Repowering Project (ERRP), provides a good, real-world illustration of how simulation not only contributes to reduced plant startup time for new power facility projects and upgrades, but also provides opportunities for savings on an ongoing basis. ERRP, a truncated combined cycle facility, went into operation several years ago as part of a major improvement project at Con Edison's East River energy complex. The project was necessary to

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*An effective simulation program can help ease transitions from analog (and even pneumatic) to more modern control architectures—just as Con Ed operators made the change from conventional boilers to gas turbine combined cycle generation. Source: Emerson Process Management*

*Virtual technology is one of the key technological developments that has fueled simulation's expanded role and, subsequently, its contribution to enhanced operator performance, more efficient workforce deployment and increased plant efficiency. Source: Emerson Process Management*

maintain a reliable and reasonably priced steam supply and electricity for Con Edison's customers throughout New York City.

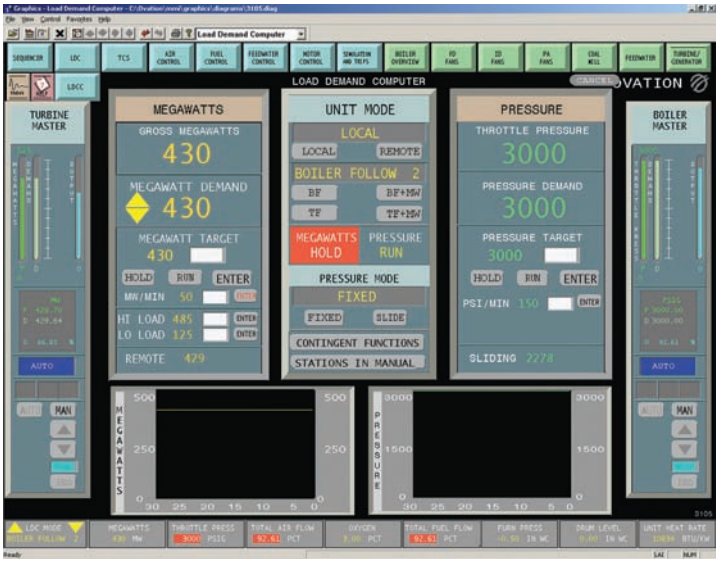
The East River facility uses two General Electric combustion turbines connected to two heat recovery steam generators (HRSGs) and a steam ring header. This unique configuration provides steam at 3.2 million lb/hr for dispatch into Manhattan, where it is used as a key source for the district heating system. Emerson's Ovation expert control system provides control for a number of critical processes used in this 360 MW plant.

Con Edison's significant investment in this plant made safe and timely commissioning and startup crucial. To help ensure optimal operation, Con Edison wanted to train their operators using equipment and plant models duplicating the repowered East River plant prior to actual commissioning and startup. Con Edison also wanted a tool to help them verify and validate new control logic prior to its installation into the plant's DCS. Con Edison engineers and operators teamed with Emerson to configure a high-fidelity simulation using Emerson's Scenario platform combined with actual plant control software and duplicate workstations that mimic the East River control room.

## From traditional to combined cycle

Scenario was used extensively to train operators who were more familiar with traditional boiler and steam turbine plant configurations on the operation of the new truncated combined cycle plant. Using the simulation technology, operators also became well-versed on the microprocessor-based system, which unlike the previously installed hard-wired controls, enables operators to recognize and react to abnormal plant process situations more quickly. Simulation was also used to develop optimum operator methodology that is documented in the plant's operating procedures.

During the design phase and prior to plant startup, East River's operators and engineers used the simulator to evaluate both steady state and transient conditions based on plant design criteria. Results of these evaluations provided Con Edison engineers with a better understanding of process dynamics and enhanced troubleshooting tactics, leading to development of accurate control strategies under normal and abnormal operating conditions.




*Just as microprocessor-based control systems offer countless advantages over older hard-wired analog control, creating an effective simulation platform using virtual technology is simpler and less costly. Operators can be trained to identify abnormal situations and learn proper responses quickly and efficiently.*

Con Edison also used the simulator to test interfaces to an extensive amount of third-party equipment connected to the DCS, such as the GE Mark V turbine control system and PLC networks for the burner management, gas compressor, and water treatment

systems. Pre-testing of the data links helped to further reduce the plant's commissioning time.

Use of simulation technology helped Con Edison ensure that its investment in new technology would be optimized by well-trained operators and accurate controls. One major benefit was a safe and efficient plant startup that reduced the commissioning time from four months to one month.

After this successful plant startup, simulation has continued to be used for operator training and to optimize East River's processes for improved efficiency and reliability. Further plant tuning, as well as plans to add any new equipment, can be tested and confirmed using the simulation technology before integration into the live system. Additionally, Con Edison is considering using simulation technology as a means to realize additional revenue through its Learning Center outsource training for new cogeneration facilities throughout the New York metropolitan area.

As impressive as this illustration is, technological advancements on the horizon will push the possibilities of what can be achieved through simulation even further. For example, Emerson foresees that, in the future, the simulator will actually reside in the control system, with simulator models performing real-time tracking of actual plant control logic and operating conditions. As such, the simulator will act as a test bed, allowing operators to test control schemes on the simulator, then immediately download them to the control system. The result will be a synchronized control and simulation architecture for real-time simulation of a power plant.

For power generators, this blending of the simulator and DCS not only offers opportunities for enhanced efficiency, but also improved reliability and the ability to meet financial objectives by reducing human error that could potentially lead to unplanned outages. As utilities continue to work toward balancing competing pressures, simulation will continue to be a vital component of a comprehensive strategy for achieving operational and financial improvement. **ce**

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