

Success Story:
Investor-owned utility; synchronous
condenser conversion

Market Served
Utility



Eaton makes it easy to retire coal plants, with synchronous condenser conversion

Location:
Midwest, U.S.

Segment:
Utility, investor-owned

Problem:
Needed to retire coal plants, but provides power to densely populated areas, with industrial and commercial customers requiring a high-power load.

Solution:
Turnkey synchronous condenser conversion.

Results:
A new system enabling reliable, real-time voltage and VAR grid support, allowing the operators to see real-time system information through an updated plant control system.

"In 2019 alone, utilities in the U.S. either retired or converted approximately 15,100 megawatts of coal-fired plants, according to Reuters, which analyzed data published by the Energy Information Administration (EIA)."

Background

A major investor-owned utility (IoU) based in the Midwest was tasked with retiring most of its existing coal plants. Its territory was densely populated, with industrial and commercial customers such as steel mills. This resulted in a high-power load, which necessitated a synchronous condenser to stabilize the grid and prevent potentially massive power swings due to increased reliance on renewable energy in the area.

The IoU required strong customer references and recommendations along with showcasing a firm commitment to stringent timelines from its vendor. Eaton was selected for the coal plant conversion/synchronous condenser project for retiring a machine with 486 MVA nameplate capacity.

Challenge

A key challenge Eaton faced was adherence to the strict timelines mandated by the independent system operator (ISO). In addition to the mandate, the IoU wanted the synchronous condenser commissioned and operational prior to the start of the summer months, when the load on the system was expected to peak. Eaton, because of its strong experience in brownfield projects, overcame the challenge by reusing and refurbishing most of the existing assets; delivery time was reduced by maximizing these assets, which reduced the need to design, build and install new components.

Another challenge was the IoU wanted to remove its incumbent plant DCS system and migrate the plant I/O to Eaton's process control system—leading to the addition of 300–400 control points.

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New medium-voltage drive and switchgear for starting package



New closed loop hybrid cooling system

Solution

The synchronous condenser project had two sections: base scope and balance of plant scope. The base scope comprised of rotating dynamics such as rotor start with a close coupled pony motor and clutch system, turning gear, turbine shaft isolation, thrust bearing, etc. The balance of plant scope included cooling systems, lubrication systems, and plant control systems such as DCS, PLC, HMI, etc.

A team of engineers from Eaton conducted a two-day workshop with the IoU to whiteboard design ideas, enabling the customer to fully understand Eaton's capabilities. The results of this session was a detailed proposal outlining Eaton's approach to the base and balance of plant scopes.

Eaton undertook a design-build approach to the project, which provided the added advantage of leveraging existing assets and minimizing overall changes in the plant. A key feature of the project involved the installation of new turning gear and clutch system at the exciter end of the rotor, along with a 5000HP, 4160V pony motor, a new variable frequency drive (VFD) and collector rings. To incorporate existing plant systems, Eaton decided to reuse the 5kV and 480V switchgear assemblies along with the existing static excitation equipment.

Eaton replaced the DCS and upgraded the vibration monitoring systems and incorporated a smaller cooling water system and lube oil system designed to minimize energy consumption. Another key feature involved the migration of an old DCS system to a PLC-based system that necessitated a different type of programming architecture; this enables the IoU to effectively monitor and control the cooling water and lube oil systems and provides remote emergency shutdown functionality.

Along with providing a best-in-class solution, Eaton demonstrated its project management expertise due to the stringent timelines and multiple stakeholders involved in the overall project. The project manager led weekly review meetings with the IoU, engineering and mechanical consultants, and subject matter experts from several Eaton divisions.

Results

Eaton's turnkey synchronous condenser solution, including the base scope and balance of plant scope, resulted in several value adds for the utility.

Delivery time

Delivery time was of utmost importance to the customer. Eaton's strategic approach to turnkey synchronous condenser solutions delivered the overall project on time, with certain parts delivered ahead of schedule. This allowed the IoU to meet the aggressive time frame outlined by the ISO for fossil fuel plant retirements.

Strategic partnerships

Due to its vast experience in the synchronous condenser market, Eaton was able to leverage its partnership network. For example, Eaton leveraged its mechanical partner's expertise for the successful execution of the base scope. Also, it partnered with the customer's contractors and vendors, leveraging such ongoing relationships to help condense the overall project timeline.

Reduced cost

Awarding the entire project to Eaton, enabled the IoU to save significant capital due to the establishment of a single point of accountability. This approach resulted in less overhead due to a reduction in the number of contractors to manage, sub-projects to handle, etc. In addition, Eaton followed a design-build methodology and had a vendor-agnostic approach; this all played a role in driving down the cost of the overall project.

Functional

The new synchronous condenser provided benefits to system and plant operations. The new system enables reliable, real-time voltage and VAR grid support; the operators see real-time system information through an updated plant control system; and a current set of design prints and comprehensive design package improve troubleshooting and maintenance time.

In summary, Eaton's holistic approach and turnkey project capabilities played a key role in efficiently converting the customer's coal plant into a synchronous condenser. The successful delivery of the project demonstrates that Eaton is ideally placed to tap into potential future opportunities as more fossil fuel plants get mandated to shut down.

Learn more at [Eaton.com/SyncCondenser](https://www.eaton.com/SyncCondenser)

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
[Eaton.com](https://www.eaton.com)

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