Ormat Technologies: Enhancing geothermal energy production to drive revenue and reliability

Ormat Technologies - www.ormat.com
Industry - Power

Challenges

- Lacked optimal geothermal energy production

- Time-consuming data access

- Critical thermodynamics calculations done manually in Excel

- Needed an integrated solution for data analytics and visualization

Solutions

- AVEVA™ PI System™ provides streamlined data collection, access, analysis, and visualization across its geothermal assets

- AVEVA™ PI Vision™ is used for data visualization, KPIs, and rapid detection of out-of-range values

- AVEVA™ Historian enables data collection and analysis of its solar assets

- AVEVA™ Plant SCADA manages and monitors various real-time industrial processes across both geothermal and solar assets

Results

- Generated 1-3.5 MW additional power per plant, driving an average of $1 million in added revenue per plant per year

- Additional anticipated cost savings in predictive maintenance

- Developed asset hierarchy, dashboards, and custom thermodynamics calculation solution to improve situational awareness and enable real-time analysis of critical plant processes

AVΞVA

Ormat is a leading company in the renewable energy sector, specifically recognized as the number one global company in geothermal power. It is committed to innovation and advancing technologies for efficient renewable energy development, reducing energy waste, and providing sustainable energy management solutions. With over 60 years of experience, it currently owns and operates over 1.5 gigawatts of renewable geothermal, storage, solar photovoltaic (PV), and recovered energy generation (REG) plants.

Ormat's geothermal power plants use a closed-loop system for sustainable power generation. Hot brine is extracted from underground and its heat is transferred to a motive fluid in the vaporizer. The vaporized fluid drives a turbine, generating electricity. Afterward, the motive vapor is condensed, reheated, and recirculated to maximize efficiency. The extracted brine, now cooled, preheats the motive liquid before being reinjected into the earth, ensuring all geothermal fluids are returned underground. This process maintains resource sustainability while delivering reliable, round-the-clock renewable energy, exemplifying Ormat's commitment to efficiency and environmental responsibility in geothermal energy production.

Ormat is the only company in the world with the capability to manage the entire lifecycle of geothermal activity. This vertically integrated structure allows it to offer flexible business models and comprehensive turnkey solutions tailored to specific sites and conditions, providing significant advantages to their clients.

Delivering reliability and performance

Ormat's primary goal is to maintain high reliability and optimal performance of its geothermal power plants, which operate 24 hours a day. The deceptively simple geothermal process has its own set of unique challenges, such as scaling, declining well performance, equipment reliability due to numerous moving parts, reservoir sustainability, and the critical task of ensuring continued injectivity without excessive back pressure.

"For this to operate properly, we must have a real-time system that monitors the asset performances at any time for each asset. So we can optimize our performance, reduce downtime, and improve availability and reliability."
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Yehiel Viner
VP Technical and Maintenance, Ormat.

"The bottom line is that in all renewables, every megawatt or kilowatt we are not generating is gone because there's no way to get it back; there are no raw materials in this industry."

Goal: Data flow from edge to enterprise

Ormat worked with AVEVA Select Partner, Casne Engineering, to develop a smart analytics solution for equipment monitoring and control that would enhance the efficiency and reliability of their geothermal plants.

Central to Ormat's data infrastructure is the AVEVA PI System portfolio. It collects real-time data from various sources, including production wells and plant equipment. AVEVA™ PI Server enables Ormat to build an Asset Framework (AF) infrastructure, which models the assets and their relationships. Building specific PI AF templates for each individual asset type allows Ormat to monitor the current status of each asset, ensure maximum capacity utilization, and identify issues for decision-making.

This templated approach has allowed them to rapidly scale their solution across multiple sites, going from a few sites per year to 11 sites in a single quarter. This framework supports advanced analytics and visualization, allowing Ormat to monitor plant performance and optimize operations.
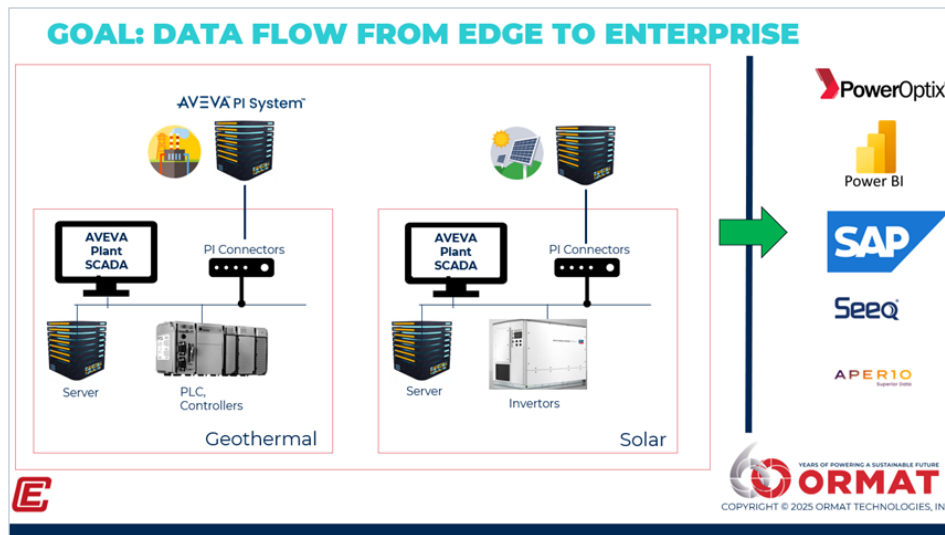
Figure 1: Ormat aims for trusted data flow from edge to enterprise

For data visualization, Ormat implemented AVEVA PI Vision. They now rely on AVEVA PI Vision's multi-state behaviors to rapidly detect out-of-range values and quickly identify problems like tube leaks in vaporizers or failed cooling tower fans, based on their operational know-how. They also display key performance indicators (KPIs) for operators on dashboards in PI Vision, allowing for a quick identification of issues and potential generation improvements.

To streamline and enhance plant performance, Ormat has developed dashboards for equipment like condensers and cooling towers, integrating real-time and simulated data for performance comparisons. Previously, analytics involved time-consuming manual processes in Excel. Now, using the AF SDK, which provides programmatic access to AVEVA PI Server's asset framework, Ormat can automate complex calculations—such as thermodynamic modeling and goal seeking—by pulling data from templates, running computations in a custom application, and writing results back. This standardizes analytics across all sites and enables rapid scaling: new plants simply instantiate new templates. Live, automated calculations empower users to detect inefficiencies and improve generation, marking a significant leap from manual methods.

Ormat has also integrated simulation-based calculations into PI System, displaying digital twins of assets with actual versus expected performance in AVEVA PI Vision dashboards. With PI Interface for Relational Databases (RDBMS via ODBC), Ormat pulled in SQL data from their proprietary simulation tool. The configured solution enables Ormat to quickly identify underperforming equipment and allows it to determine if each plant utilizes its maximum capacity efficiently.

At each geothermal and solar site is AVEVA Plant SCADA. This Supervisory Control and Data Acquisition (SCADA) solution provides real-time monitoring and control of Ormat's renewables plants. It collects data from sensors and equipment, enabling operators to monitor the status of the plant and make informed decisions. The integration of Plant SCADA with the PI System ensures that data is consistently collected and analyzed.

While AVEVA PI System is now deployed across its geothermal sites, Ormat continues to rely on AVEVA Historian at its solar sites. This solution provides a comprehensive record of plant operations, which can be used for trend analysis, performance benchmarking, and regulatory compliance. AVEVA Historian also supports backfilling data into the PI System, ensuring that historical data is available for analysis and decision-making at all levels of the business.
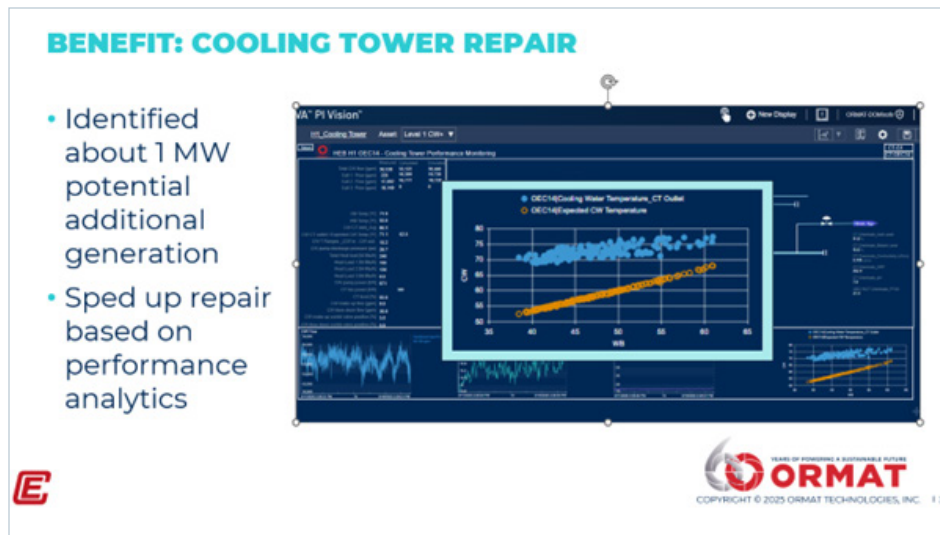
Figure 2: Ormat's cooling tower repair analytics have identified about 1MW potential additional generation

These AVEVA solutions work together to provide Ormat with a robust data infrastructure that supports real-time monitoring, predictive maintenance, and performance optimization. By leveraging these technologies, Ormat has achieved substantial cost savings, improved operational efficiency, and increased generation capacity.

By embracing the principle of "Keep It Simple and Standard" (KISS), Ormat achieved remarkable improvements. The new system featuring AVEVA has enabled Ormat to extract an estimated extra megawatt per site, which translates to roughly one million dollars of added value per location. Scaling this across the entire fleet, they're looking at potential savings of up to $30 million.

Citation:

Viner, Yehiel, Rachel Huberman, and Sarah Rappaport. "Ormat: Equipment Monitoring Improvements with the AVEVA PI System and Standardization of Complex Analytics" https://www.aveva.com/en/perspectives/presentations/2025/ormat--equipment-monitoring-improvements-with-the-aveva-pi-system-and-standardization-of-complex-analytics/

"It's amazing. If we do it across all the plants, it's $30 million of saving that we can put into our bottom line. Of course, the system will not fix it, but it will identify what we should do. So, it's not a pure saving, but it's an identifying saving."
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Yehiel Vine
VP Technical and Maintenance, Ormat r

Watch the full presentation