



CUSTOMER CASE STUDY

Optimizing Power Generation Efficiency with ML-Driven Generation Output Forecasts

BKOAI developed thermodynamics-informed machine-learning models to forecast power-generation output and support proactive dispatch and efficiency decisions

Solution: Thermodynamics-Informed ML Models

Industry: Power Generation

Use Case Focus: Generation Output Forecasting

GOALS

- Enable proactive efficiency optimization across generating units.
- Consolidate fragmented operating data from compressors, turbines, and related equipment.
- Give operators timely visibility into generation output forecasts and plant-performance indicators.

SOLUTIONS

- **Template-Driven Contextualization:** Built simulation-driven ML models grounded in thermodynamics and historical time-series data to capture the nuanced operation of each unit.
- **Seamless Integration:** Embedded models into industrial platforms such as Seeq and AVEVA PI for continuous prediction and efficiency monitoring.

CHALLENGES

- **Limiting analysis.**
- **Limited Domain Alignment:** Off-the-shelf machine-learning models may not capture thermodynamic behavior unique to power-generation cycles.
- **Delayed Decision-Making:** Operators often lack timely insight into generation-output forecasts, leading to reactive rather than proactive decisions.

RESULTS

- **Generation Output Forecasts:** Produced forecasts that supported proactive operating adjustments.
- **Custom Model Design:** Each unit model reflects real-world operating behavior and plant-specific thermodynamics.
- **Real-Time Visibility:** Operators gained timely visibility into generation output forecasts and plant-performance indicators.

EXECUTIVE SUMMARY

BKOAI developed thermodynamics-informed machine-learning models to forecast power-generation output and support proactive dispatch and efficiency decisions. The approach combines historical time-series data with thermodynamic context to model unit-specific operating behavior. These models are embedded into platforms such as Seeq and AVEVA PI, giving operators timely access to generation-output forecasts and plant-performance indicators inside existing workflows.

Overcoming Fragmented Plant Data

Power-generation teams often work with operating data spread across compressors, turbines, and related equipment. Inconsistent formats make unified analysis difficult, while generic machine-learning models may not capture the thermodynamic behavior that governs plant-specific power-generation cycles. Without timely forecasts, operators can be forced into reactive rather than proactive decisions.

Thermodynamics-Informed Machine Learning

BKOAI built simulation-driven machine-learning models grounded in thermodynamics and historical time-series data. This contextualization helps each model reflect the nuanced operation of its generating unit instead of relying on a generic statistical approach. The models are integrated into Seeq and AVEVA PI so predictions and efficiency monitoring remain accessible through established industrial workflows.

Supporting Proactive Dispatch and Efficiency Decisions

The resulting generation-output forecasts support earlier operating adjustments and more proactive efficiency optimization. Each custom unit model reflects real-world operating behavior and plant-specific thermodynamics, while operators gain timely visibility into generation-output forecasts and plant-performance indicators for day-to-day decision support.