UptimeAI

CASE STUDY

CUSTOMER PROFILE

Industry:
Power Generation (Coal-Fired Thermal)

Unit Capacity
300 MW

Asset Type
Main steam turbine (HP/IP/LP shaft line)

Monitoring Scope
> 100 Tags

Value Delivered
$2.5M+ in avoided forced outage and repair costs

300 MW COAL UNIT AVERTS $2.5M TURBINE TRIP AFTER UPTIMEAI TRACES AXIAL SHIFT TO STEAM-FLOW IMBALANCE

Axial displacement was climbing toward the trip limit unexplainably. Getting to the true source required the context of the full system.

Turbine Trip Cascade Effect on Unit Dispatch Priority

In a coal-fired power plant, the steam turbine converts boiler output into grid-ready electricity. For a 300 MW unit dispatched at baseload, every hour of forced outage represents roughly $9,000 in lost contribution margin. A 10-day outage—typical for an axial-shift event requiring thrust bearing replacement and rotor seal machining—translates to over $2.1M in lost generation alone, before accounting for $0.5–1.0M in repair costs, grid penalty exposure, and the cascade effect on unit dispatch priority.

Axial shift is one of the failure modes operators fear most. When the rotor moves beyond its design tolerance, the consequences escalate fast: thrust bearing overload, blade-to-seal rubbing, and if not caught in time, a catastrophic trip that can damage seals, bearings, and the rotor itself. The risk is compounded during cycling and two-shifting, where repeated thermal transients increase the likelihood of differential expansion mismatch between rotor and casing.

Axial Shift Is a Symptom. Threshold Alarms Don't Diagnose It.

The DCS watches axial position as a number. When it approaches the trip limit, the alarm fires. But axial shift can originate from many different root causes: thrust bearing degradation, differential expansion from thermal transients, seal wear creating asymmetric loading, or steam distribution imbalance across the HP and IP cylinders. Each demands a different corrective action. A bearing problem means a shutdown. A steam imbalance means an online adjustment.

Without the reasoning to distinguish between these causes, the default response to a rising axial trend is conservative: reduce load, plan an outage, inspect the bearing. If the actual root cause is steam distribution, that outage was unnecessary —and the problem returns the next time the unit ramps back up.

This unit had tripped on high axial position before. The pattern was familiar to the operations team. But familiarity hadn't produced a fix, because the existing monitoring infrastructure could see that the rotor was moving—it couldn't explain why.

Reasoning Across the Shaft Line, Not Watching a Single Tag

UptimeAI correlated a rising axial trend against stable vibration and identified the root cause as HP/IP steam-flow imbalance—enabling an online correction that avoided a forced shutdown.

CASE STUDY

UptimeAI deployed AI reasoning agents covering both steam turbine performance and reliability, modelling the full shaft line as a connected system rather than isolated equipment monitors. The Root Cause Agent traced the imbalance to the steam extraction configuration.



The auxiliary header was drawing from the IP cylinder's 4th extraction, creating asymmetric loading that progressively shifted the rotor axially. The system recommended rebalancing by redirecting extraction to the HP cylinder's cold reheat line.

The operations team redirected the auxiliary steam supply, and the unit continued generating at full load. An online steam redistribution instead of a 10-day forced outage.

Without this reasoning, the same data would have been a rising number on a DCS trend, approaching a trip limit that had tripped this unit before.

Enterprise Wide Process Transformation

72,000 MWh Of Generation Capacity Protected

Quantifiable Gains

- $2.5M+ in combined outage and repair costs avoided (10-day forced outage + thrust bearing/rotor seal repair)
- 72,000 MWh of generation capacity protected
- Online correction executed without load reduction or unit trip
- Grid dispatch commitments maintained—no penalty exposure

Operational Shift

- Axial shift events diagnosed by reasoning across the full shaft line—not reacting to a single DCS trend approaching a trip limit
- Steam distribution issues separated from mechanical bearing degradation before they force a shutdown decision
- Recurring trip pattern broken: root cause identified and corrected where prior events had only triggered reactive responses

What's Next?

With the axial shift pattern resolved through online correction, the operator is extending UptimeAI's reasoning agents across additional critical systems—applying the same shaft-line analysis to the generator, condenser, and boiler feed pump circuits to surface cross-system interactions that single-parameter monitoring cannot connect.

About UptimeAI

UptimeAI provides AI reasoning agents that help industrial operations teams make goal-oriented, real-time optimal decisions. Our solutions achieve 90%+ pilot-to-production success rates and are trusted by leading companies in cement, oil & gas, power generation, chemicals, and metals industries. Backed by industry leaders including ABB, Yokogawa, and Mitsubishi.

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