

OXmaint Factory AI

Oxmaint AI – Coal Power

Plant Operations

Suratgarh Super Thermal Power Station

AI-Driven Reliability, Efficiency & Multi-Unit Optimization

255-425 Cr

Annual ROI Potential

47%

Downtime Reduction

9-15 Mo

Payback Period

2820 MW

Plant Capacity

A plant-specific blueprint for deploying explainable AI and Large Language Models (LLMs) to manage the operational complexity of mixed subcritical and supercritical units, improve heat rate, reduce outages, and extend asset life at Suratgarh.



Prepared by: Oxmaint Factory AI Solutions
Version: 2.0 | December 2025
Classification: Industry Whitepaper

Table of Contents

1. Executive Summary	3
2. Plant Context – Suratgarh STPS	4
3. Mixed Fleet Operating Reality & AI Alignment	5
4. Suratgarh-Specific AI & LLM Use Cases	6
4.1 CCRFleet-Level Intelligence	6
4.2 Heat-Rate & Fuel Efficiency Optimization	6
4.3 Boiler & Turbine Predictive Maintenance	7
4.4 Balance of Plant & Common Systems	7
4.5 FieldOperations & Multi-Unit Walkdowns	7
5. Quantified ROI Analysis	8
6. Deployment Roadmap	9
7. Conclusion: The Future is Intelligent	10
8. Contact Information	11

1. Executive Summary

Suratgarh Super Thermal Power Station (SSTPS) represents one of Rajasthan's most critical power generation assets, with a combined capacity of 2,820 MW across eight units. The unique challenge of operating both legacy subcritical units and modern supercritical technology side-by-side creates an ideal opportunity for AI-driven optimization.

THE CHALLENGE

- Mixed technology fleet with varying operational characteristics
- Heat-rate variations across unit types affecting fuel efficiency
- Complex outage coordination across 8 units
- Workforce skill alignment for diverse technologies
- Legacy automation with siloed data systems

THE SOLUTION: OXmaint AI Platform

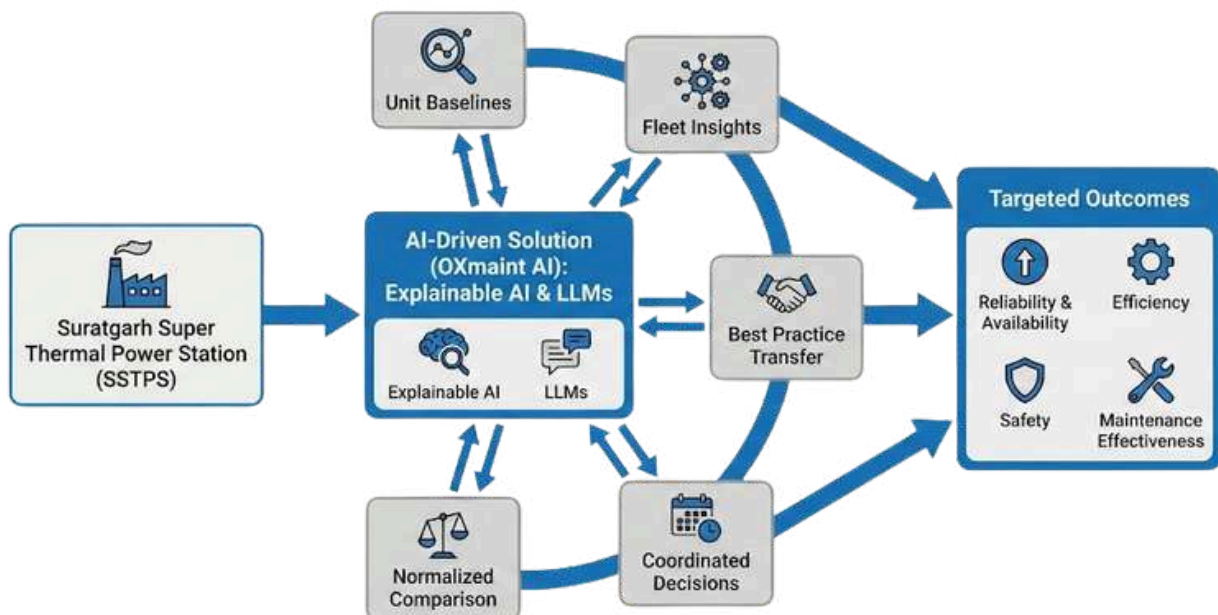
- Explainable AI for predictive maintenance across all units
- LLM-powered CCR copilot for natural language queries
- Unit-specific heat-rate optimization models
- Fleet-wide best practice transfer and learning
- Integrated BOP analytics for common systems

KEY INSIGHT: Due to its large capacity and mixed technology base, Suratgarh offers one of the highest ROI opportunities for AI-driven optimization in Rajasthan's coal fleet, with annual benefit potential of ₹ **255-425 Crore** and typical payback in **9-15 months**.

2. Plant Context – Suratgarh Super Thermal Power Station

Suratgarh Super Thermal Power Station (SSTPS) is one of Rajasthan's largest coal-fired generation complexes, comprising both older subcritical units and newer supercritical 660 MW units. This mixed-technology fleet creates unique challenges in operations, maintenance practices, control philosophies, and workforce skill alignment, while the plant remains a critical baseload and peak-support asset for the state.

Parameter	Details
Plant Type	Coal-fired thermal power station
Installed Capacity	2,820 MW
Unit Configuration	6 × 250 MW (Subcritical) + 2 × 660 MW (Supercritical)
Number of Units	8
First Unit COD	1998
Operational Role	Baseload with peak support
Key Challenges	Mixed unit technology, heat-rate spread, outage coordination



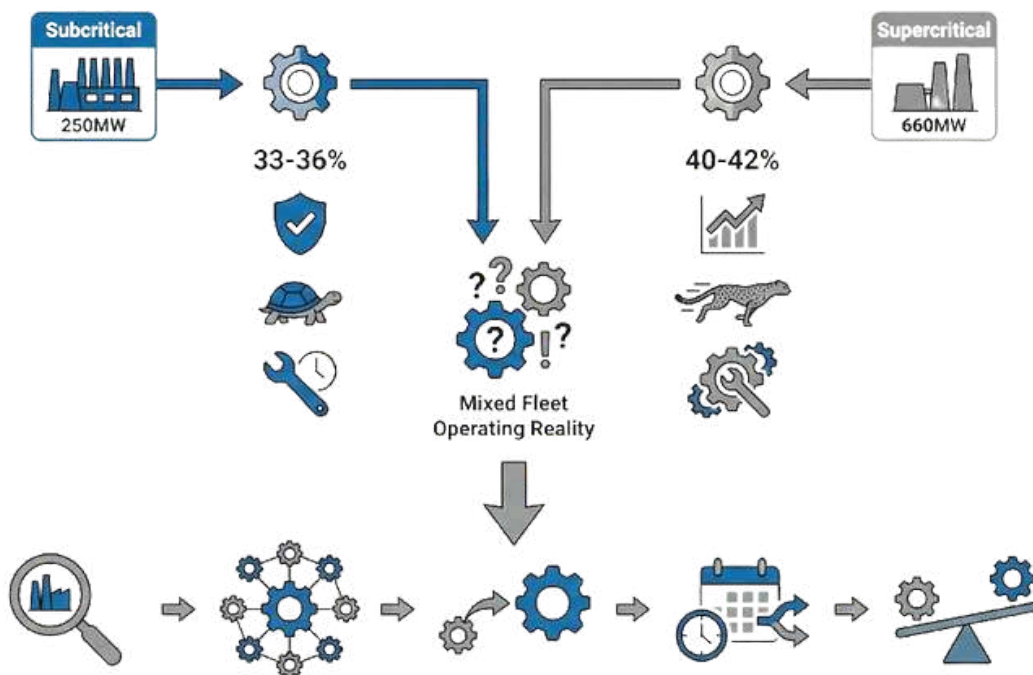
3. Mixed Fleet Operating Reality & AI Alignment

Operating subcritical and supercritical units side by side introduces significant variation in response behavior, efficiency curves, alarm patterns, and maintenance needs. Traditional approaches treat each unit type separately, missing opportunities for cross-fleet learning and optimization.

How OXmaint AI Addresses This Challenge:

- **Unit-Specific Baselines:** AI learns unique operating characteristics of each unit type
- **Fleet-Wide Insights:** Cross-unit pattern recognition identifies systemic issues
- **Best Practice Transfer:** Successful strategies from one unit inform others
- **Coordinated Decision-Making:** Holistic view enables optimal fleet scheduling
- **Normalized Comparison:** Fair performance benchmarking across technology types

Aspect	Subcritical Units (6x250 MW)	Supercritical Units (2x660 MW)
Efficiency Range	33-36%	40-42%
Response Time	Slower ramp rates	Faster load following
Maintenance Profile	More frequent, predictable	Less frequent, complex
AI Focus	Reliability & availability	Efficiency optimization



4. Suratgarh-Specific AI & LLM Use Cases

4.1 CCR Fleet-Level Intelligence

- Natural-language queries across all 8 units simultaneously
- Real-time comparison of subcritical vs supercritical performance
- Alarm flood reduction and unit-wise root cause analysis
- Shift handover automation with AI-generated summaries
- Instant access to historical trends via voice commands

4.2 Heat-Rate & Fuel Efficiency Optimization

- Unit-specific heat-rate deviation detection and alerting
- Coal quality impact analysis across different unit types
- AI-guided operating envelopes for supercritical units
- Combustion optimization recommendations in real-time
- Fuel blending optimization based on coal characteristics

4.3 Boiler & Turbine Predictive Maintenance

Machine learning models continuously monitor critical equipment health indicators to predict failures before they occur, enabling planned maintenance and avoiding costly unplanned outages.

Equipment	AI Capability	Expected Benefit
Boiler Tubes	Tube leak, slagging, erosion detection	25-35% fewer forced outages
HP/IP Turbines	Vibration & efficiency analytics	40% longer intervals between overhauls
Generators	Thermal & electrical anomaly detection	30% reduction in failure risk
Mills & Feeders	Wear prediction & throughput optimization	20% maintenance cost reduction

4.4 Balance of Plant & Common Systems

- Predictive analytics for shared auxiliaries (coal handling, CW, ash handling)
- Identification of common-cause failures across units
- AI-assisted root cause analysis for system-wide issues
- Cooling tower performance optimization
- Electrical system health monitoring

4.5 Field Operations & Multi-Unit Walkdowns

- Voice-based inspection routes mapped per unit type
- Image-backed defect reporting with automatic unit context
- Faster coordination between operations and maintenance
- Mobile-first work order management
- AR-guided maintenance procedures

5. Quantified ROI Analysis for Suratgarh SSTPS

Due to its large capacity and mixed technology base, Suratgarh offers one of the highest ROI opportunities for AI-driven optimization in Rajasthan's coal fleet. The following analysis provides indicative annual benefits based on industry benchmarks and OXmaint implementation experience.

Value Lever	Annual Benefit (₹ Crore)	AI Impact
Heat-Rate Improvement (0.5–1%)	80 – 130	Unit-specific efficiency optimization
Forced Outage Reduction (1–2%)	90 – 160	Early detection & alarm intelligence
Maintenance Cost Reduction (8–12%)	45 – 70	Condition-based work prioritization
Aux Power Reduction (3–5%)	25 – 40	BOP optimization & load balancing
Manpower Productivity	15 – 25	Fleet-wide voice logs & reporting automation

Total Annual ROI Potential

₹255 – ₹425 Crore

for a 2,820 MW mixed-fleet plant

Typical Payback: 9–15 months

6. Deployment Roadmap for Suratgarh SSTPS

A phased implementation approach ensures manageable risk, quick wins, and sustainable transformation. Each phase builds on the previous, creating compounding benefits.

Phase 1: Foundation (0–90 days)

- CCR fleet copilot deployment
- Digital shift logbooks implementation
- Historian integration across all 8 units
- Baseline data collection and model training

Success Criteria: Working prototype with measurable quick wins

Phase 2: Scale Up (3–9 months)

- Unit-wise predictive maintenance models
- BOP reliability analytics deployment
- Heat-rate optimization algorithms
- Integration with existing SCADA/DCS systems

Success Criteria: Full coverage with significant cost savings documented

Phase 3: Advanced Optimization (9–18 months)

- Advanced fleet optimization algorithms
- Best-practice transfer across RVUNL plants
- Autonomous optimization recommendations
- Full digital twin deployment

Success Criteria: Industry-leading metrics and knowledge transfer capability

7. Conclusion: The Future is Intelligent

OXmaint AI enables Suratgarh Super Thermal Power Station to operate its diverse subcritical and supercritical fleet as a single intelligent system. By embedding explainable AI into daily operations, Suratgarh can significantly reduce fuel cost, outages, and maintenance risk while improving long-term asset health.

KEY OUTCOMES

- Higher production output with lower downtime and maintenance cost
- Superior fuel efficiency through AI-optimized heat rates
- Extended asset life via predictive maintenance
- Empowered workforce with AI-assisted decision making
- Platform for best-practice transfer across RVUNL fleet

Ready to Transform Suratgarh STPS?

The technology – AI, IoT, advanced analytics, cloud platforms like OXmaint Factory AI – has matured and is ready to deploy. The intelligent power plant of the future is within reach today.

Schedule a demo to explore how OXmaint Factory AI can tailor Industry 4.0 solutions to Suratgarh's specific needs.



Oxmaint Factory AI

Transforming Industrial Operations with Artificial Intelligence

Oxmaint AI is the leading provider of AI-powered CMMS and manufacturing operations platforms, combining on-premise reliability with cutting-edge AI. Our solutions are trusted by power plants, steel mills, and heavy industries worldwide.

- ✓ On-premise AI deployment with local LLMs on NVIDIA GPUs
- ✓ Complete data sovereignty—production data never leaves your facility
 - ✓ Proven results: 32% downtime reduction, 18% cost savings
 - ✓ Modern architecture with continuous innovation and support

Contact Information

OXMaint AI

Website: www.oxmaint.com | Email: contact@oxmaint.com | Phone: +91 9460222122



[Schedule a personalized demo: Scan QR Code](#)

Document Information

Version: 2.0

Date: December 2025

Classification: Industry Whitepaper

Prepared by: Oxmaint Factory AI Solutions Team