Revolutionizing Energy Management in Power Generation

Company Profile

The client is a leading power generation company that has developed a 1980 MW Thermal Power Plant (TPP) consisting of three **660 MW unit**s. Strategically located in Uttar Pradesh, the facility plays a crucial role in meeting the region's growing energy demands.

Case Summary

The power generation facility sought to implement a Smart Energy Management System to enhance operational stability, improve performance parameters, and drive overall efficiency and reliability. Since its commissioning, the plant faced challenges in effectively tracking Auxiliary Power Consumption (APC), resulting in inefficiencies and increased operational costs. To address these issues, an integrated energy management solution was required.

The solution required the integration of real-time data monitoring and a digital dashboard to provide enhanced visibility and control. By leveraging advanced technologies such as IoT, AI, cloud computing, and data analytics, a comprehensive system was deployed to optimize the plant's performance across various functions. This approach ensured improved operational efficiency, cost reduction, and the promotion of sustainable operations.

Business Challenges

Before implementing the Smart Energy Management System, the plant faced several operational inefficiencies that impacted performance and cost-effectiveness:

- Manual Operations: The Coordinated Master Control (CMC) system and automated loops were not commissioned, resulting in suboptimal operational efficiency.
- High Auxiliary Power Consumption (APC): Ineffective APC tracking led to excessive energy consumption and reduced overall plant efficiency.
- Lack of Real-Time Monitoring: The absence of an integrated digital monitoring system limited visibility into unit performance, hindering timely decision-making.
- Manual Data Recording: Dependence on manual data collection introduced inaccuracies and inefficiencies in operational processes.
- Unoptimized Equipment Performance: Without data-driven insights, inefficiencies persisted due to equipment overuse, maintenance delays, and suboptimal energy utilization.

To address these challenges, the client required an advanced IoT and AI-based Smart Energy Management System. This solution enabled real-time monitoring, data-driven decision-making, and optimized plant operations, resulting in improved energy efficiency, enhanced equipment reliability, and reduced operational costs.

Our Solution

To address the challenges, we developed and implemented an IoT-powered Smart Energy Management System. This solution integrates real-time monitoring, AI-driven analytics, and a centralized dashboard to enable data-driven optimization of operations. The system tracks individual equipment energy consumption in real-time and provides operators with a dashboard for comparing consumption data across units and equipment. This allows engineers to optimize equipment performance and make informed overhauling decisions based on specific energy consumption metrics.

In the event of a fault, automated alerts are generated, with a predefined response matrix based on fault severity. Additionally, the HVAC system is optimized through damper throttling and reducing the operating hours of fans and pumps.

Key Business Impact

Reduction in Auxiliary Power Consumption (APC) from **7% to 5%** resulting **$1,992 thousand USD** worth of additional power through optimized equipment usage.

Custom Dashboards for Real-Time Performance Monitoring, ensured better decision-making.

Enhanced Equipment Health Monitoring, reducing failures and maintenance costs.

Automation of Manual Processes, leading to improved efficiency & accuracy by **90%.**

Through optimized operations and energy management, energy costs were reduced by **~6%.**

Seamless access to historical data, facilitating long-term analysis and continuous performance improvement.

Environmental & Social Impact

Saved **5,00,000 tons** of coal, resulting in a reduction of **5,70,000 tons** of CO2 emissions.

Aligned with PAT cycle (Perform, Achieve, and Trade) and complied with ISO 50001 energy management standards.

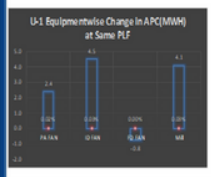
Success Recap

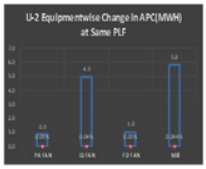
The successful implementation of this project has significantly transformed the energy management system, establishing a new standard for digitalization in thermal power plants. By integrating advanced technologies and data-driven solutions, the initiative has improved operational efficiency, enhanced sustainability practices, and optimized resource utilization. This digital transformation not only resulted in tangible operational improvements but also positioned the organization as a leader in the energy sector, showcasing its commitment to innovation and forward-thinking strategies.

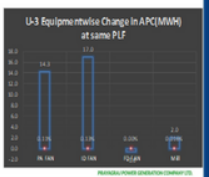
The project highlights the profound impact of digitalization on traditional power plant operations, streamlining processes and ensuring long-term efficiency and reliability. By embracing these innovations, the organization is paving the way for a more sustainable future, setting an example for others in the industry to follow.

Unit wise APC Comparision

Date	BTG U1	CW+ACW+Comp	BOP	Total APC	PLF%	U-1 SCC
6-Jul-22	3.15%	1.14%	1.11%	5.40%	87.63%	0.6061
13-Oct-22	3.21%	1.25%	0.92%	5.38%	87.75%	0.6037
Date	BTG U2	CW+ACW+Comp	BOP	Total APC	PLF%	U-2 SCC
22-Jul-22	2.95%	1.27%	1.10%	5.32%	84.15%	0.614
13-Oct-22	3.02%	1.25%	0.93%	5.19%	84.15%	0.597
Date	BTG U3	CW+ACW+Comp	BOP	Total APC	PLF%	U-3 SCC
12-Sep-22	3.33%	1.23%	0.99%	5.55%	81.00%	0.610
13-Oct-22	3.61%	1.25%	0.94%	5.79%	80.93%	0.583



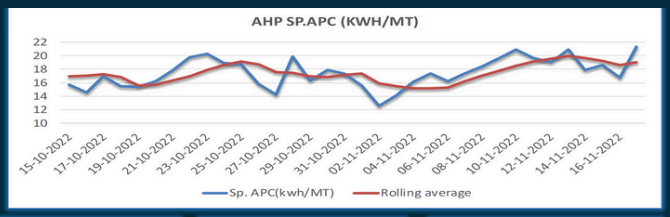


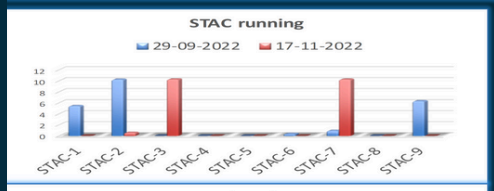


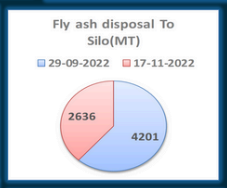
BTG APC %	APC %		
	U-1	U-2	U-3
PLF %	91.41%	90.28%	86.49%
PA FAN	0.46%	0.53%	0.56%
ID FAN	0.80%	0.81%	0.81%
FD FAN	0.19%	0.19%	0.20%
Mill	0.43%	0.42%	0.47%
ESP	0.29%	0.24%	0.26%
AC VENTILATION	0.10%	0.07%	0.05%
Boiler LT Drive	0.05%	0.04%	0.04%
Turbine LT Drive	0.07%	0.07%	0.07%
Emergency Board	0.06%	0.06%	0.05%
CEP	0.38%	0.38%	0.40%
DMCW	0.04%	0.00%	0.05%
MDBFP	0.00%	0.00%	0.00%
BCP	0.00%	0.00%	0.00%
BTG APC %	2.88%	2.83%	2.96%
SCC	0.535	0.561	0.544

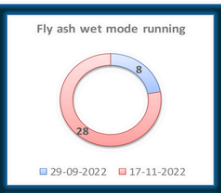
APC Dashboard

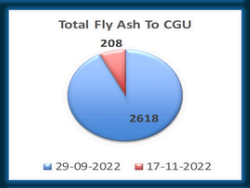
Equipment	UOM	Consumption 29-09-2022	Consumption 17-11-2022	Difference
50K Ton Silo	MWh	14.97	9.23	-5.73
Total AHP BAHP APC	MWh	6.78	6.19	-0.59
Total AHP HT Panel PMCC APC	MWh	47.75	56.36	8.61
Total AHP PTAC APC	MWh	29.01	29.47	0.46
Total AHP STAC APC	MWh	23.26	21.10	-2.16
Total	MWh	121.77	122.35	0.58

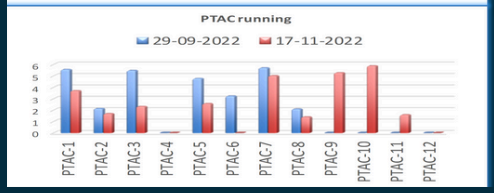


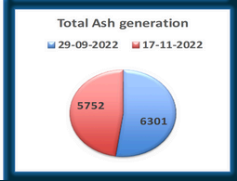


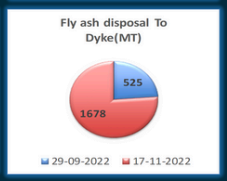


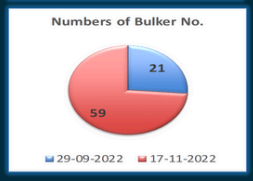












Y-O-Y APC Improvement