



AVEVAWORLD

ACCELERATE INDUSTRIAL INTELLIGENCE

CESC :

Accelerating Operation Excellence through Real Time Performance Monitoring & Advance Analytics

Enhancing Reliability, Efficiency & Data-Driven Decisions across CESC Generation

AVEVA WORLD – Milan

Powering the Future of Power Generation





Brajesh Singh

MD-Generation

CESC Limited



Balaram Saha

*Head- Analytics Centre Of
Excellence(ACOE)*

CESC Limited



Jimesh Gajera

Chief Technology Officer

*CereBulb
(Implementation Partner)*





Table of Content

01 Introduction

05 Benefits

02 Problem Statement

06 Graphics, KPI & Report

03 Architecture

07 Future Vision

04 Use Cases

CESC : POWERING EXCELLENCE

CESC IS ONE OF INDIA'S LEADING ENERGY COMPANIES, WITH OPERATIONS EXTENDING PAN INDIA ACROSS GENERATION AND DISTRIBUTION.



2,125 MW
Operational thermal capacity

Distribution Footprint
Kolkata, Noida, Chandigarh, Kota, Bikaner,
Bharatpur, Malegaon

4.7 Million+
Total consumers

3.2 GW Hybrid RE
Planned through Purvah Green

Generation Portfolio



3 X 250 MW
Budge Budge Generating
Station



2 X 300 MW
Haldia Energy Limited



2 X 300 MW
Dhariwal Infra. Limited



2 X 67.5 MW
Southern Generating
Station



40 MW, AFBC
Crescent Power Limited

PLF (%) in the last three years

	2024-25	2023-24	2022-23
HEL	91.1	88.0	80.3
DIL	87.3	83.9	80.5
BBGS	83.6	88.4	81.1



Generating Stations -



Budge Budge Generating Station
3*250 MW
Kolkata, West Bengal, India



Haldia Energy Limited
2*300 MW
Haldia, West Bengal, India



Dhariwal Infrastructure Limited
2*300 MW
Chandrapur, Maharashtra, India

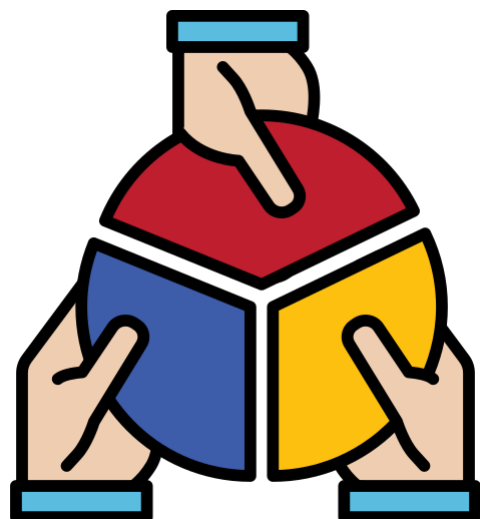
Analytics Centre Of Excellence

Plant ACOE

- Digital Champion
- Corp ACoE Team

Central Team ACOE

- Lead ACOE
- Business Analyst



To achieve the richness and moving towards next level of performance, leveraging data within the organization new ACoE structure has been created.

- **Plant ACoE Team**
- **Corp ACoE Team**

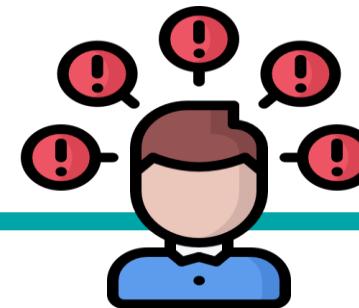
Plant ACoE: Each plant will have one Digital Champion to Lead the Digital transformation programme & a team of Digital Evangelist to work actively to developed advance tools and models for Performance & Reliability Improvement.

- **Digital Champion**
- **Digital Evangelist**

Central Team at HO: Will drive all Key initiatives along with Station. Will deploy & enable AI/ML Infrastructure, software support, remote Monitoring support to station for development of various advance tools and models for Performance & Reliability Improvement.

- **Lead ACOE**
- **Business Analyst**

Problem Statement



Fragmented Data

Operational data is spread across DCS, SCADA, OEM packages and manual reports, limiting one trusted real-time view.



Limited Asset Health Visibility

Teams need earlier warning of degradation in pumps, fans, transformers, auxiliaries and balance-of-plant equipment.



Late Response to Anomalies

Late alarms and post-fault analysis make it harder to prevent trips, derating and avoidable maintenance events.



Optimization Opportunity Gap

Performance, heat rate, auxiliary consumption and load-dependent behavior need deeper visibility and faster analysis & Immediate Corrective action



Compliance & Traceability Needs

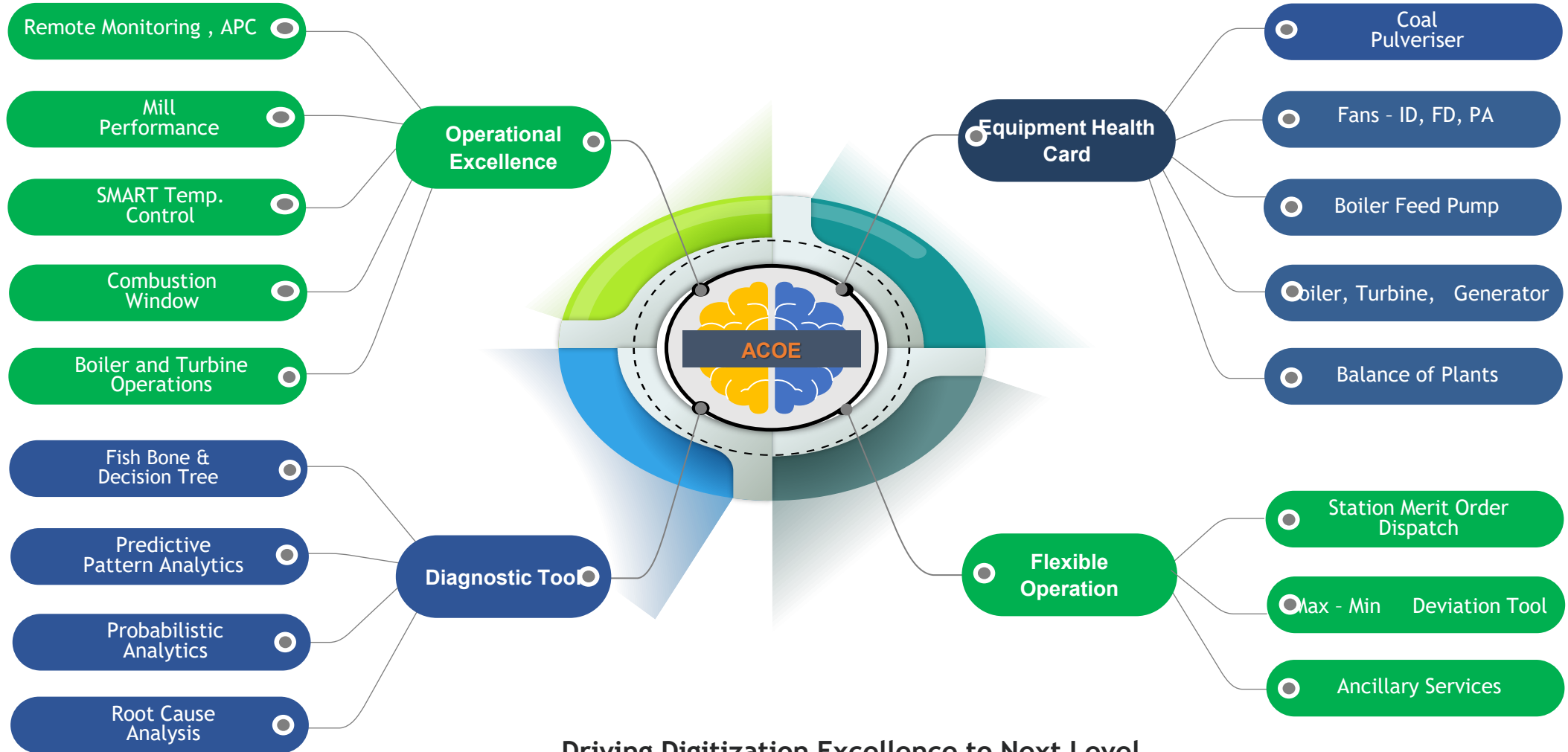
Environmental and operating data must remain continuously visible, contextualized and audit-ready for reporting.



Multi-Plant Standardization

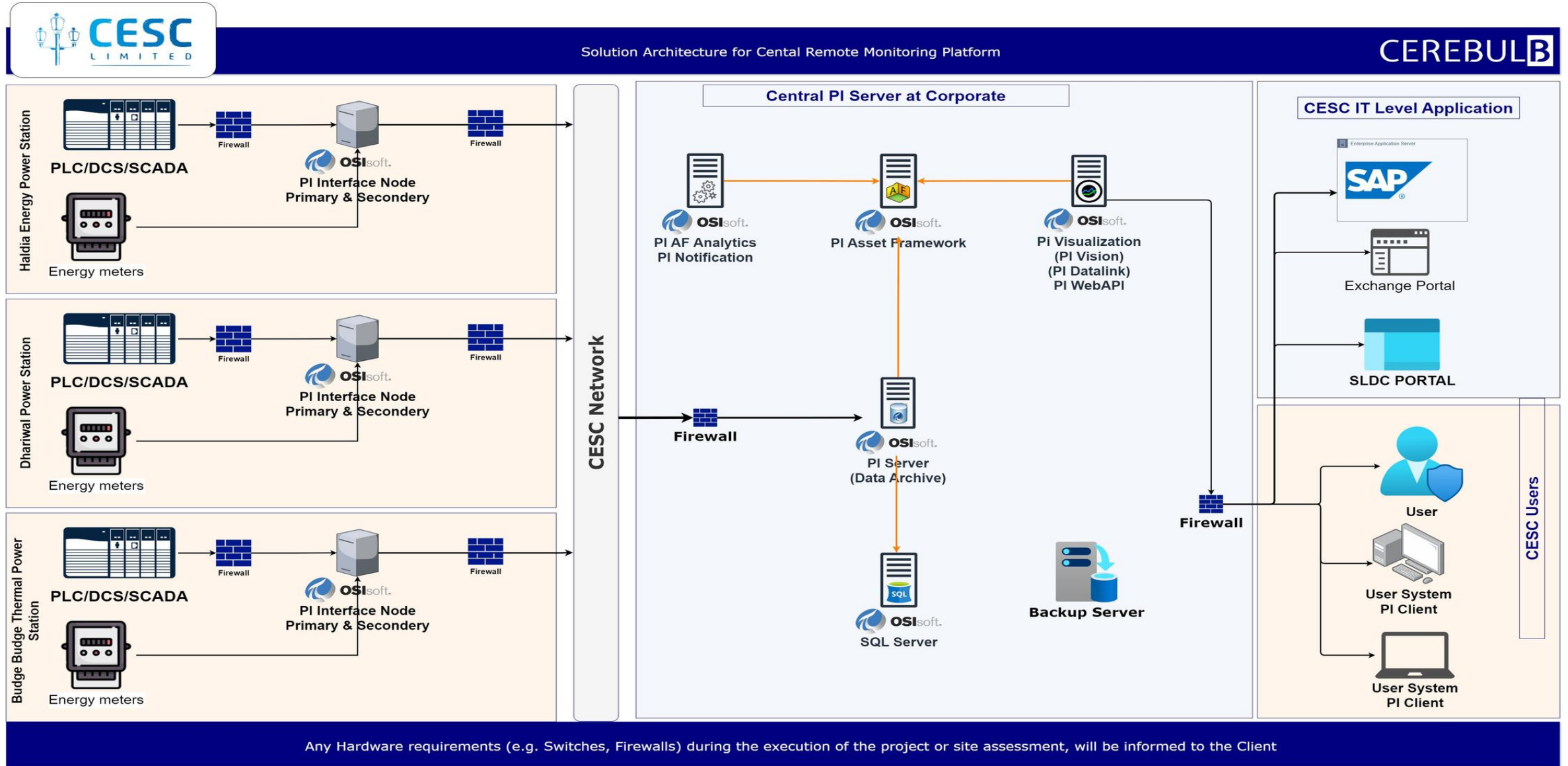
A common data model, KPI framework and analytics workflow is needed to scale across units and sites.

SAMARTH -Analytics Centre of Excellence (ACOE)

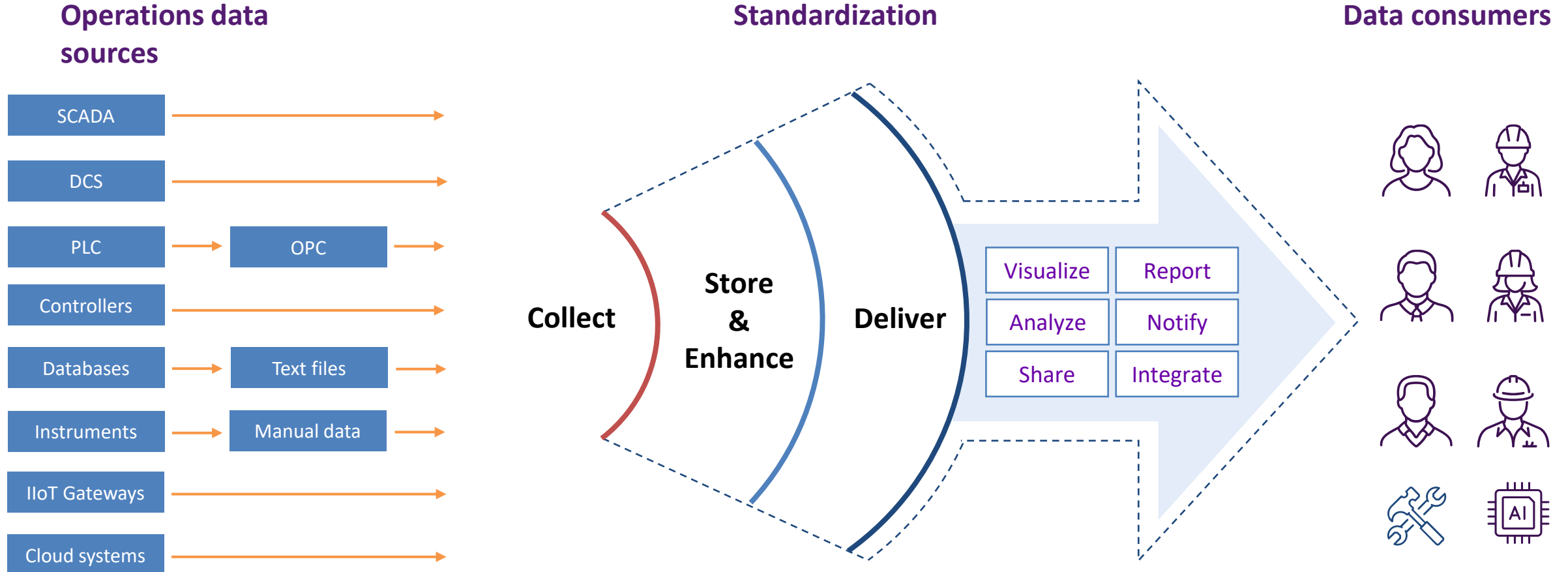


Driving Digitization Excellence to Next Level

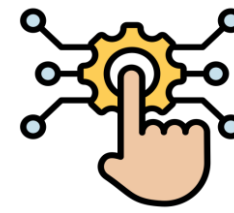
Architecture – AVEVA PI System integration with Plant DCS



Integration of Data for decision making through AVEVA PI System



Vision of Digital Transformation



Unified Real-Time Data Platform

Single source of truth across BBGS, HEL & DIL



Centralized Monitoring & Analytics

Live dashboards for management and operators



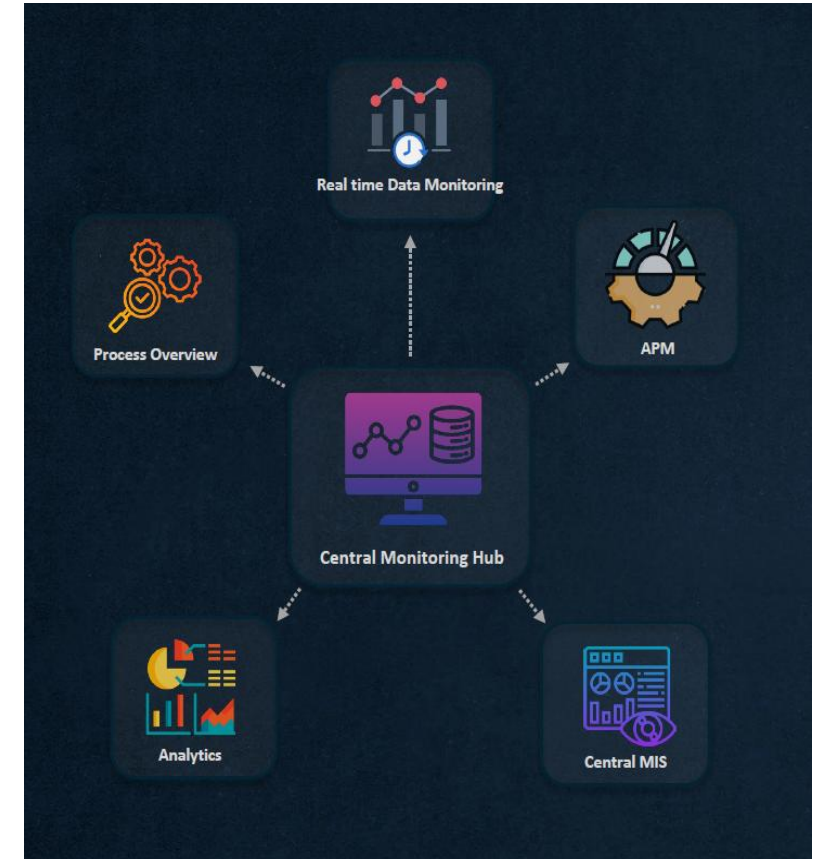
Predictive & Prescriptive Decisions

Move from reactive to proactive operations

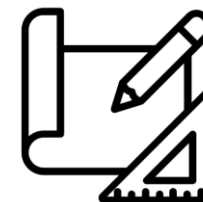


Standardized KPIs & Performance Models

Consistent benchmarking across all units



Architecture Overview



PLANT LEVEL

PI System Interface → Data Collection
BBGS | HEL | DIL

CORPORATE LEVEL

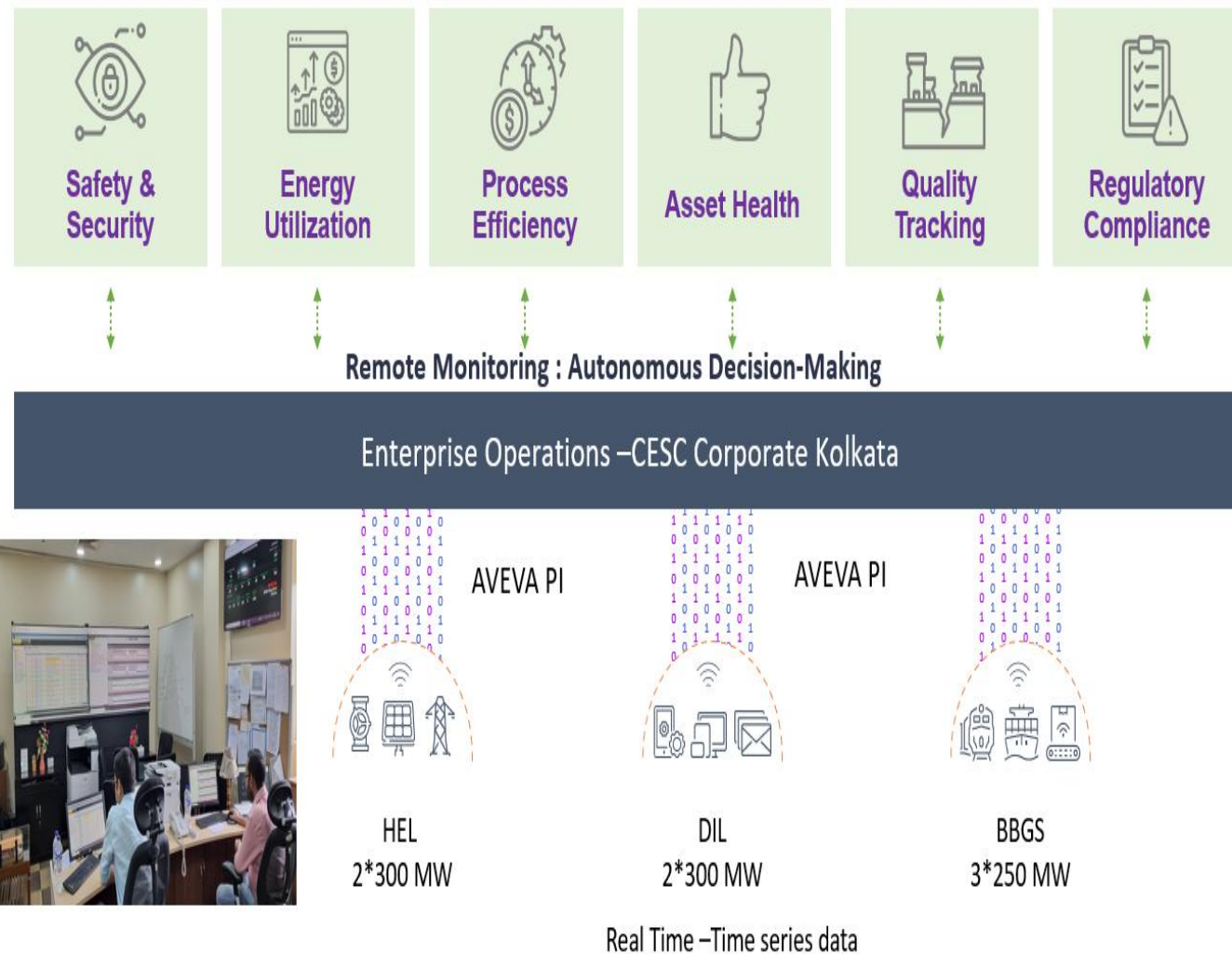
PI Server → Central Repository
Unified Data Lake

VISUALIZATION

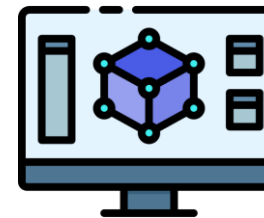
PI Vision / Dashboards
Role-Based Live Views

ANALYTICS LAYER

Models & Health Indices
Predictive Intelligence



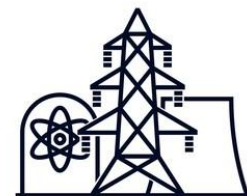
Current Models Implemented



1

Heat Rate Calculation Models

Gross & net heat rate tracking at unit level



2

Coal Mills Health & Performance Models

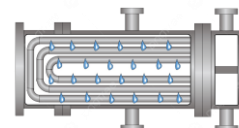
Real-time boiler performance with loss analysis



3

Condenser & HPH Performance Monitoring

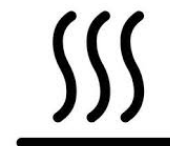
HP/LP turbine efficiency and deviation tracking



4

Boiler Heat Mapping Dashboard and Tracker

CTI-based approach factor and range monitoring



5

Auxiliary Power Consumption Tracking

Unit-wise auxiliary consumption benchmarking



**Standardized
Across**

BBGS

HEL

DIL

Energy Efficiency : Digital Tool Kit



 Merit Order Tool	• Recommends optimal allocation of station demand across BTG Units
 APC Tracker	• Recommends optimal equipment stoppage time during shutdown, reducing Aux Power
 Oil Planning Toolkit	• Assesses boiler condition during start-up to suggest activity-level ideal secondary fuel consumption
 Coal Mill Toolkit	• Mill Window, Mill Effectiveness Index to monitor, detect and correct sub-par mill performance and ensure safe operation
 Boiler Heat Pick-up Tool	• Monitors heat pick-up in various boiler zones
 Coal Ranking Tool	• Dynamically profiles mines basis quantity, quality and landed cost to suggest optimal coal lifting amounts & minimize coal cost

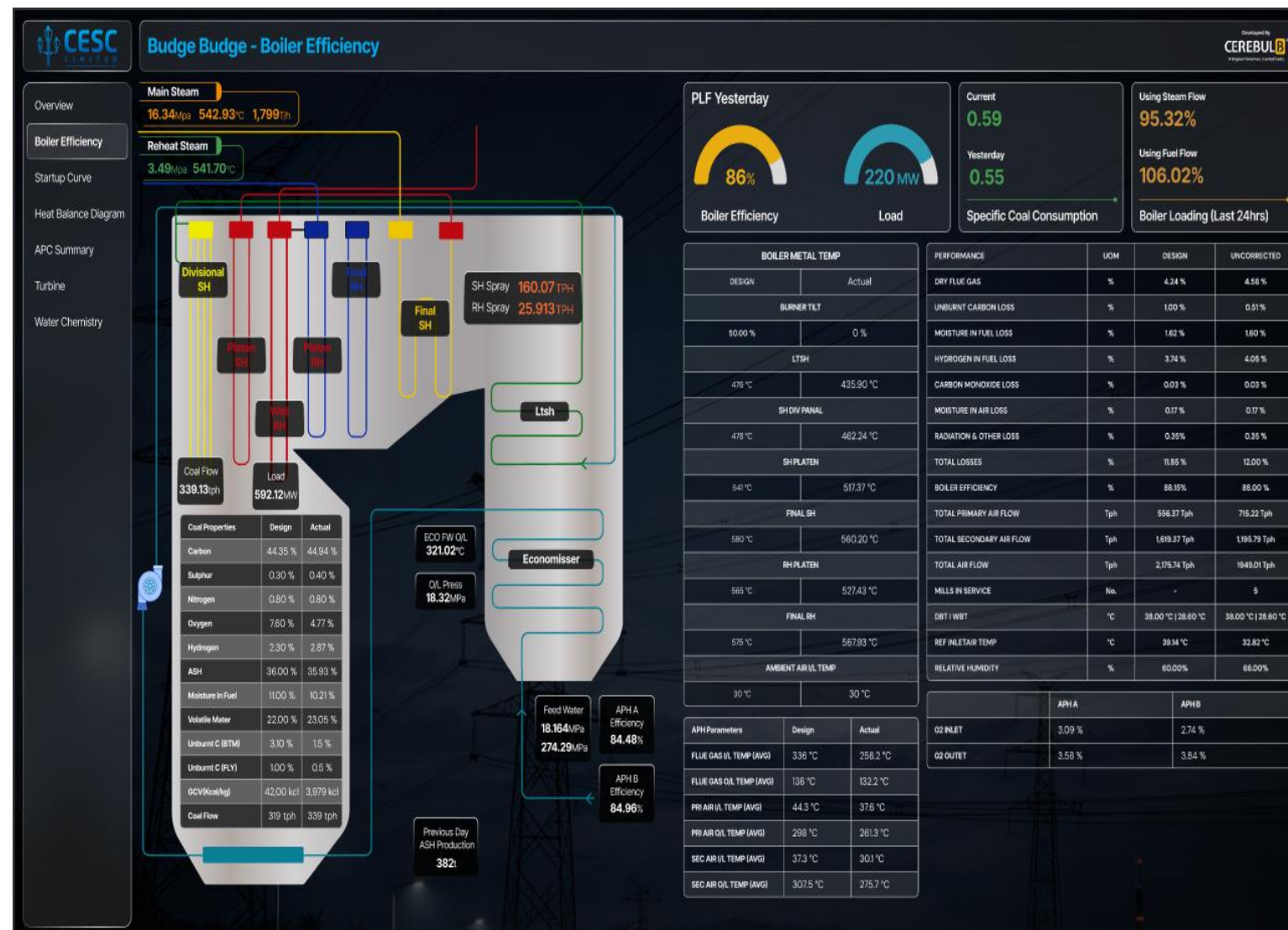
Boiler Efficiency Model

Advanced Monitoring

- Superheater & Reheater temperature tracking
- Economiser & feedwater performance monitoring
- Coal quality vs actual comparison
- Air & flue gas temperature deviations

Business Value

- Identify **efficiency gaps** and fuel wastage
- Reduce **specific coal consumption**
- Improve **combustion optimization**
- Enable **data-driven operational decisions**



Startup Curve Analytics Model

Advanced Capabilities

- Ignition to Rolling trend visualization for dynamic analysis
- Identification of **thermal stress risks**
- Detection of **delays in pressure/temperature build-up**

Business Value

- Optimize **startup time and fuel consumption**
- Reduce **thermal fatigue and equipment stress**
- Standardize **best startup practices**
- Improve **unit availability and reliability**



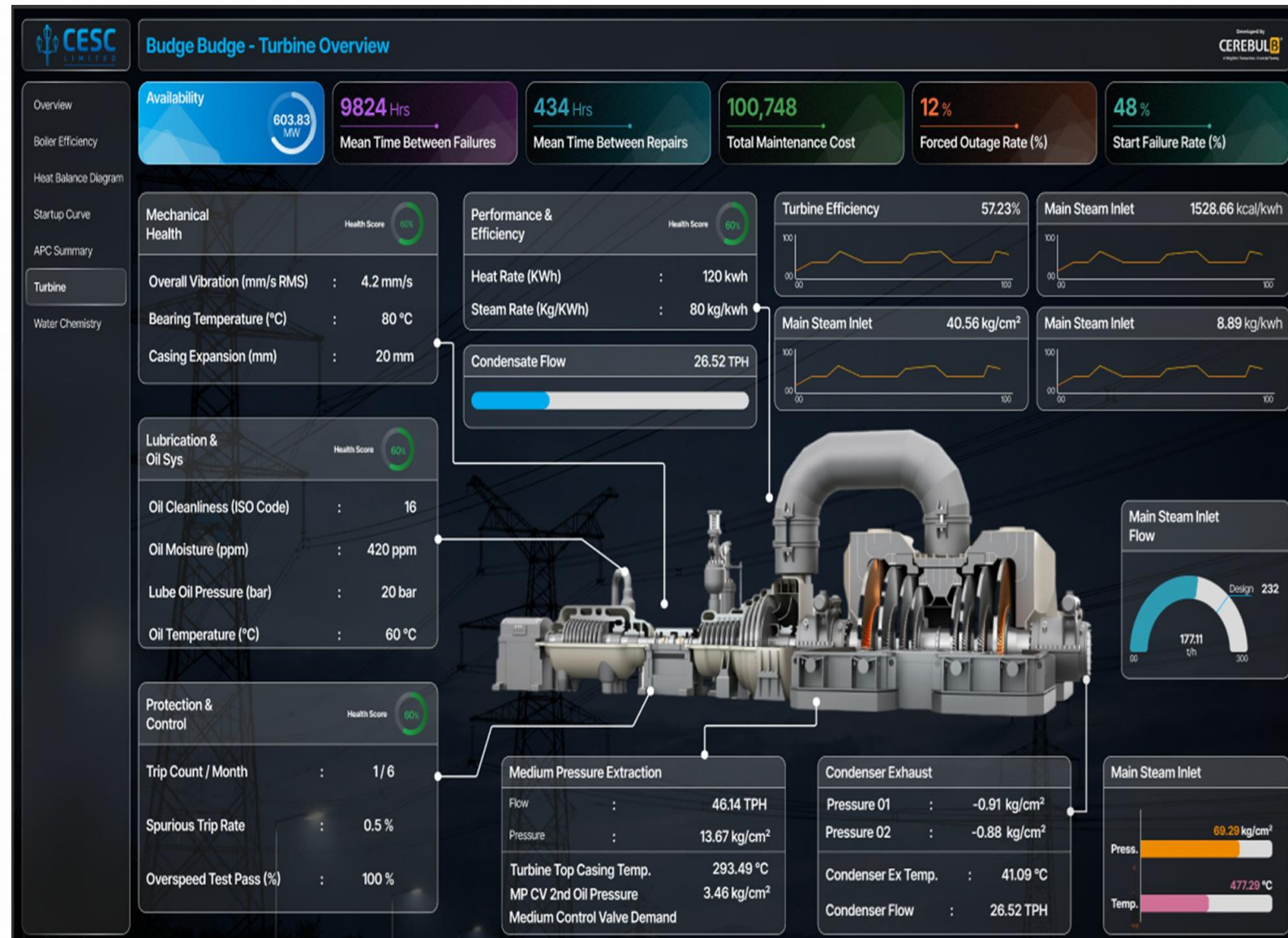
Turbine Health Monitoring Model

Advanced Capabilities

- Condenser performance tracking
- Extraction pressure & flow monitoring
- Real-time efficiency trends

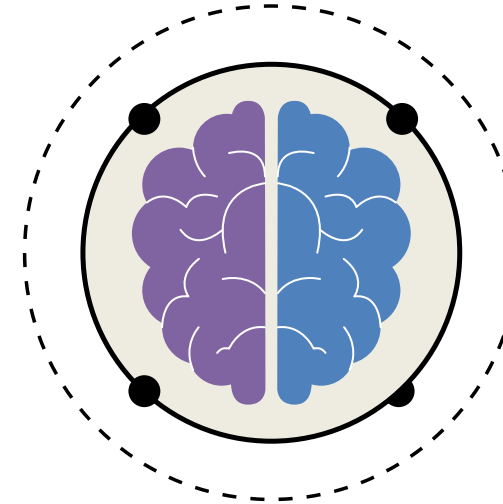
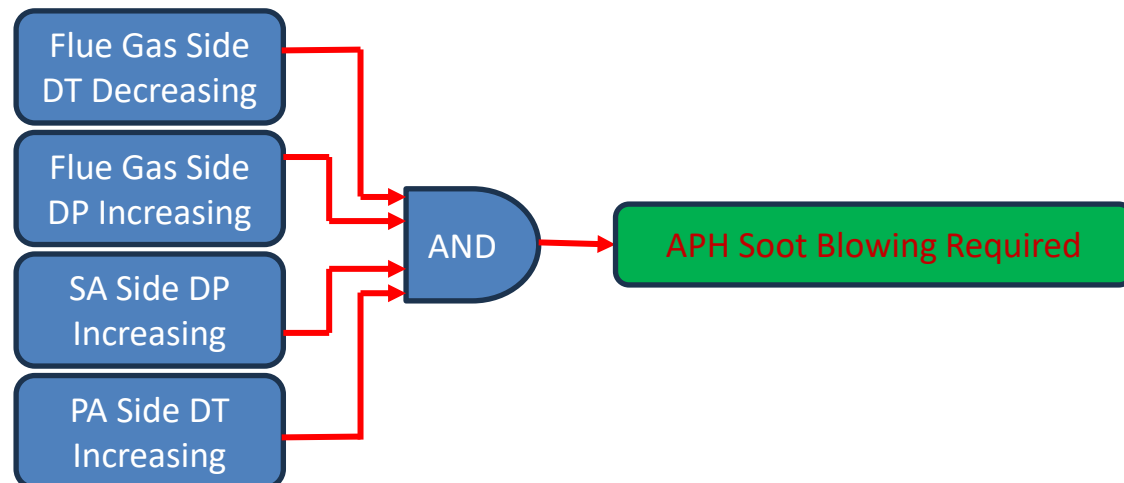
Business Value

- Improve **turbine reliability & uptime**
- Enable **predictive maintenance**
- Reduce **forced outages**
- Optimize **heat rate and efficiency**

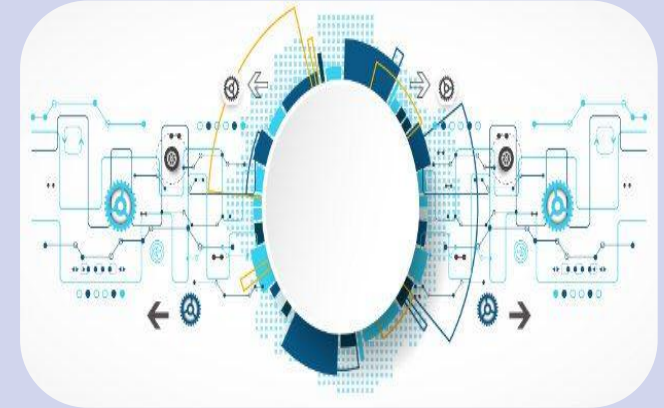


Development of Intelligence models (Analytics + Thermodynamic)

Real time Equipment Performance Dashboard

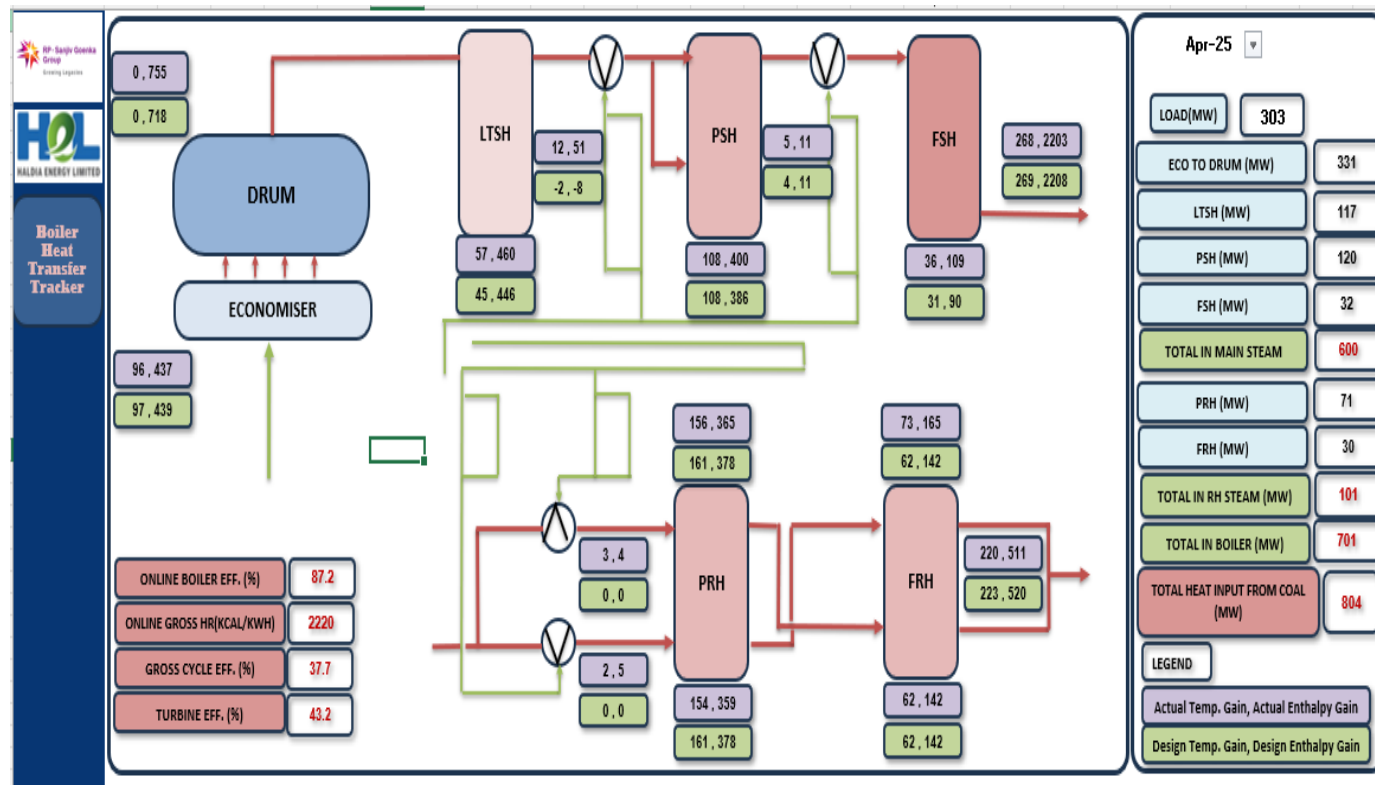


Analytics +Thermodynamic Model



- ✓ For health & Performance Model Logics developed for giving **Analytics +Thermodynamic** based advisories.
- ✓ This will help **Real time decision making** for operator to improve unit performance & efficiency at same boundary operating parameters.

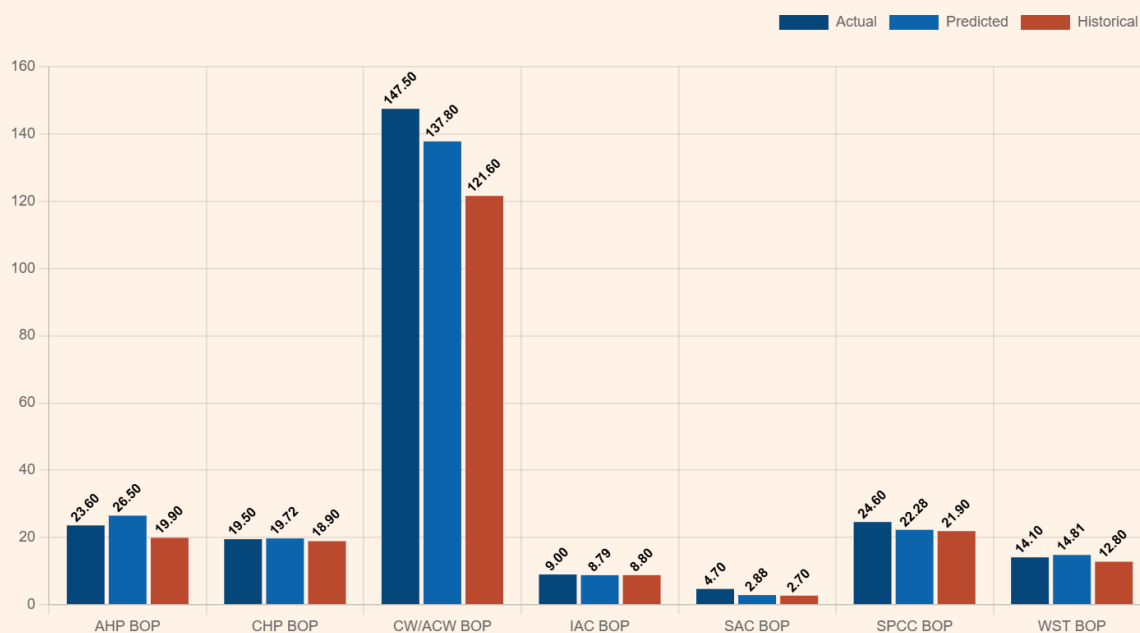
Boiler Heat Mapping Dashboard and Tracker



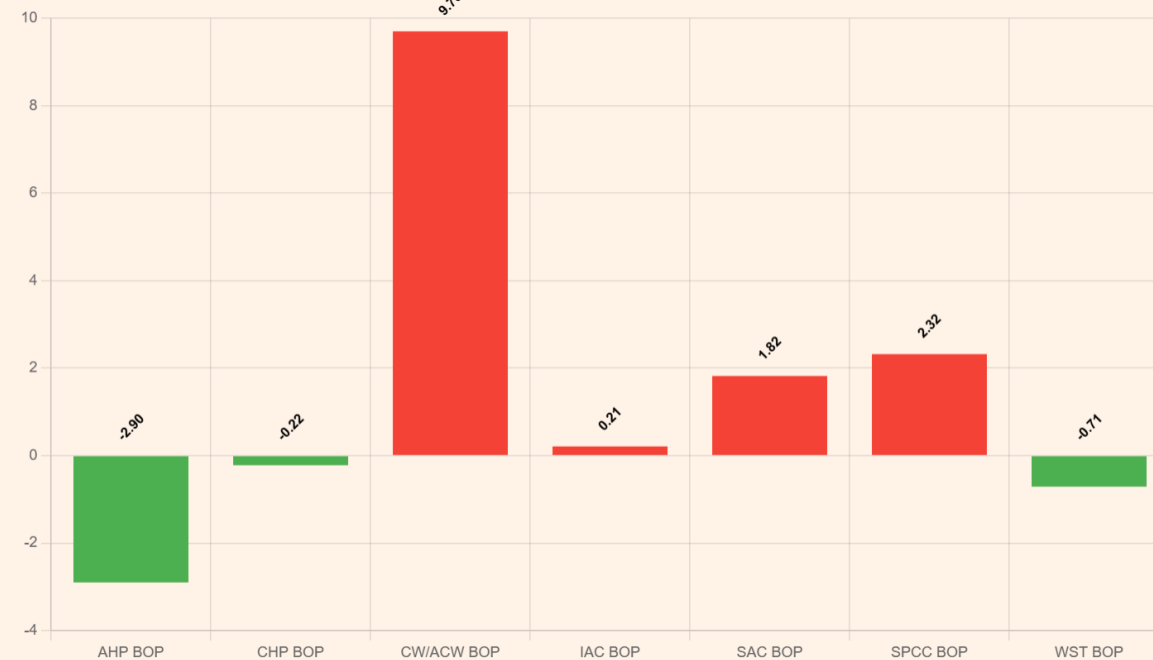
- Aimed at real time tracking and monitoring and recording temperature and enthalpy gains across the different Heat Transfer zones of the Boiler.
- Model has been made dynamic, the actual temperature and enthalpy gains can be compared in real time with the design values at different loads.

- Based on the AI Model inputs, the APC model generates a Predicted Output
- Based on the input given, tool suggests predicted APC % for unit & individual equipment based on past historical Equipment data.
- This clearly gives an input to Plant engineer where there is a Gap & opportunity for improvement .

BOP APC Comparison (MWhr)



Actual - Predicted Deviation



Remote Monitoring through AVEVA PI System

— Alarm/Trip
Actual
Predicted



Alert Trend Analysis with predicted trend.

Alert List

Case Number	Asset(s)	Name	Owner	Category	Status	Impact	Likelihood
13066	DIL-2-BFPA	DIL-2-BFPA Hydraulic Coupling IB Output Journal Bearing - Local Bearing Problem	sumit das	Equipment	Notification to Customer	Normal	Ver
13065	BB-2-CON	BBGS-2 Condenser instrument issue	sumit das	Performance	Notification to Customer	Normal	Unl
13064	BB-2-HPH7	BB-2-HPH7 Tube Leak	sumit das	Instrumentation	Notification to Customer	Normal	Ver
13063	BB1-BP-B	BB1-BP-B Pump Performance Loss	sumit das	Instrumentation	Notification to Customer	Very Low	Ver
13062	BB-1-PAA	BB-1-PAA Fan IB Bearing - Local Bearing Problem	sumit das	Instrumentation	Notification to Customer	Normal	Unl
13061	DIL-2-TURB	DIL-2-TURB HP STEAM - CV3 Valve Problem	sumit das	Instrumentation	Notification to Customer	Normal	Ver
13060	BB-2-MILD	BB-2-MILD Motor OB Bearing Sensor Problem	sumit das	Instrumentation	Notification to Customer	Normal	Ver
13059	DIL-2-CEPB	DIL-2-CEPB Recirc - Valve Problem	sumit das	Performance	Notification to Customer	Normal	Unl
13058	HEL-2-CEPB	HEL-2-CEPB Local Bearing Problem - Motor Inboard Bearing	sumit das	Equipment	Notification to Customer	Normal	Unl
13057	BB-2-BFPA	BB-2-BFPA Pump - High Internal Recirculation	Saikat Bhattacharjee	Instrumentation	Notification to Customer	Very Low	Ver
13056	BBGS-3-BOILER	BBGS-3 BOILER HP Drum - Chemistry Problem	sumit das	Equipment	Notification to Customer	Severe	Ver
13055	DIL-2-DMCWA	DIL-2-DMCWA Local Bearing Problem - Motor Inboard Bearing	sumit das	Equipment	Notification to Customer	Normal	Ver
13054	HEL-2-CT	U2 CT FAN-12 Gearbox vibration gradually increasing	sumit das	Equipment	Notification to Customer	Normal	Ver



Reliability Model Revealed

- Early Warning
- Bearing Stress
- Residual Spike
- Repeated Alerts
- Fault Isolation
- Planned Intervention

Predictive & Prescriptive Analytics

Descriptive
(What happened?)

Diagnostic
(Why did it happen?)

Predictive
(What will happen?)

NOW

Prescriptive
(What should we do?)



Early Fault Detection

Trend-based anomaly detection across critical parameters



Predictive Maintenance Planning

Schedule maintenance before failures reduce availability



Root Cause Analysis

Deep dive into historical data to identify failure origins



Prescriptive Recommendations

Operator advisory system with actionable guidance

Business Impact

 **Reliability**

- The models has helped in reducing forced outages and improving availability.
- HEL (2*300 MW) – 100 %
- DIL (2*300 MW) - 99.51%
- BBGS (3*250 MW) - 96.67 %

 Scalability

- The project has enabled Standardize KPIs, dashboards and models across units, plants and the wider power portfolio.

 Improved MTTR/MTBF

- The project has led to improve MTTR & MTBF of critical equipment by enabling data driven & quick response to equipment health related problems.

 Environmental Impact

- The project has led to total coal saving of 55000+ MT and prevent Co2 emission of 1,10,000+ MT post implementation.

 Energy Savings

- More than 50 Mu has been saved in Auxiliary power & 15 Kcal/Kwh reduction in Gross Heat rate



Future Scope of AVEVA PI System



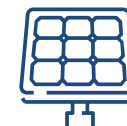
Integration of Thermal , Wind , Solar Assets with Transmission and Distribution at Smart Energy Centre



Thermal



T&D



Solar PV



Wind



Centralize Operation Monitoring :

After full flagged implementation of PI system , SMART ENERGY NETWORK CENTRE will be developed for Centralized Operation & Performance Monitoring for all Thermal & Renewable asset .



Centralize Power Market & System Control Monitoring :

Centralize monitoring of Real time Power Market like DAM, TAM ,RTM . Real time decision making in Coordination with system Control . Integration of RE power Vs Thermal Power and effective coordination



Realtime Interactive Performance & Reliability Dashboard will help to improve operation performance & equipment downtime.

CESC Limited delivers INR 220 Million in annual efficiency gains with real-time analytics

Challenge

- Data fragmented across DCS, OEM systems, and manual reports
- Limited real-time visibility into asset health and performance
- Late detection of issues increased risk of forced outages and efficiency losses
- Inconsistent KPIs and analytics across plants hindered standardization
- Manual compliance tracking added operational effort and risk

Solution

- CESC implemented AVEVA™ PI System™ and AVEVA™ PI Vision™ as the foundation for real-time operations and analytics, enabling a centralized Analytics Centre of Excellence (ACoE) for both plant-level and corporate monitoring.

Results

- **Achieved highest level of availability (> 96 %) in all Thermal Power Plants**
- **Reduced forced outages through early detection and predictive alerts**
- **Saved 50+ MU of auxiliary energy and reduced gross heat rate by 15 kcal/kWh**
- **Delivered 55,000+ MT coal savings and avoided ~110,000 MT CO₂ emissions**
- **Generated approximately INR 220 million in Annual value (~ 1.95-2.0 million Euros) from KPI improvements**





THANK YOU

Contact: Balaram.saha@rpsg.in
Phone no- +91 9599755055