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OCTOBER 2024

Adani Power Limited

Advanced Monitoring and Optimization Strategies for Enhancing Efficiency and Reliability

Rakesh Kumar Dash | Somesh Kumar | Jimesh Gajera

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Advanced Monitoring and Optimization Strategies Enhancing Efficiency and Reliability

Presented by

Rakesh Kumar Dash

Head , Adani ENOC
(Thermal ,Renewable , Grid solutions)

25+ Years of expertise in the energy Sector with exposure to projects, engineering, commissioning, O&M and Automation

* A patent holder in the field of automation

Somesh Kumar

Lead – Analytics & Automation
ENOC

Electrical Engineer
Certified Energy Manager from BEE , India

Budding Developer of various Analytics & Visualization Tools
Expertise in AVEVA PI, SQL, Python , Power Bi and other MS Office tools

Jimesh Gajera

CTO , Cerebulb India

Bachelors in IT
Business Analyst

Expertise in Digital Transformation Project in wide range of industrial sectors like Manufacturing, Electric Power, Oil & Gas, Marine, Mining

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Bonjour, PARIS!

ADANI POWER LIMITED, INDIA

AVEVA WORLD PARIS,2024 | OCTOBER 15

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KHAVDA
528 square kms area which is
5X area of _____
Enlightening more than
16.1 Millions Homes

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Topic outline

01 An introduction to Adani Energy Business

02 What we do at ENOC

03 Retrofitting of Existing Platform to AVEVA PI System

04 Development of Use cases in PI System

05 Feedback - Q&A

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Adani
energy window

Adani Power Limited (Thermal)

India's Largest Power
Generation Company
(Private Sector)

17+ GW Capacity

10 Power Stations

29 Running Units
2 Ultra Super Critical Units
14 Super Critical Units
13 Sub critical Units

11+ GW capacity
in making

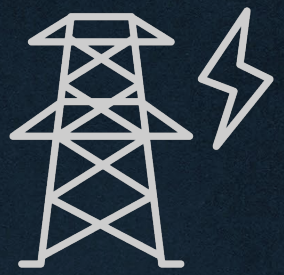
Adani Green Energy Limited (Renewable)

India's Largest
RE Power Producer

12+ GW
Total Operational Renewable Portfolio

52.3 Million Tons CO_2 emissions
avoided cumulatively till FY24

Target 50 GW Capacity by 2030



Adani Energy Solution Limited (Grid)

Largest Private Sector
Transmission Company in the country

17000+ Circuit Kms

52 Sub stations

33000+ MVA
operational capacity

First ever HVDC Project
in private sector(India)

Remote Operation
for 33 Sub Stations

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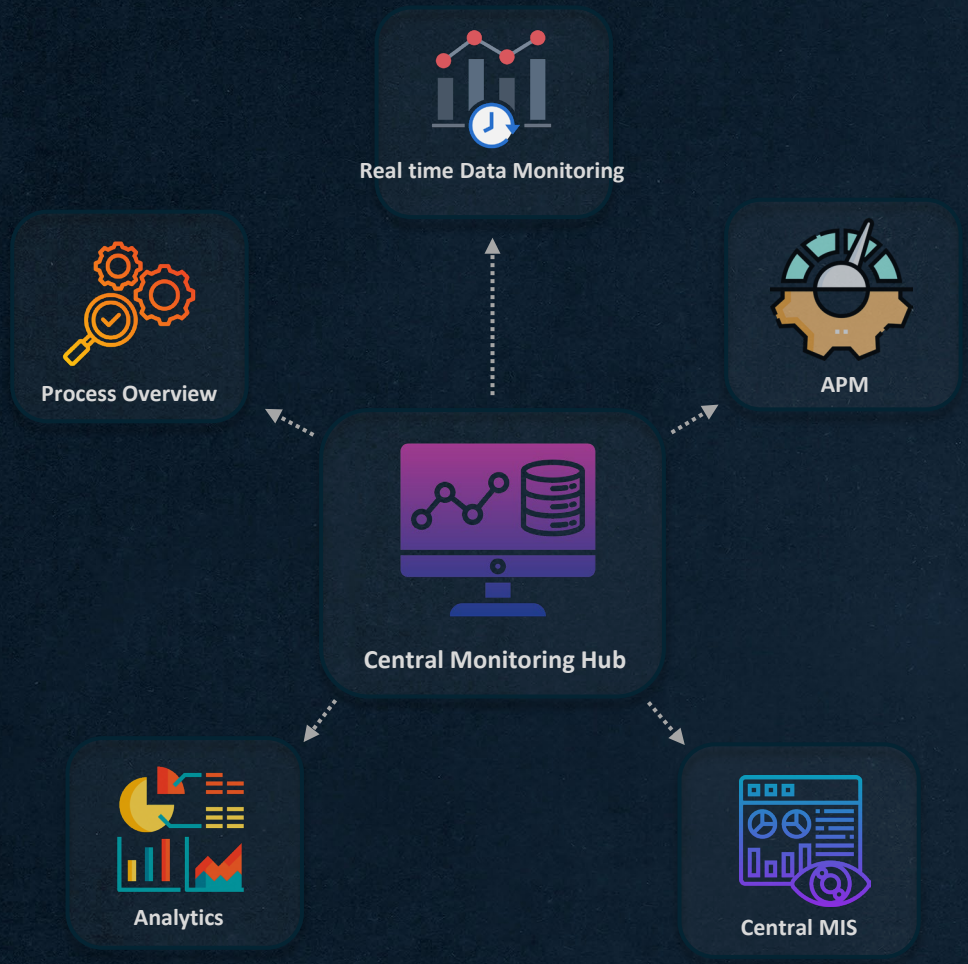
ENOC | Energy Network Operation Center

Right information to the Right people at the Right time in the Right way



Centralized Management
Manage all Adani energy sites from one location

Capacity Expansion
Increased monitoring from 27 GW to 80 GW by 2030

Asset Longevity
Ensure assets last longer at optimal costs

Remote Operations
Remote control for transmission assets

Global Partnerships
Collaborate with global digital and IoT providers like Google

Advanced Technologies
Use of ML and AI

Data Analytics & Forecasting
Build robust data analytics and real-time forecasting

Business Intelligence
Achieve precise business MIS, CxO dashboards, and asset performance monitoring

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ENOC

ADANI CORPORATE HOUSE
AHMEDABAD | INDIA

Energy Network Operation Center

Retrofitting with PI System

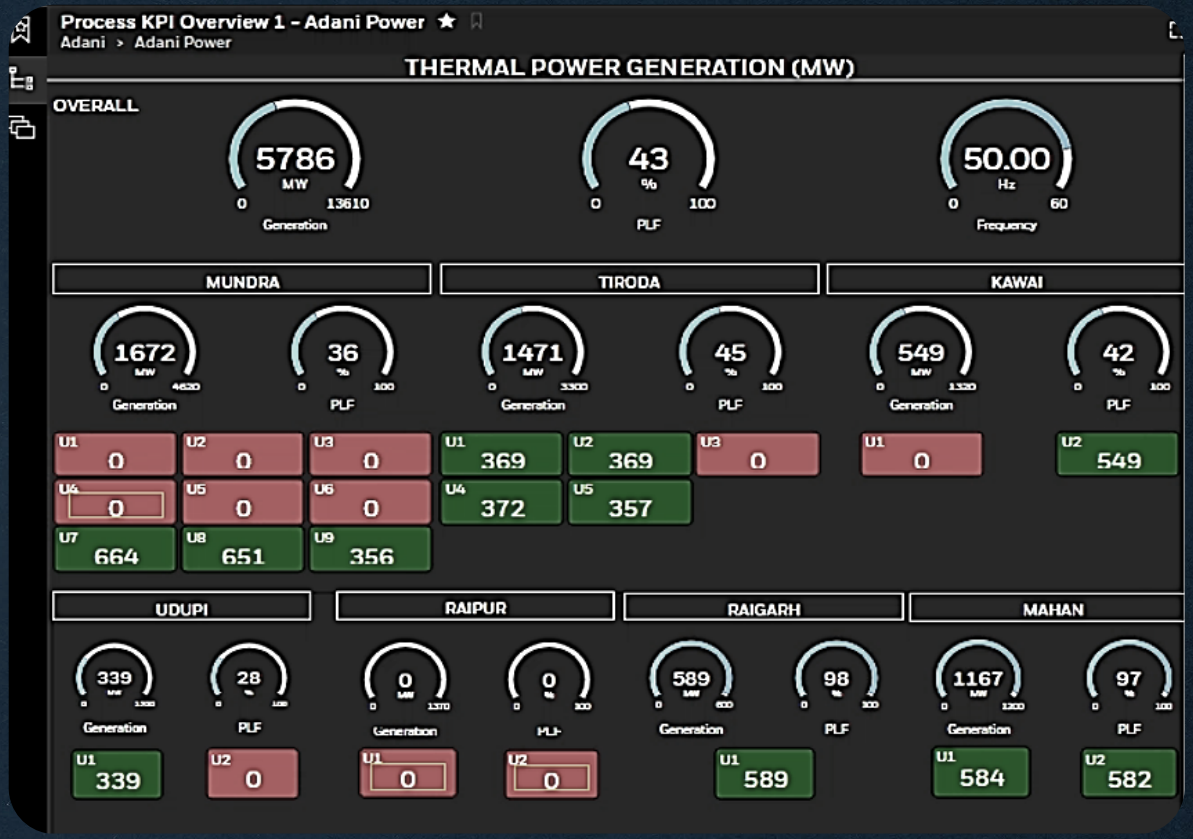
Background

Older System

PIMS (Plant information Monitoring System)

- Limited information
- Minimum data refresh rate 01 minute
- Slow response time in data retrieval
- New Development limitation
- Limited Accessibility
- Limitation in embedding Analytics
- Restricted features

Older System



Incorporating

PI System

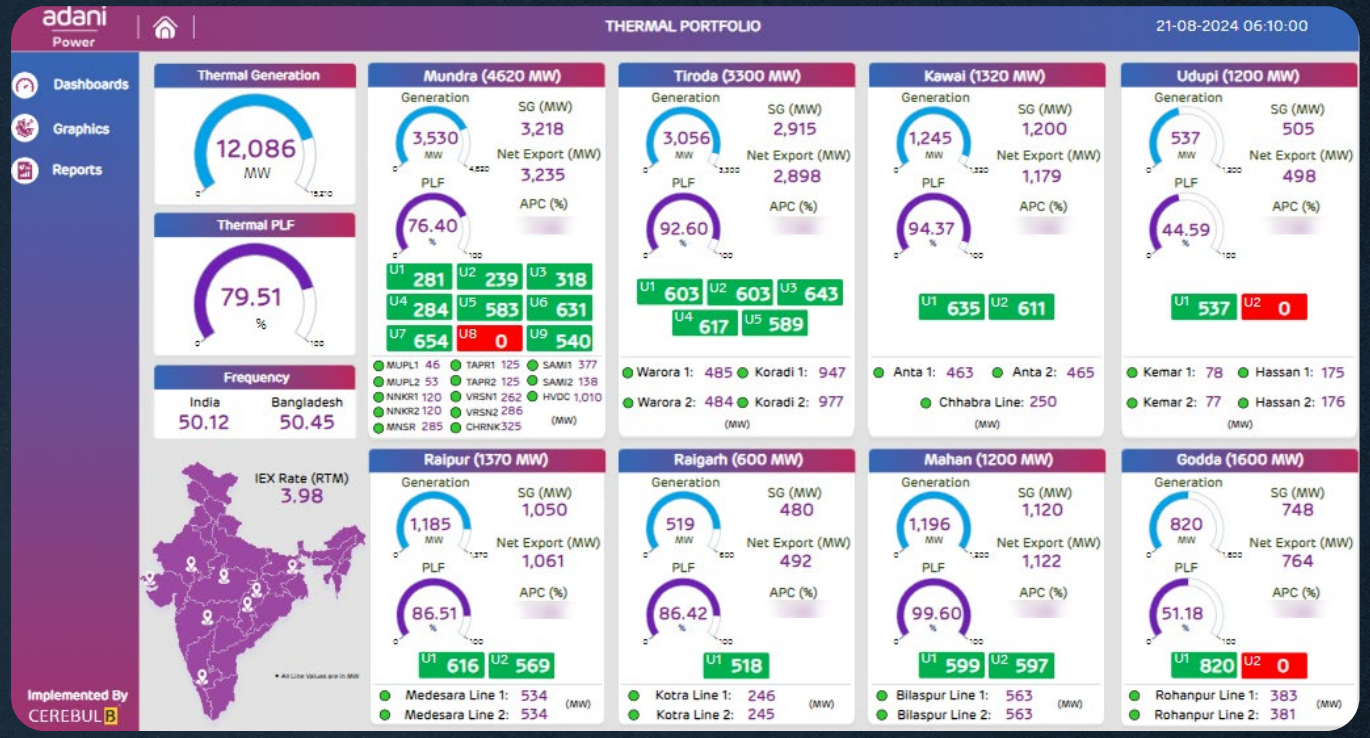
Platform Upgrade

New System

OPMS (Operation & Performance Monitoring System)

- Increased **data refresh** rate up to **2 Sec**
- Faster page response
- Multiple Features
- User friendly with customization
- Single sign on
- Robust data pipeline
- Leveraging PI System **Advanced Features**

New System



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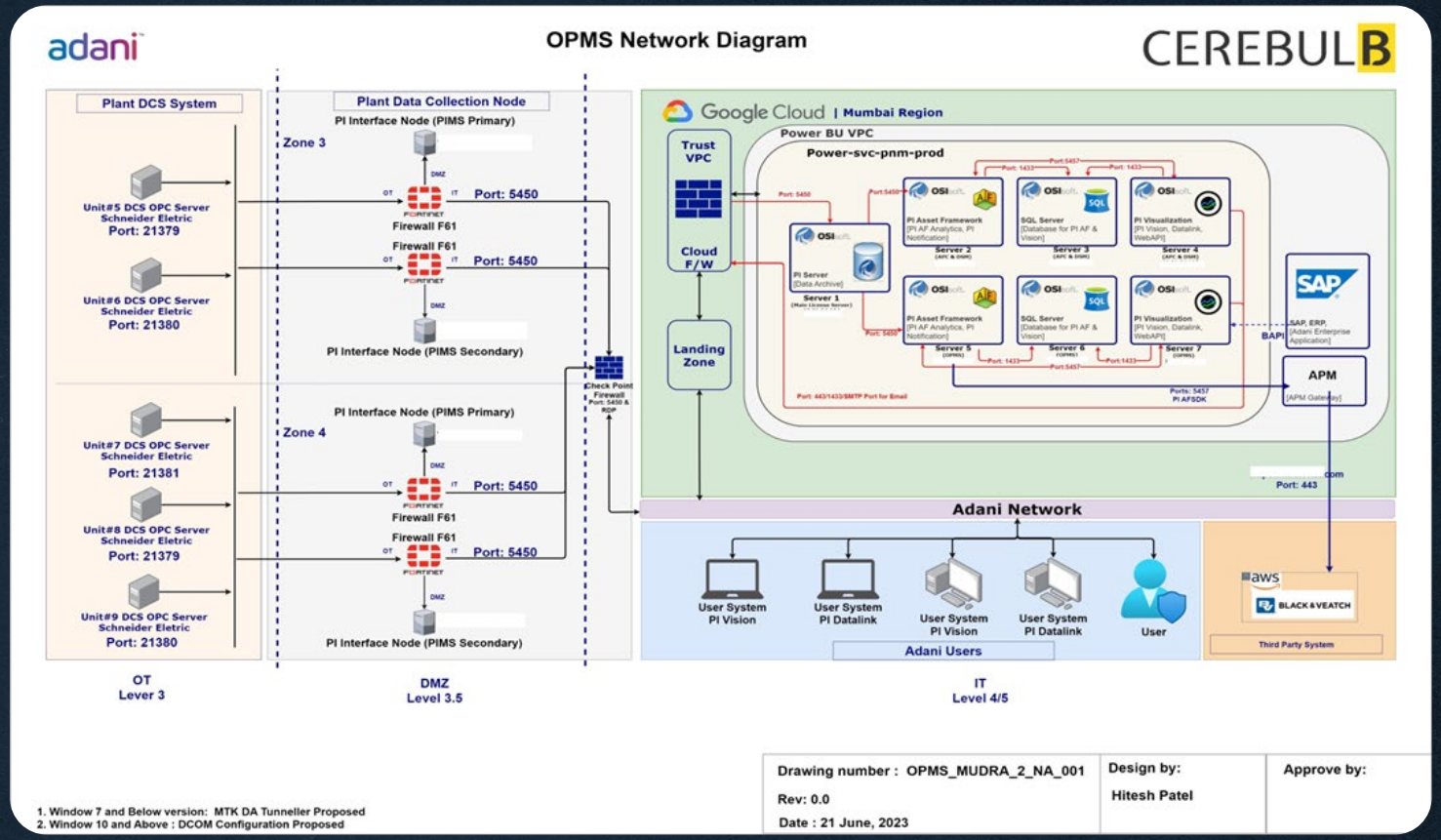
System

Architecture

- ✓ 8 Location, **25 Unit connected**
- ✓ Interfaced with 25 control system
- ✓ **14 Schneider electric** DCS System
- ✓ **24 Interface** PC Installed
- ✓ 24 Firewall Installed
- ✓ **1.5 Lakh tags** integrated with OPMS
- ✓ Interfaced with third party applications



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Life with PI System

IMPLEMENTATION

25 Thermal Units
Integrated 3 month advance from schedule.
Partnered by Cerebulb

OBJECTIVE

Enhanced Monitoring
Enhanced reliability
Real time insights

Efficiency

Heat Mass Balance diagram (HMBD)
Boiler Efficiency Monitoring (BEM)
Merit Order tool (MOT)

RELIABILITY

Asset Health Index (AHI)
Metal Excursion (X-Tool)

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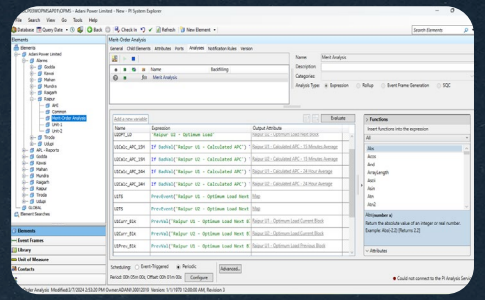
Customized
Data Infrastructure

python

Pi archive



Pi Asset Framework

Pi Vision

Customized architecture used for some of unique tool

Python platform is leveraged for AI/ML Integration

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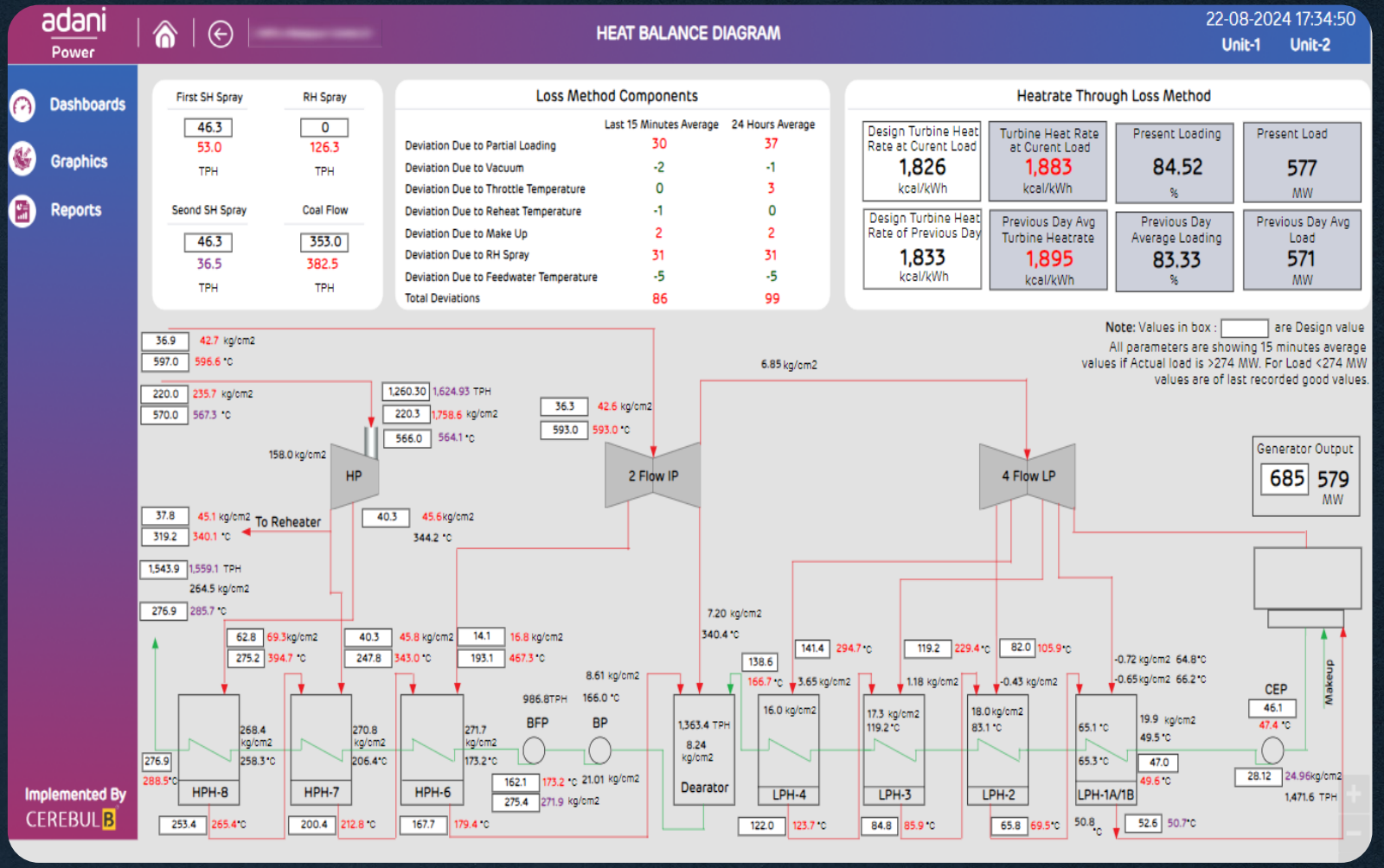
Development of tools using AVEVA PI SYSTEM

HMBD

Heat Mass Balance Diagram

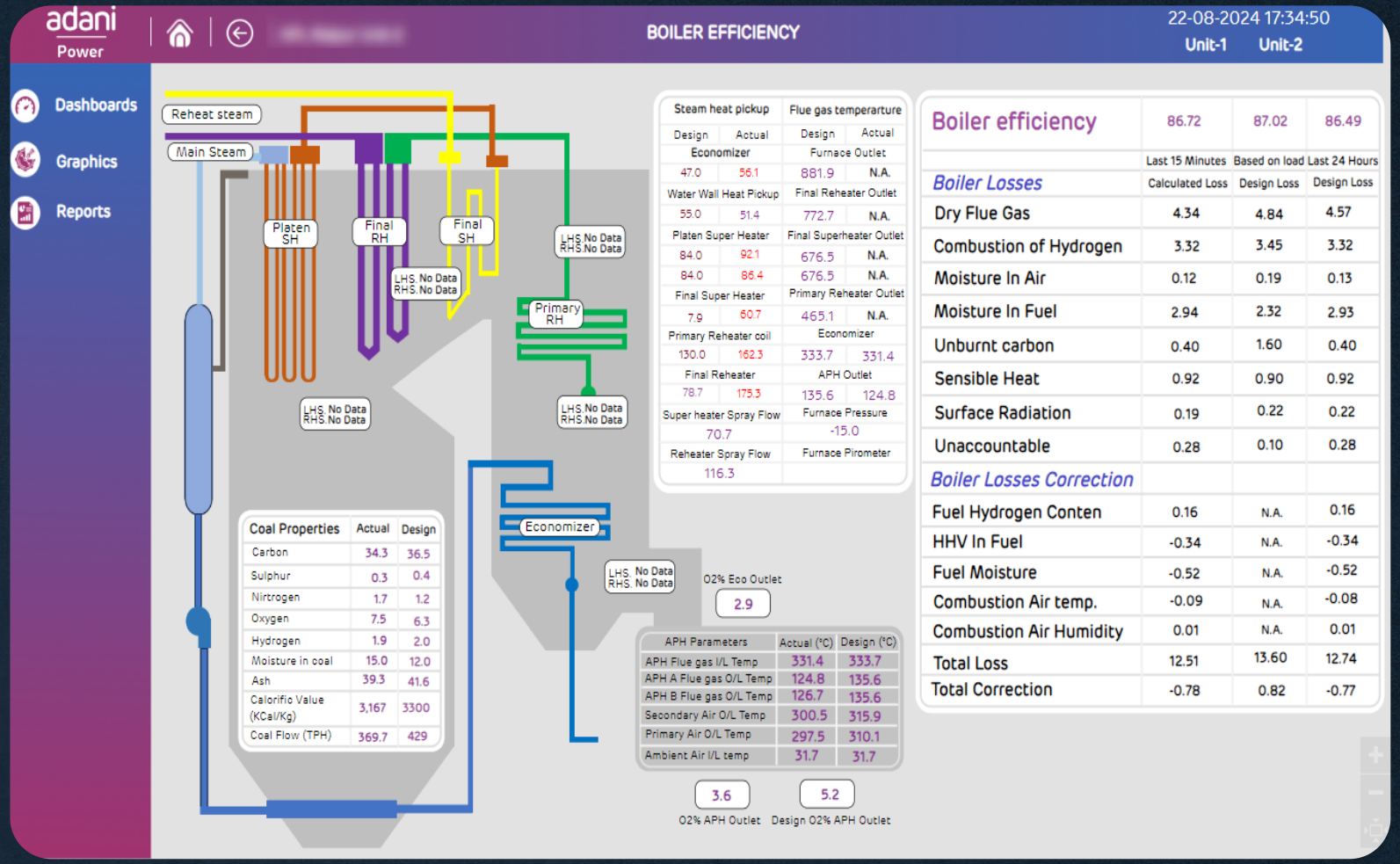
Design vs Actual

- ✓ All turbine loss calculated and mapped on screen with interval
  - Last 15 Minute
  - Last Day
- ✓ **Realtime monitoring** of design vs actual turbine losses displayed
- ✓ Design value are dynamic and changing with respect to actual loading of units.
- ✓ **Thermodynamic module** - enthalpy and entropy in PI AF
- ✓ This enables operator to have real time insight of all the losses and enable them to take corrective actions to **minimize the losses**.



Boiler Efficiency Monitoring

- ✓ All boiler loss calculated and mapped on screen with interval – 15 Min & 24 Hrs.
- ✓ **Realtime monitoring** of design vs actual boiler losses
- ✓ Design value are dynamic and changing with respect to actual loading of units.
- ✓ Thermodynamic module used in calculation
- ✓ **Manual logger utilized to capture coal quality**
- ✓ This enables operate to have real time insight of all the losses and enable them to take corrective actions



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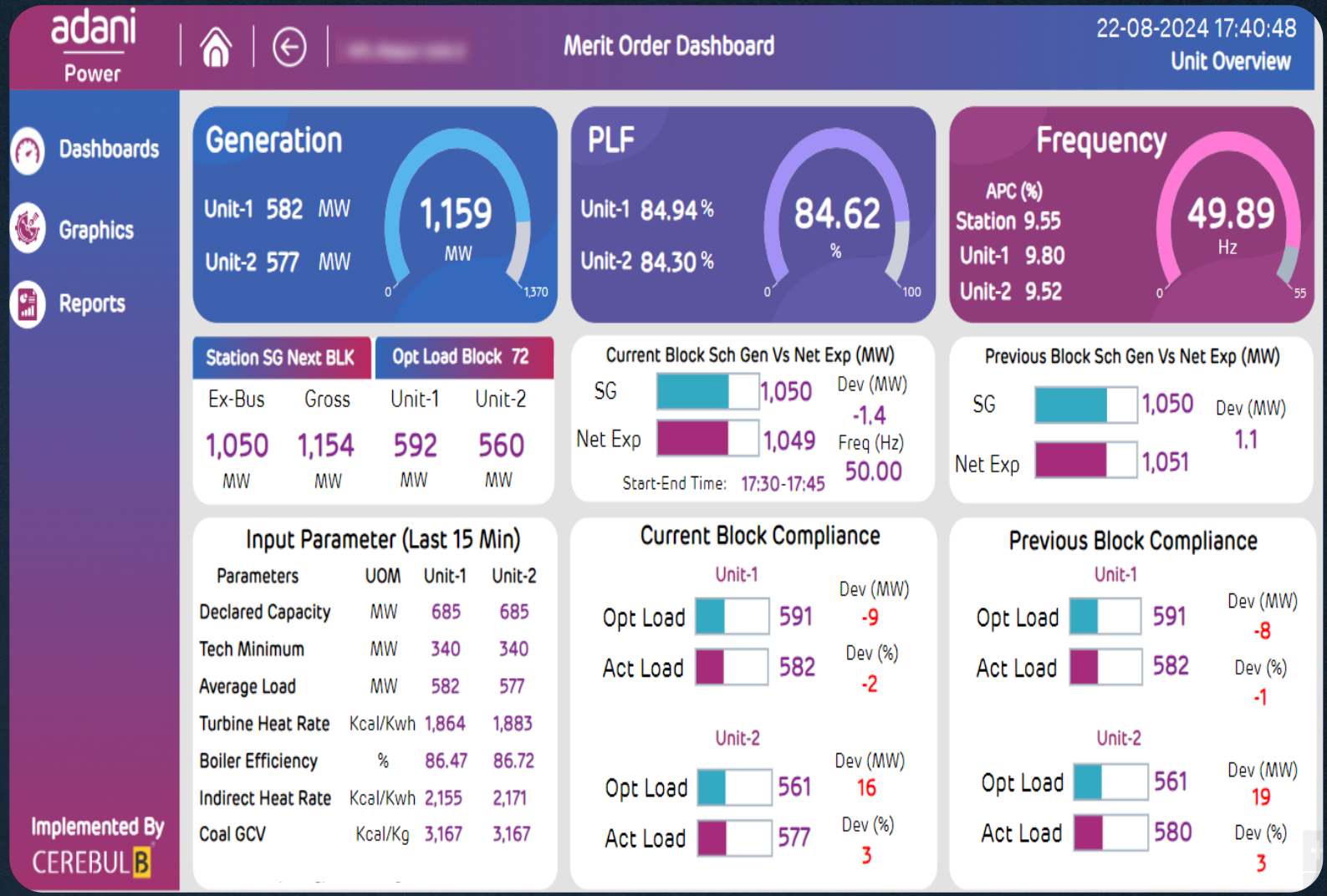
Merit Order Tool

- ✓ Enables **REAL** data-driven decision making
- ✓ Ranking of unit decided based on efficiency of units
- ✓ Significant improvement in the overall **station heat rate**
- ✓ Reduction in **operational costs** by optimization in station heat rate.
- ✓ Reduction in carbon footprint.



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Asset Health Index (AHI)

Further steps towards

Reliability

Challenge

- Asset health status is not visible
- Real-time dashboard for all assets on one platform
- Insights on parameters deviating from normal limits
- Data-driven decisions for equipment maintenance

Solution

- Python code developed for health score calculation for each parameters of equipment
- HMI for insight
- Station Health score
- Asset Health Score
- Equipment Health score
- Radar chart for Identifying Sensor health score

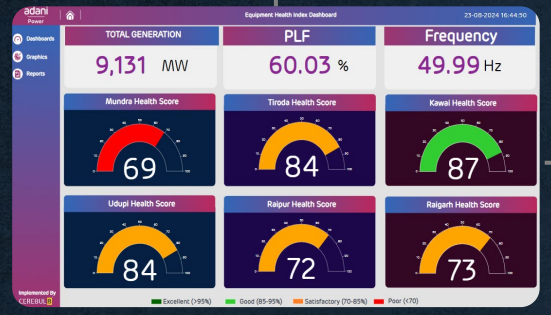
Result

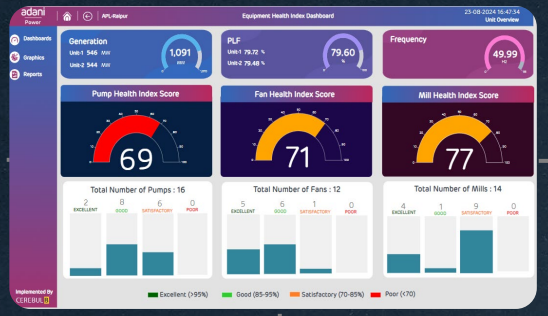
- Increased Equipment Reliability
- Optimized Maintenance Strategies
- Reduced Maintenance Costs
- Enhanced Safety and Compliance
- Improved Asset Lifecycle Management
- Increased Operational Efficiency

AHI Asset Health Index

Multi tier Scoring Index methodology

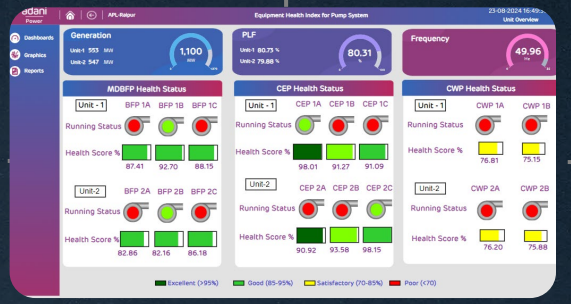
Station level

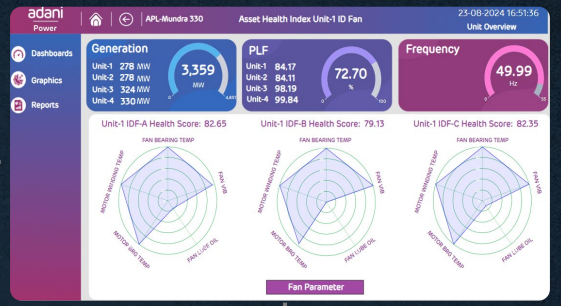




Asset level

Equipment level



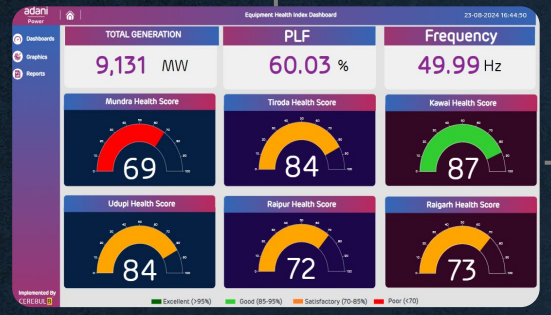


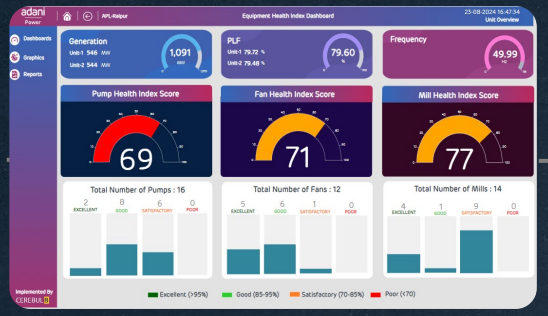
Sensor level
(Customized radar chart)

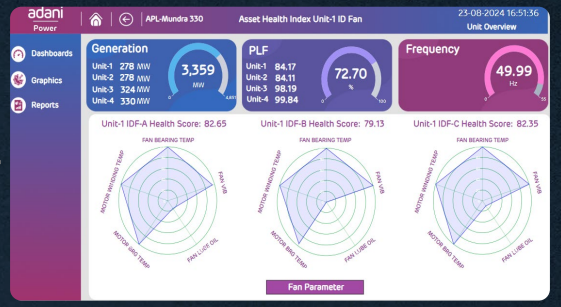
AHI Asset Health Index

Multi tier Scoring Index methodology

Station level

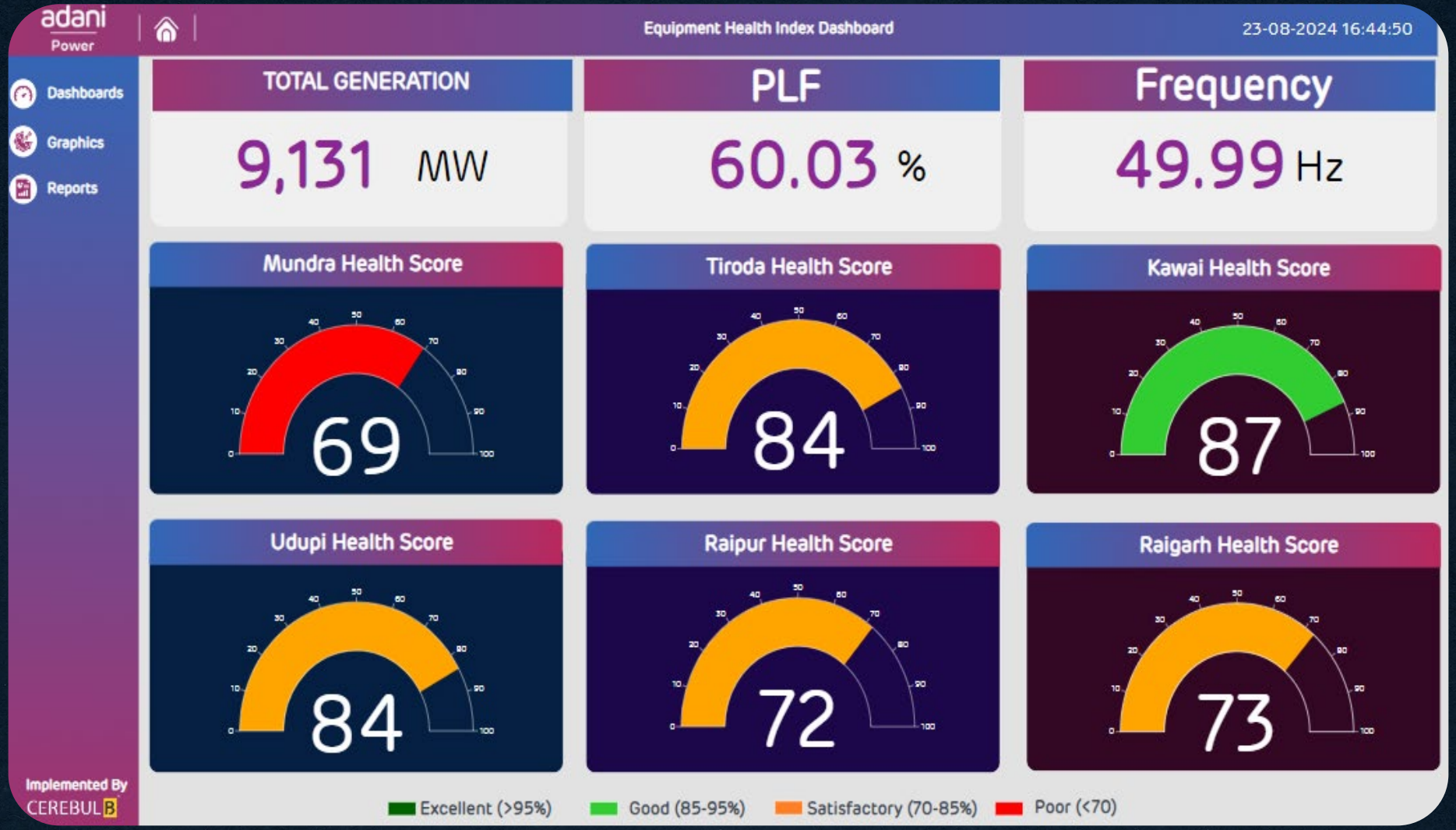






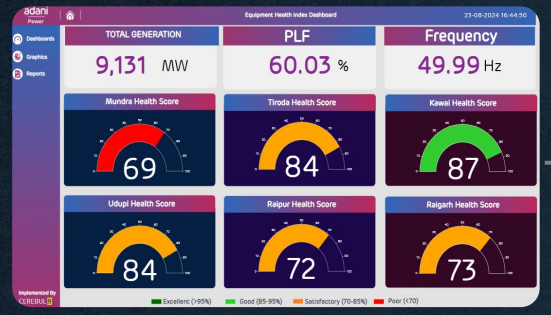
AHI Asset Health Index

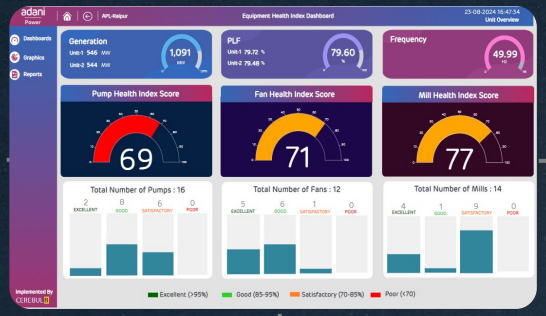
Station level



AHI Asset Health Index

Multi tier Scoring Index methodology

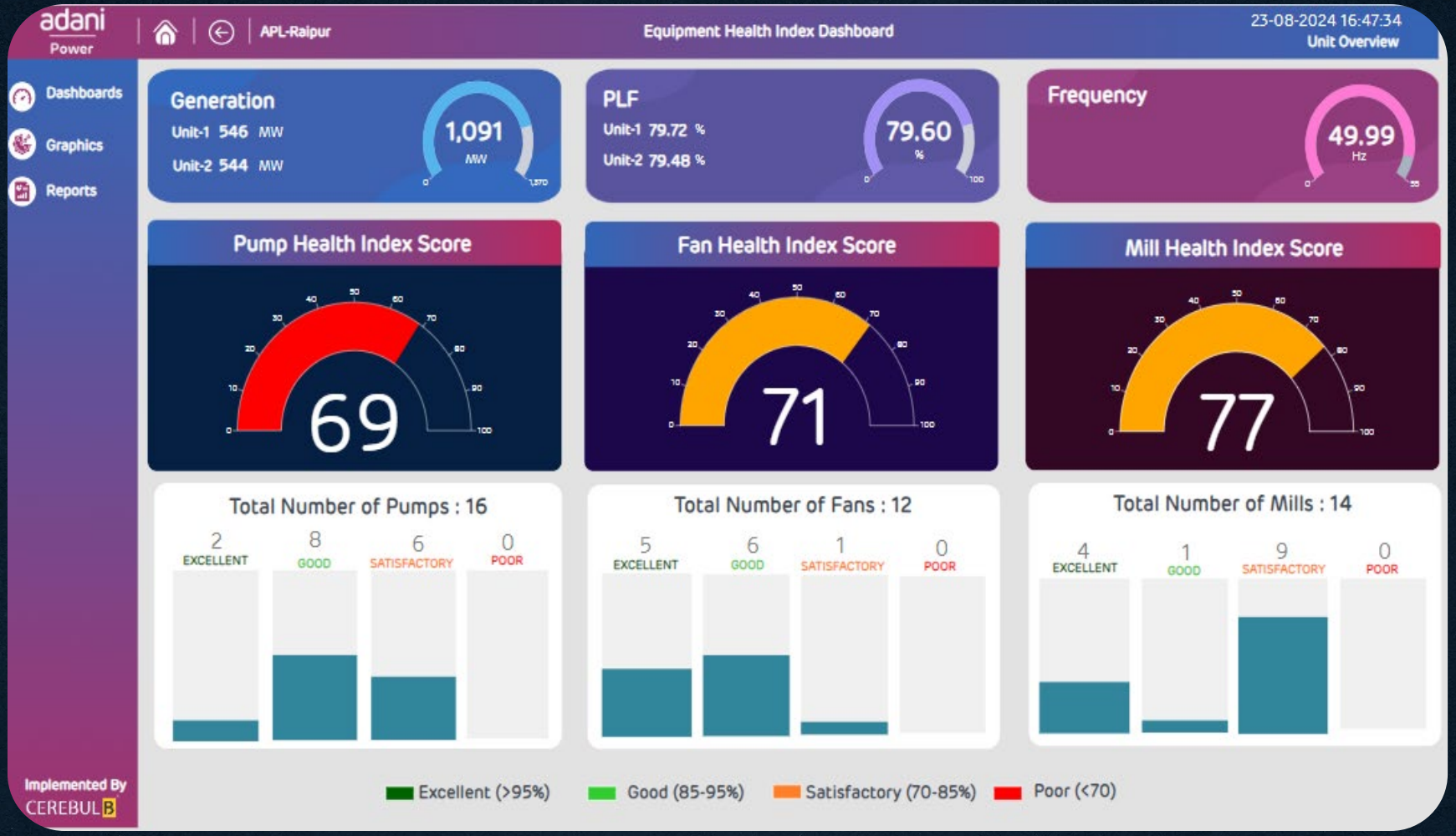




Asset level

AHI Asset Health Index

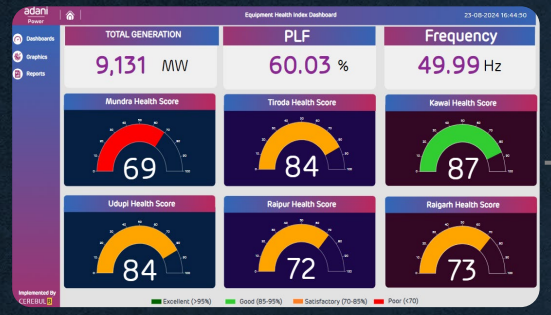
Asset level

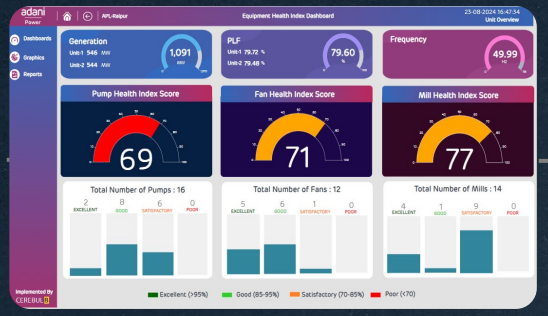


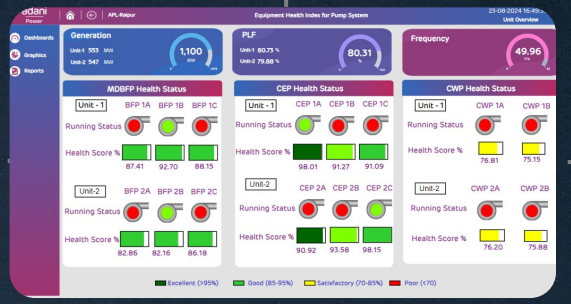
AHI Asset Health Index

Multi tier Scoring Index methodology

Equipment level





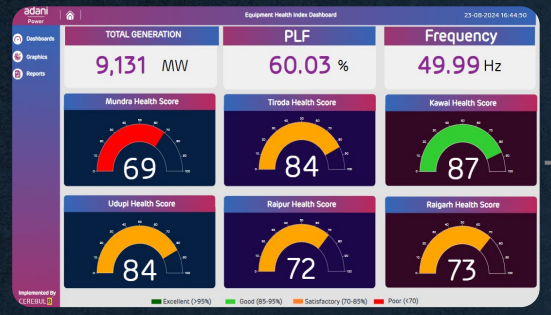


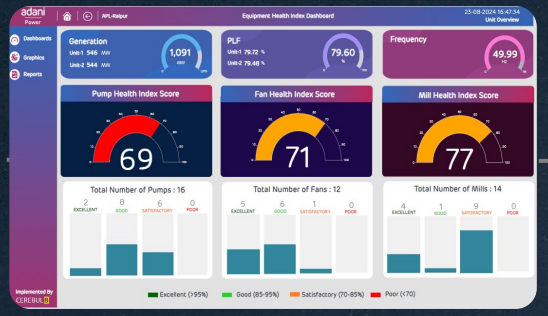
AHI Asset Health Index

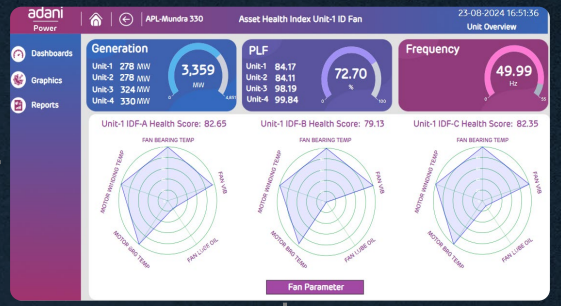
Equipment level

AHI Asset Health Index

Multi tier Scoring Index methodology



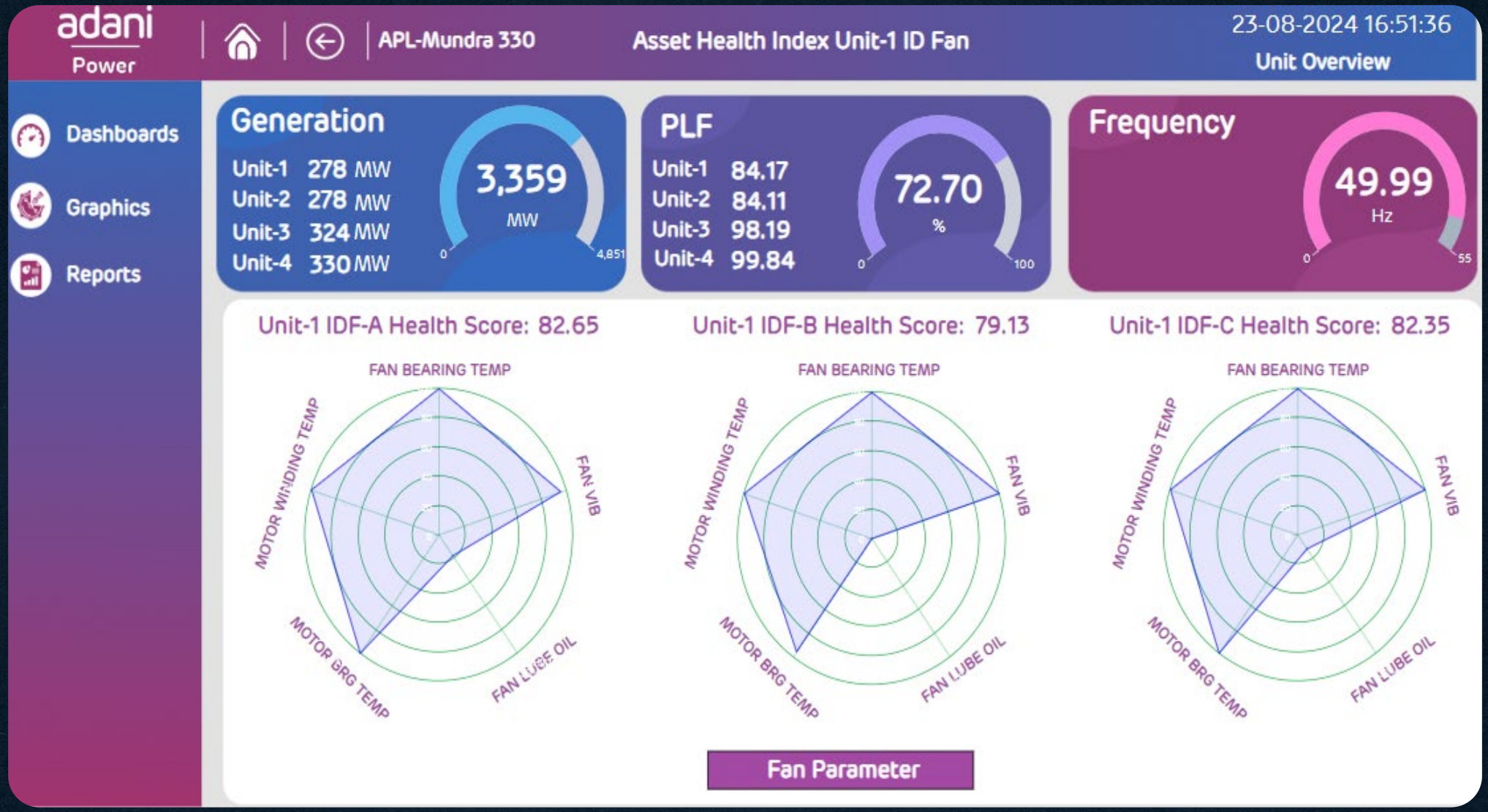




Sensor level
(Customized radar chart)

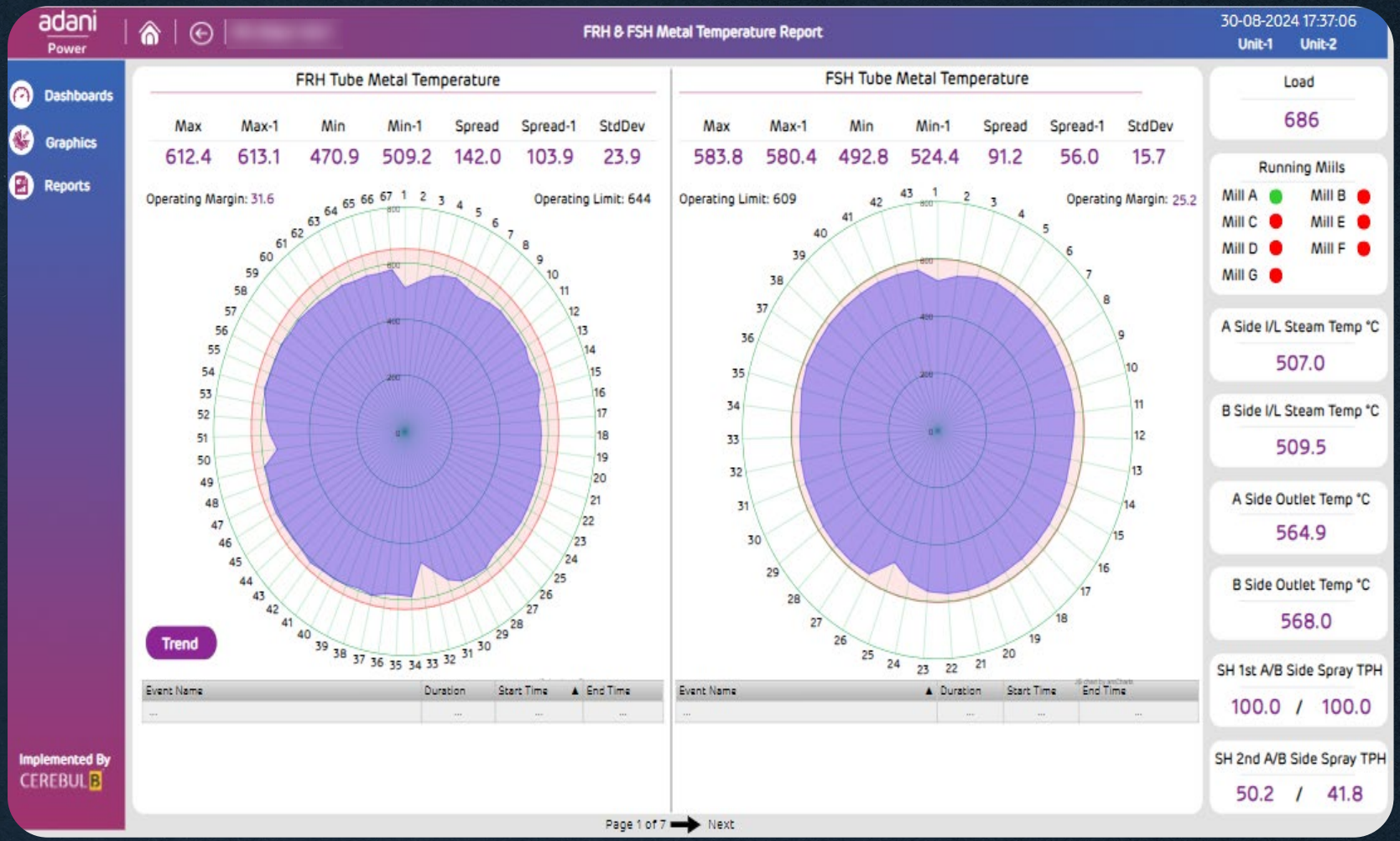
AHI Asset Health Index

Sensor level
(Customized radar chart)



Metal Excursion (XTool)

- ✓ Customized radar chart
- ✓ Tube metal temperature of each section is mapped to see the shift in pattern of metal temperature
- ✓ Event frame created for all temperature sensors
- ✓ Influencing parameter mapped for analysis of excursion pattern
- ✓ Max, Mean, Spread and standard deviation displayed



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Future Vision

01 Integrate AVEVA Predictive analytics [prism] on top of PI System for Asset performance management using AI/ML

02 Exploring Unified PI system for Adani Energy business portfolio

03 Benchmarking of new site integration on AVEVA PI Platform

04 Exception management through single window for all assets across APL

THERMAL ENERGY | INDIA

Adani Power optimizes operational costs with improved operational efficiency and reliability

Challenge

- Non-existence of a robust platform as One Stop Solution
- Robustness of Data Pipeline and its sanity
- Excel based tools for analysis & reporting
- Standalone application for business needs (SMS, MOT, APM etc.)
- Only Data, No insight. Resulting in delayed decision making
- Will to do but tied hands
- Competitiveness in the market. Every $ counts

Solution

- Deployed AVEVA™ PI System™ to streamline data collection, access, analysis and reporting across all 8 location with cloud based centralized server.
- Merged all external tools into single platform.
- Created decision dashboards through various use cases.

Results

- **Better Monitoring -> Better Control -> Better Decision Making -> Better Performance**
- **Improved operational efficiency**
- **Enhanced availability and reliability**
- **Optimized operational costs through reduced SHR via Merit Order Tool**
- **Reduction in carbon footprint (reduction in CO2 emissions)**

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Q & A

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