



Council of Enviro Excellence



5TH NATIONAL POWER-GEN ENERGY EFFICIENCY

SUMMIT AND AWARDS 2025

Enhancing Efficiency in Indian Thermal Power Plants

**SUSTAINABLE EFFICIENCY GAINS - MODERN
RETROFITTING APPROACHES FOR STEAM
TURBINES IN INDIA**

MR. SAURABH VERMA

Performance Monitoring

SKETWIN

5th National Power-Gen Energy Eff Summit & Award
23rd Mar 2026





Any Fleet Make



Performance Packed



Decarb



Locally Controlled

Product description

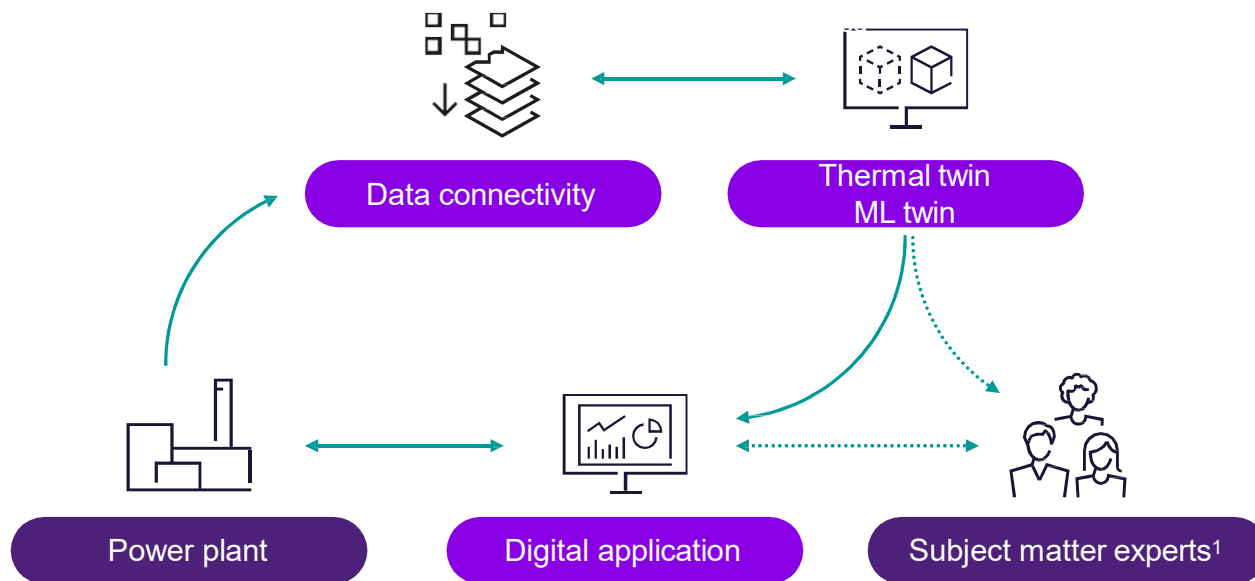
- Thermodynamic models ideal state plants performance “the digital thermal twin”.
- Deviation from the ideal state can be identified by customer or with help of Performance expert

Key Features

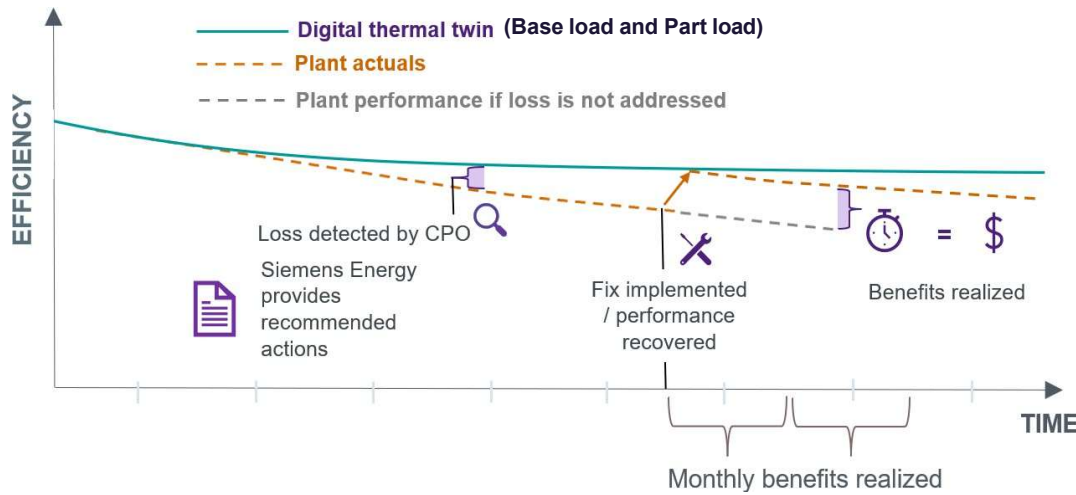
- Real time performance monitoring
- Real time financial impacts and optimize plant economics
- Power plant individual equipment degradation prediction for extended period of time
- Optimize your capex and opex budget
- Consolidated dashboard view on a user-friendly platform

We provide you with supplemental decision-making resources.

Performance Monitoring using best-in class digital thermal twin



Power plant digital twin create digital model for identifying the recoverable degradation



Enhance Plant Efficiency

- Base Load Efficiency
- Transient Efficiency

Power

- Power Output
- Power Saving

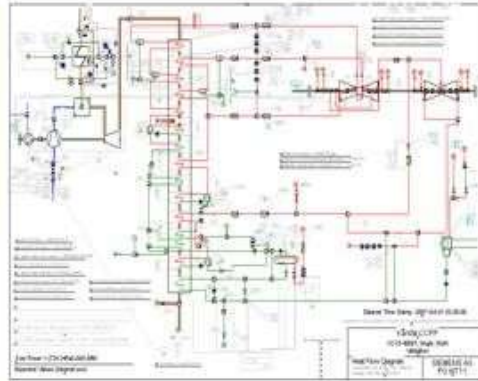
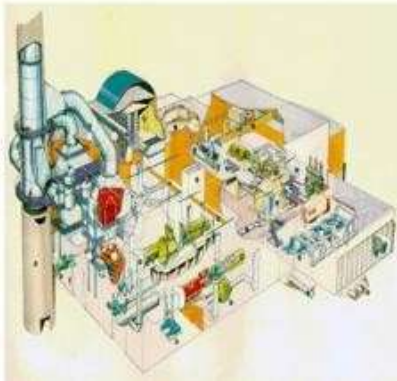
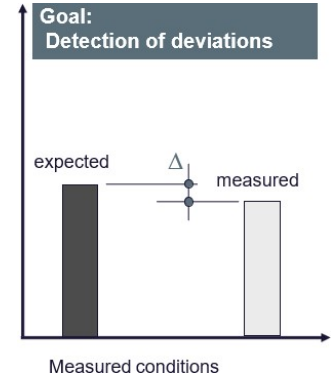
Sustainability

- Carbon Footprint
- Operational Emission

- Continuous monitoring and proactive service from our plant performance monitoring experts
- Detailed reports with actionable insights
- Periodic meetings with our performance monitoring experts

Digital Thermal Twin – Thermodynamic Framework

reality	model	mathematical abstraction
components like GT, ST, pumps, heating surfaces, ...	aggregates, represented by icons	f: set of nonlinear algebraic equations
fluid in connecting pipes or channels	fluid streams, represented by lines connecting the aggregates; nodes	x: degrees of freedom (= unknowns) of the equations, for each mass flow, enthalpy, pressure of the fluids



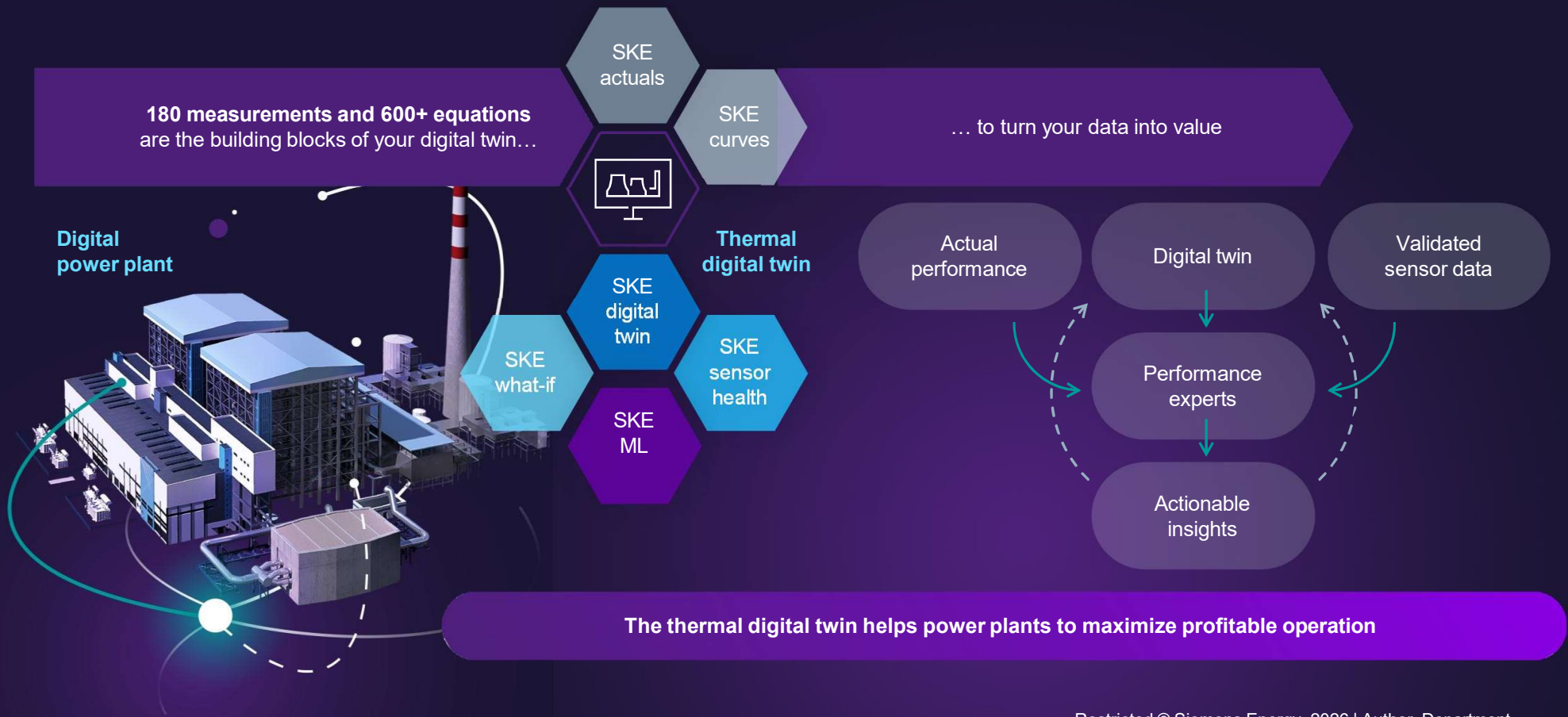
$$x = \begin{pmatrix} m_1 \\ \dot{h}_1 \\ \dots \\ p_{xx} \end{pmatrix}$$

$$f(x) = 0$$

Primary Objective:

- Physics based model created for all assets like Steam turbine, boiler, heaters, condenser etc.
- Models tuned with design data and validated with plant running data
- Generate the KPI for plan and equipment level such as expected vs calculated performance
- Showing the impact of each delta in MW loss and equivalent financial impact

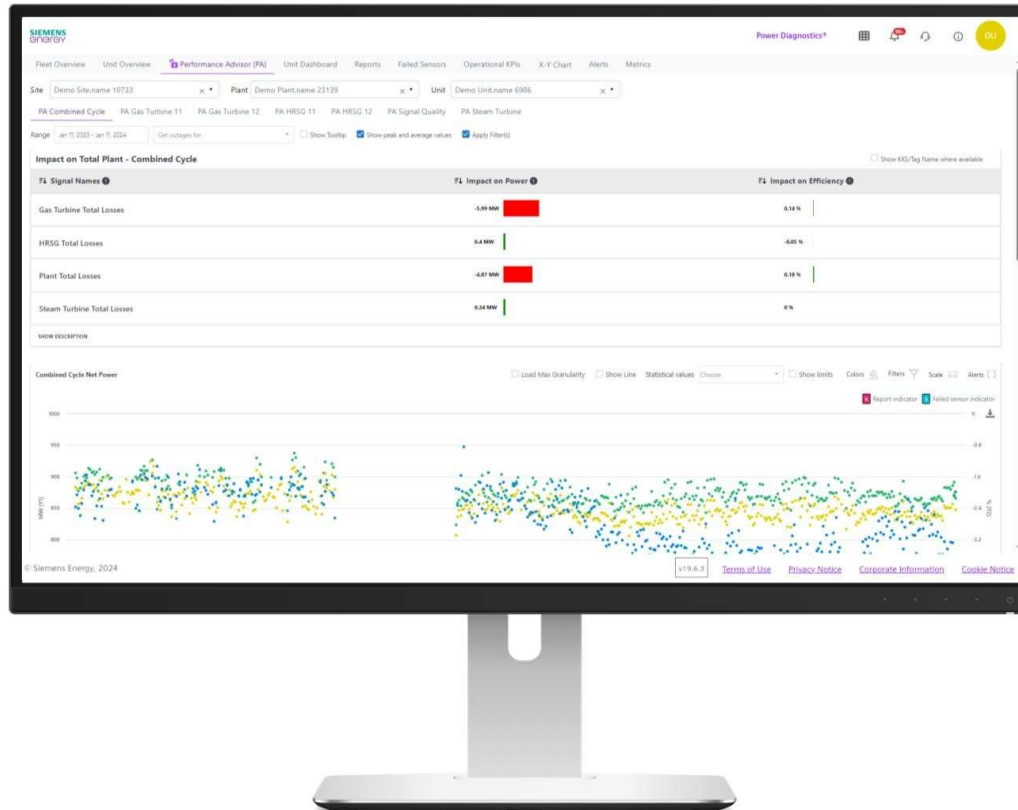
The thermal digital twin calculates differences between observed vs. expected values, turning your data into a decision-making input



You can observe and study the performance of your plant via our industry leading digital applications

✓ Compare actual vs. expected digital twin values for a quick overview of controllable losses

✓ Communicate effortlessly with our performance experts online and refer back to historical actions and outcomes



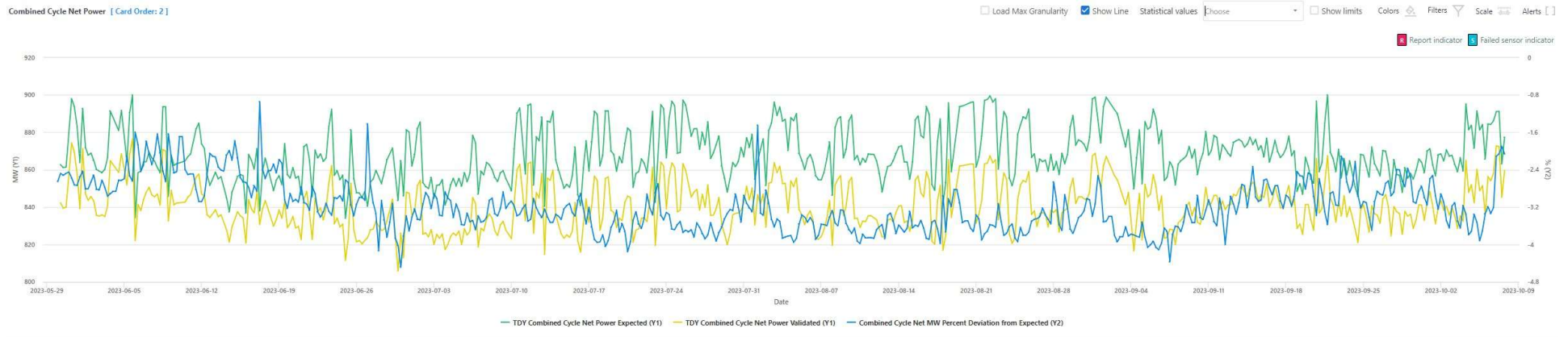
✓ Reconcile & validate sensor measurements according to VDI 2048*

✓ “What-if” calculations for:

- Sensitivity analysis for different parameters
- Load dispatch, e. g. for next day
- Determination of optimum operational conditions

* VDI 2048 German Guideline (publicly available)

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SHOW DESCRIPTION



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Reconcile & validate sensor measurements according to VDI 2048*



Communicate effortlessly with our performance experts online and refer back to historical actions and outcomes



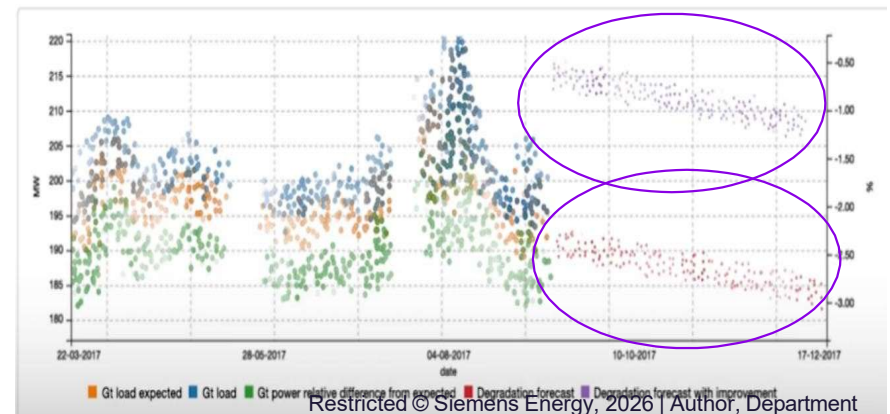
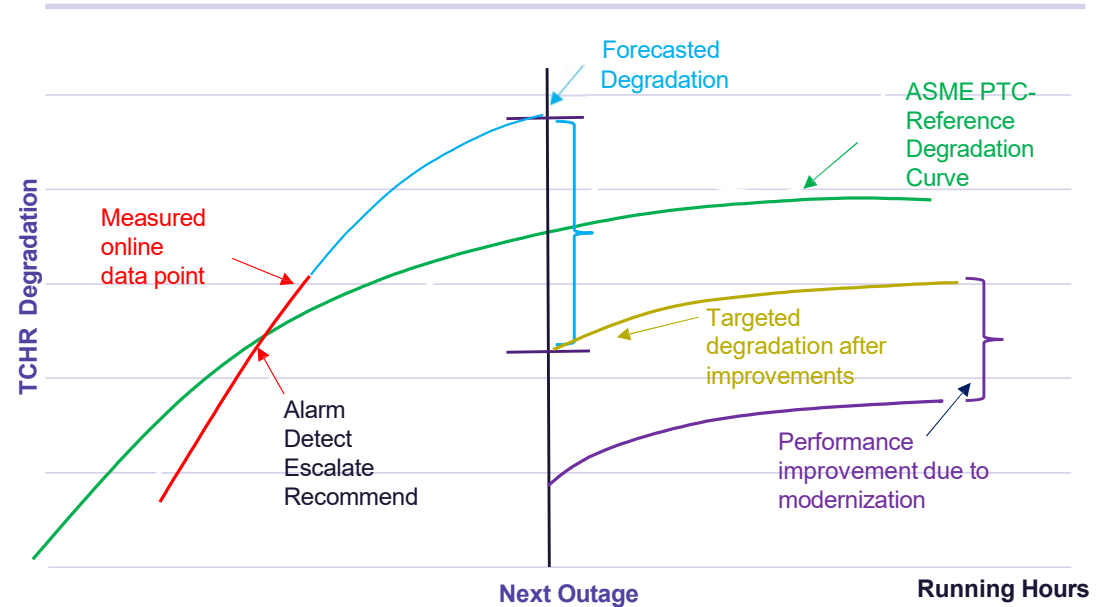
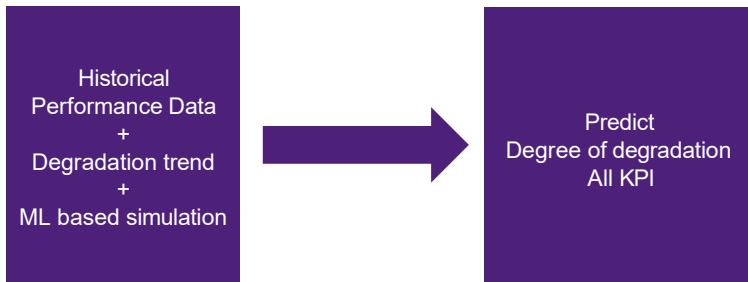
“What-if” calculations for:

- Sensitivity analysis for different parameters
- Load dispatch, e. g. for next day
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* VDI 2048 German Guideline (publicly available)

ML Based Plant & Equipment Degradation

- Early identification, evaluation and timely action can help plant to continuously maintain and optimize performance.
- Improved maintenance planning with long-term monitoring of component deterioration
- Actionable early time prediction to fix the equipment (Maintenance scope, Resource allocation, hardware procurement)
- Cost saving on running equipment on improved performance



Analytic tools to determine root cause

Various expert displays



Tables

Objektname	Bezeichnung	Einheit
3LA500FC31	Mot. 1 STR PPE A/STR B	uA
3LA500FC32	Mot. 2 STR PPE A/STR B	uA
3LA500FC33	Mot. 3 STR PPE A/STR B	uA
3LA500FC34	Mot. 4 STR PPE A/STR B	uA
3LA500FC35	Mot. 5 STR PPE A/STR B	uA
3LA500FC36	Mot. 6 STR PPE A/STR B	uA
3LA500FC37	Mot. 7 STR PPE A/STR B	uA
3LA500FC38	Mot. 8 STR PPE A/STR B	uA
3LA500FC39	Mot. 9 STR PPE A/STR B	uA
3LA500FC40	Mot. 10 STR PPE A/STR B	uA
3LA500FC41	Mot. 11 STR PPE A/STR B	uA
3LA500FC42	Mot. 12 STR PPE A/STR B	uA
3LA500FC43	Mot. 13 STR PPE A/STR B	uA
3LA500FC44	Mot. 14 STR PPE A/STR B	uA
3LA500FC45	Mot. 15 STR PPE A/STR B	uA
3LA500FC46	Mot. 16 STR PPE A/STR B	uA
3LA500FC47	Mot. 17 STR PPE A/STR B	uA
3LA500FC48	Mot. 18 STR PPE A/STR B	uA
3LA500FC49	Mot. 19 STR PPE A/STR B	uA
3LA500FC50	Mot. 20 STR PPE A/STR B	uA

x-y plot

Instruments Error

Instrument	Value	Unit
Black-Box Temperature 1.1	1943.30	°C
Black-Box Temperature 1.2	26.18	°C
Black-Box Temperature 1.3	22.24	°C
Black-Box Temperature 1.4	22.33	°C
Black-Box Temperature 1.5	1134.50	°C
Black-Box Temperature 1.6	1144.71	°C
Black-Box Temperature 1.7	57.35	°C
Black-Box Temperature 1.8	1142.85	°C
Black-Box Temperature 1.9	20.99	°C

Overviews

Trends

Reports

Special diagrams

- Turbine Operation total
- Details
- Trends

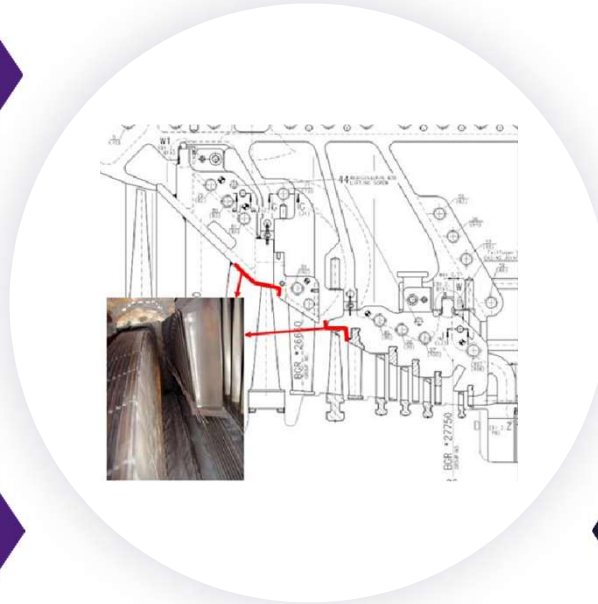
Use Case 1: Erosion and corrosion prediction

Self-managed findings

Realtime calculation of erosion rates of susceptible areas with operating parameters

Predict failure before they actually occur

Better: Avoidance of such operation regime suggested to customers



Customer voice:

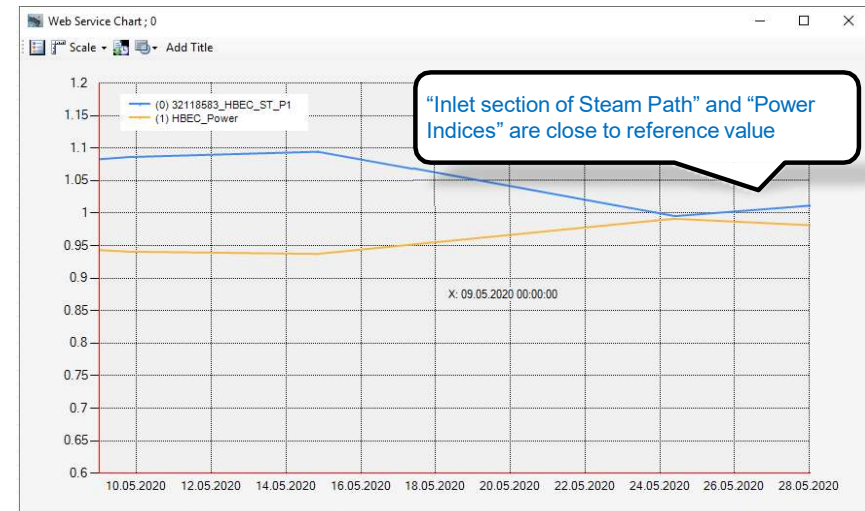
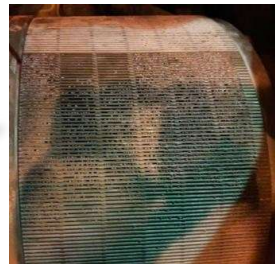
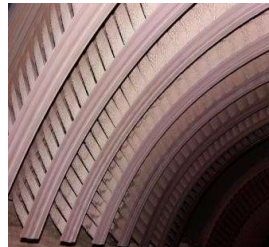
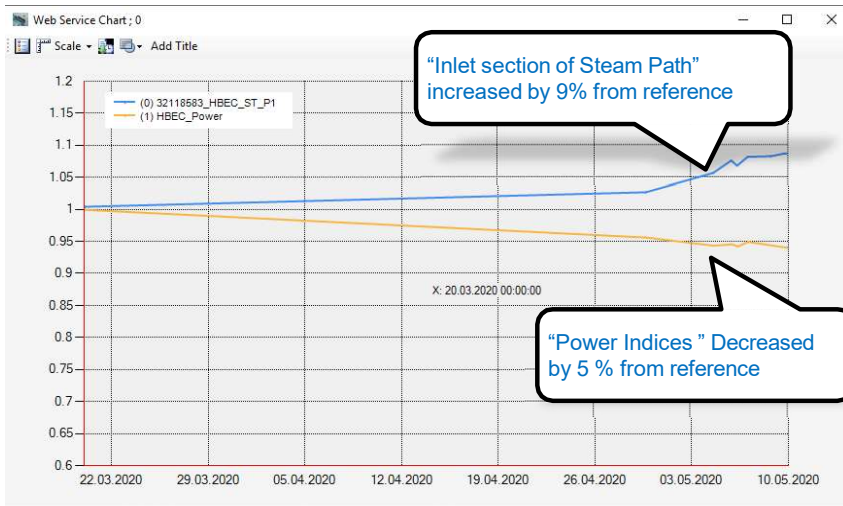
Indian supercritical power plant customer has been advised to operate at better vacuum condition without fear for erosion of blades.

Improved efficiency by 1%

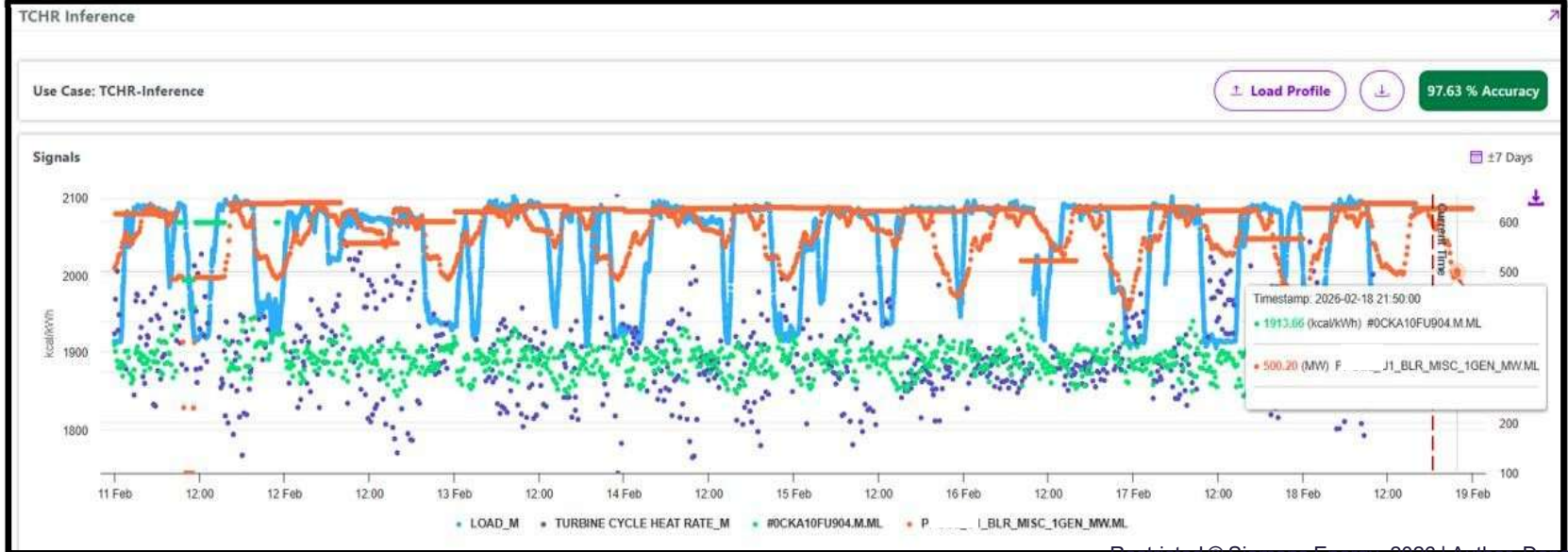
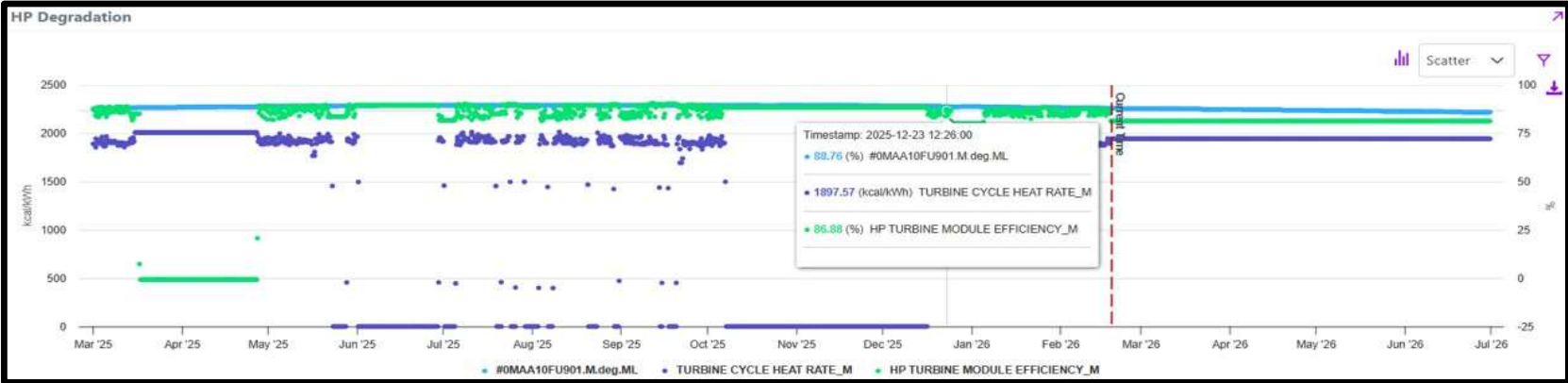
Getting best from your existing assets

Use case 2: Early detection of Deposits

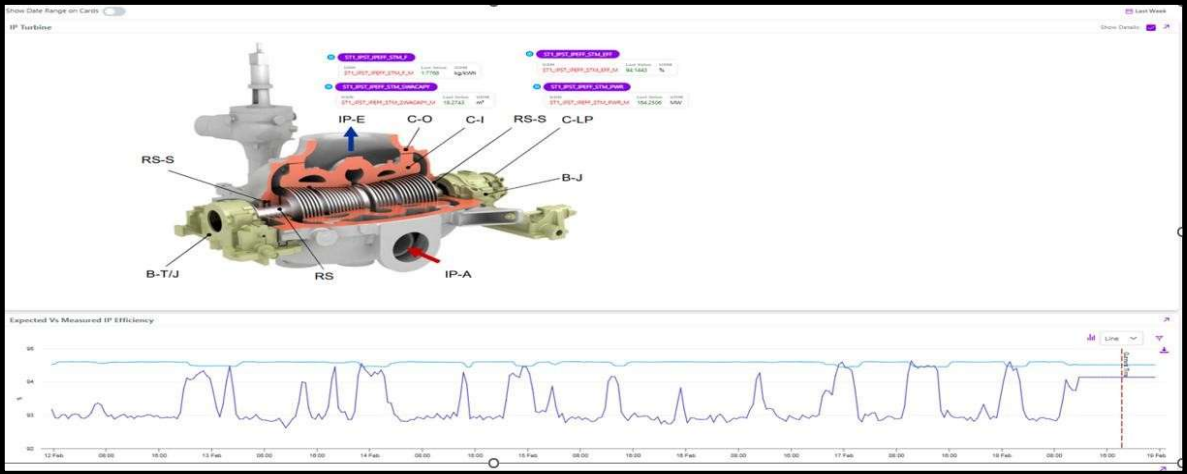
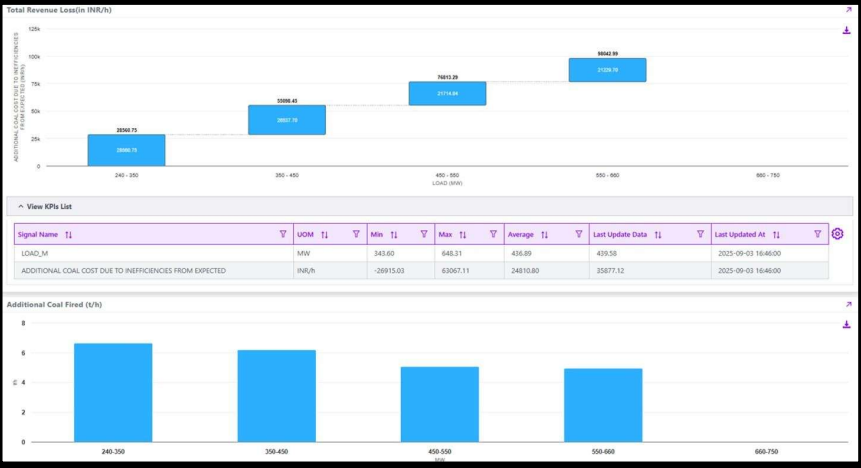
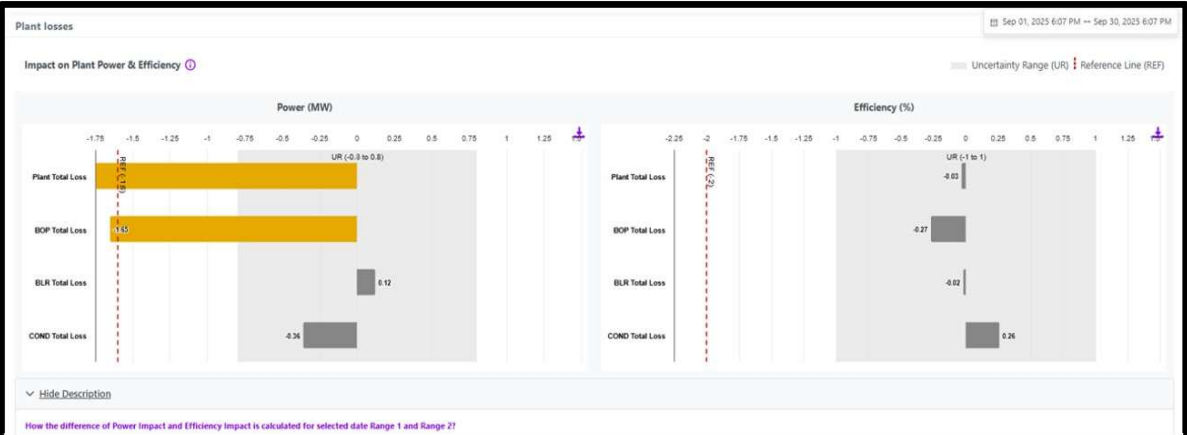
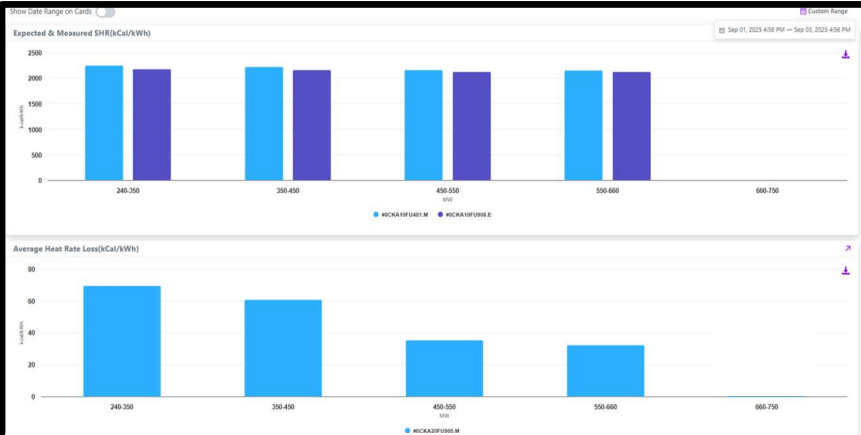
Self-managed findings



SKETWIN ML KPI



SKETWIN- PERFORMANCE KPI



Performance Monitoring

model depth description compared with competitors

Usually offered by

Competitors

Competitors

Siemens Energy

Plant performance calculations based on:

Actuals only

Curves only

Thermal digital twin

Model	no model, based on thermodynamic equations only	simple model, based on design curves only	proprietary thermodynamic model based on customer specific design data
Outputs	Measured (.m)	<ul style="list-style-type: none"> Measured (.m) Expected (.e) Deviation from expected (DFE) 	<ul style="list-style-type: none"> Measured (.m) Expected (.e) Deviation from expected (DFE)
Great for	<ul style="list-style-type: none"> Performance Monitoring – Base load Performance Losses – Not great Only step changes will become visible, which could be caused by damages or changes in the operation.- 	<ul style="list-style-type: none"> Performance Monitoring :within base load operation only Performance Losses :major-component level only. Only some type of performance losses can be identified. 	<ul style="list-style-type: none"> Performance monitoring : within base load and part load operation Performance losses : Location of performance losses, sub-component and sensor level. All kind of performance losses become visible.

Optional add-ons

Sensor health check*	✗	✗	(✓)
What-if tool	✗	✗	(✓)
Machine Learning	✗	✗	(✓)

* Data reconciliation according to VDI 2048

Thank You!

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