
AVEVAWORLD
PARIS

AVEVA’s Predictive Analytics helps maintain reliable, low carbon power generation

Thomas Walker
Samuel Plumb
Dr David Smith

drax

(Our purpose (16:9) on Vimeo)

Speaker Introductions

Thomas Walker

Tom is a Condition Based Maintenance Engineer at Drax Group within power generation at Drax Power Plant. He has been with Drax for almost 2 years and previous to that has 10 years experience as a Reliability Engineer across various industries specializing in CBM technologies, maintenances strategies, asset criticality and Root Cause Analysis.

At Drax his responsibilities include managing predictive analytics on site with over 500 models built and expanding to the wider areas of the group such as hydro plants. He is an SME in CBM technologies and is also heavily involved in the overall asset management strategy as Drax looks to move more to a predictive and risk-based strategy.

Samuel Plumb

Sam is a development Engineer in the Condition Based Maintenance team. He started working for Drax 6 years ago as a Control and Instrument Technician as an Apprentice. After his 4 year apprenticeship he spent a year on shift with operations before becoming fully embedded in the CBM team at Drax.

Daily Responsibilities include looking after the predictive analytics software and assisting and leading projects such as installing monitoring equipment. He also assists and leads Root Cause Analysis investigations where required.

Dr David Smith

David is Head of AI Product Innovation, AVEVA. He is a Chartered Mechanical Engineer and holds a Ph.D. in Fluid Mechanics from Imperial College London. Spending the first half of his career in industry mainly with OEM and EPC companies, he lead design, development, and commissioning of Power Plant processes and combustion systems.

Moving to AVEVA, he is responsible for AI Product Innovation in AVEVA with a particular focus on AI infused solutions for asset management and autonomous operations.

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Background

Drax Group

Background

Drax Group (Our purpose (16:9) on Vimeo)

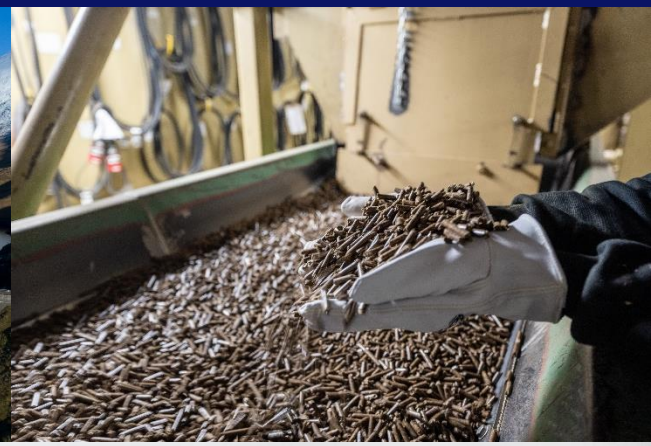
Enabling a zero carbon, lower cost energy future

- Drax Group are a renewable energy leader engaged in renewable power generation, the production of sustainable biomass and the sale of renewable electricity to businesses.

- Drax owns and operates a portfolio of renewable electricity generation assets in England and Scotland. The assets include the UK's largest power station, based at Selby, North Yorkshire, which supplies five percent of the country's electricity needs and has been converted to use sustainable biomass instead of coal. The use of biomass pellets reduces our carbon emissions by 80% compared to coal .

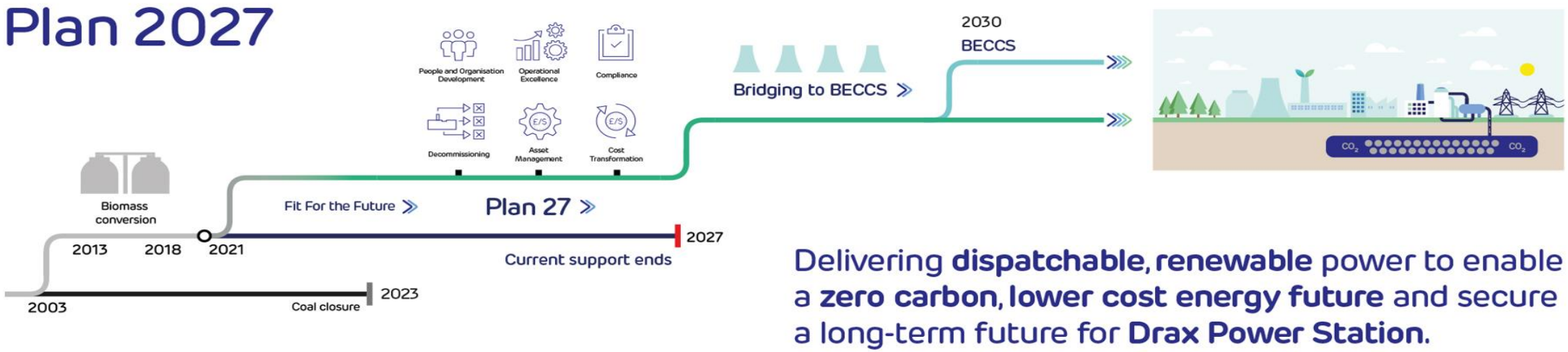
- Drax is the second largest producer of sustainable biomass globally, and the UK's largest source of renewable power by output, providing a secure, reliable and flexible source of renewable energy to support more intermittent renewables, such as wind and solar.

- Drax Power Station has evolved considerably since construction began in the 1960s and this year celebrates it's 50th year since it began generating electricity. The age of the power station presents various challenges, with some assets still in place from when the site began operations in 1974.



Future monitoring & post 2027

- Remote monitoring contract ending meant that a number of assets would no longer be monitored, increasing the likelihood of unplanned failures.
- One of the big challenges are plans to install Bioenergy with Carbon Capture and Storage (BECCS) technology at Drax Power Station by 2030, which will make Drax carbon negative.
- With more and more renewable energy such as wind and solar becoming part of the UK's energy mix. Drax's operations have shifted to become a more flexible operator, to support the national grid during peak times and when the wind doesn't blow, or the sun doesn't shine.
- Like any large power station, Drax faces the challenge of skills and knowledge gaps when people leave or retire.
- Goal – Adapt the maintenance strategy. Move towards predictive maintenance and a risk-based strategy. Moving away from time based and breakdown/reactive maintenance.



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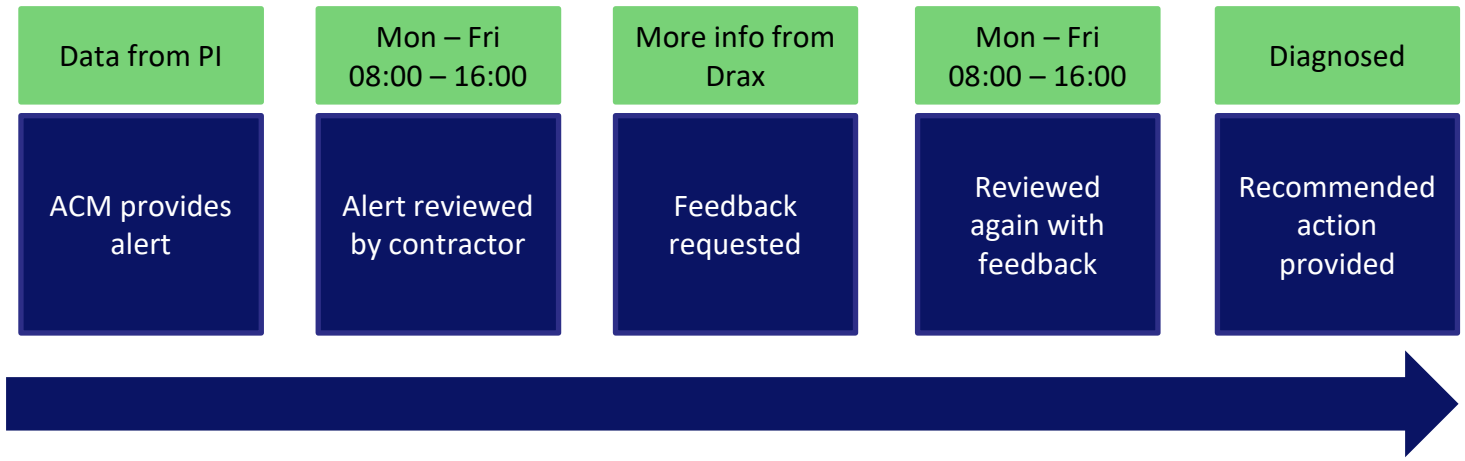
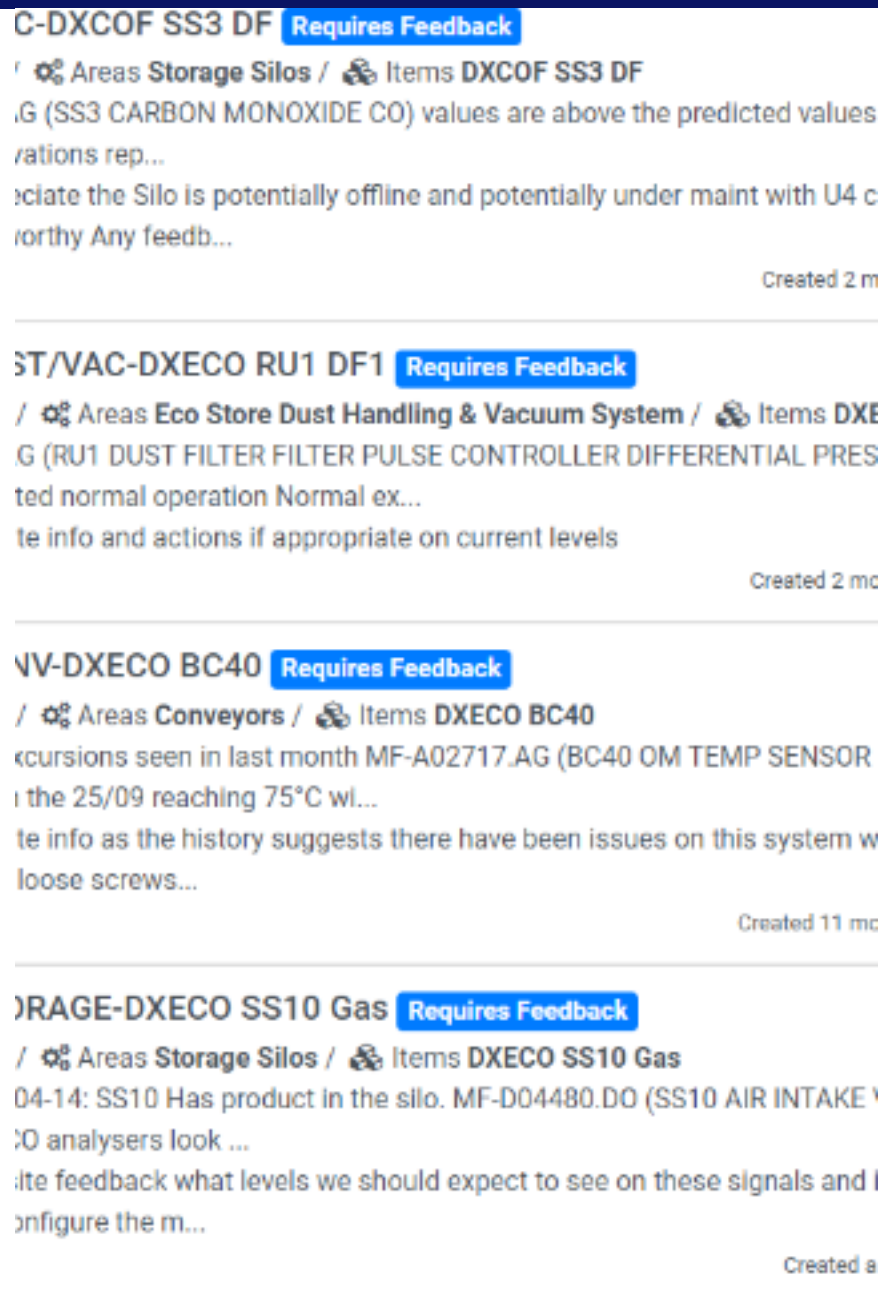
Introduction

Drax’s predictive analytics

Drax predictive analytics prior to AVEVA

- Drax Power Station had a three-year contract with an external contractor from 2019 to 2022 to implement Advanced Condition Monitoring system on the Eco Store, Units 1, 2, 3, 4 and common services. The monitoring service served Drax well but was being withdrawn after the contract.
- The system generated alerts when tags strayed from normal behavior, these were reviewed by the contractor to weed out nuisance alerts before broadcasting valid alerts on a Predictive Maintenance Hub (PMH). The service operated on a Monday to Friday normal working day basis because it was intended to give advanced warning of asset deterioration before normal operating limits are exceeded.
- As of December 2022, the contractor withdrew their Advanced Condition Monitoring services and support for Drax Power Plant.





Disadvantages & Opportunities for improvement

Disadvantages

- Monitoring was not round the clock and risks were present during weekends and outside of normal daily work hours.
- Alerts raised heavily dependent on site feedback.
- Lack of proximity creates a delay
- No sight on exactly what is being monitored or how the model works
- Lack of ownership and drive on alerts

Opportunities

- Ensure monitoring 24/7
- Reduces delays in the process by ensuring feedback is provided asap
- Improve confidence in the alerts raised
- Drive ownership of alerts
- SME knowledge input into the models

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Drax & AVEVA Collaboration

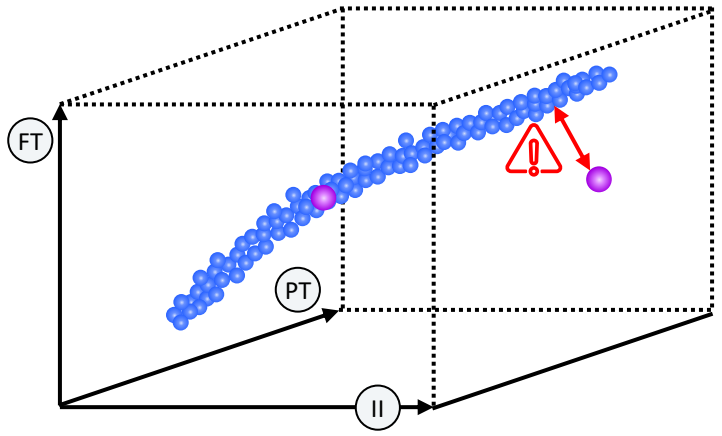
Drax Group

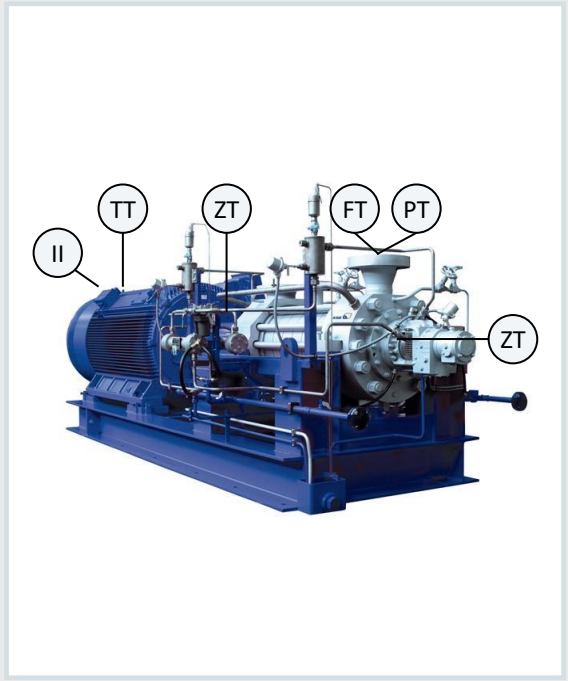
24 October 2024

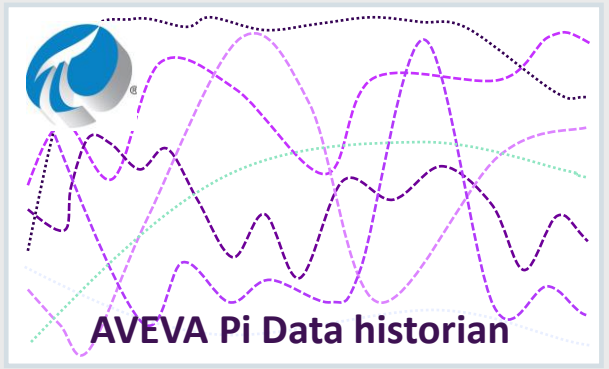
AVEVA Predictive Analytics

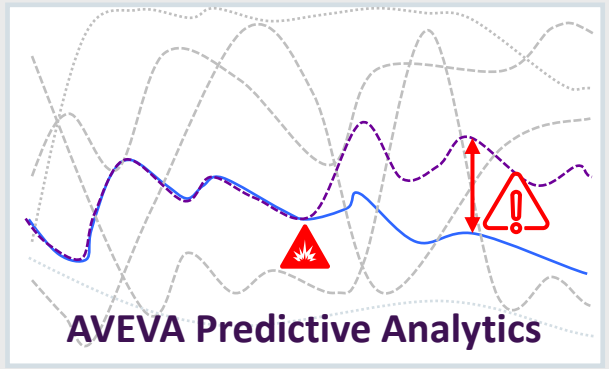
AI Driven analytics and risk mitigation

- 1000s of IoT sensors monitoring temperatures, pressure, flows, vibrations
- Traditional univariate integrity limits protect plant from catastrophic damage, but equipment degradation remains hidden
- AVEVA™ Predictive Analytics harnesses machine learning to continuously monitor critical asset behavior in real time and provide early warning of abnormal behavior









AVEVA Predictive Analytics

AI Driven analytics and risk mitigation

- Monitor health in real time – early identification of anomalies via anomaly index and drill-down to contributing signals
- Rank and diagnose faults based on anomaly deviation signature
- Obtain prescriptive guidance for remediation
- Forecast and track burndown of time until failure

Case management

First principles

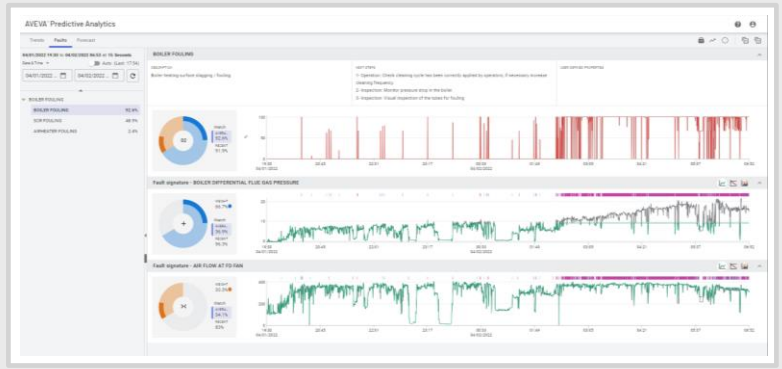
Transient analysis

AVEVA™ PI System™ Integration

Custom algorithms

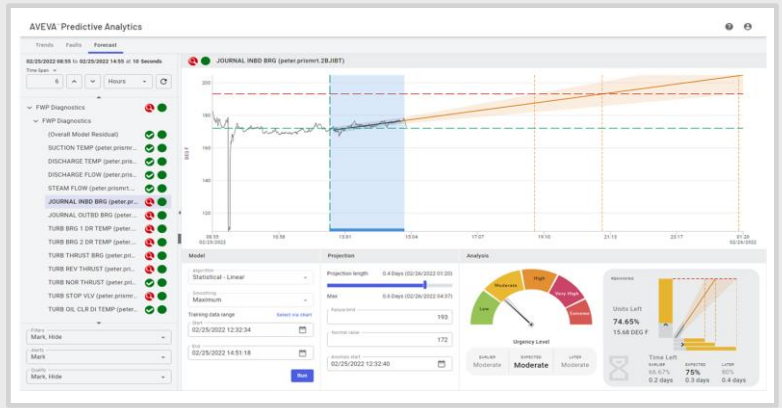
Anomaly index

Sensor contributions



Fault diagnostics

Prescriptive actions



Forecast

Implementation

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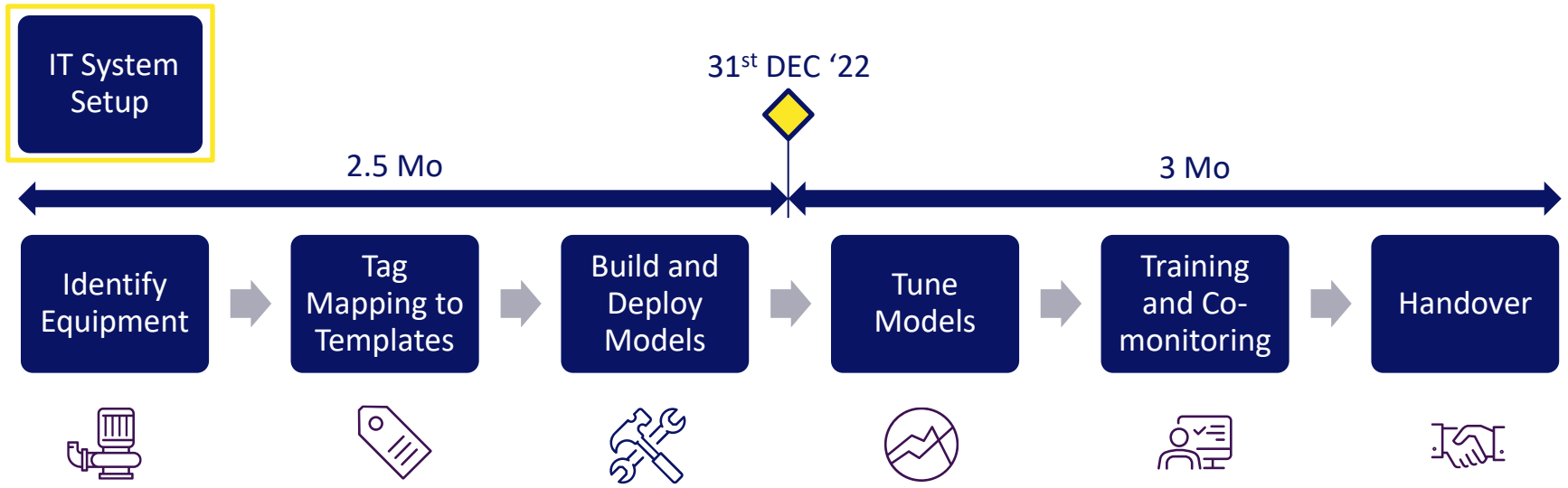
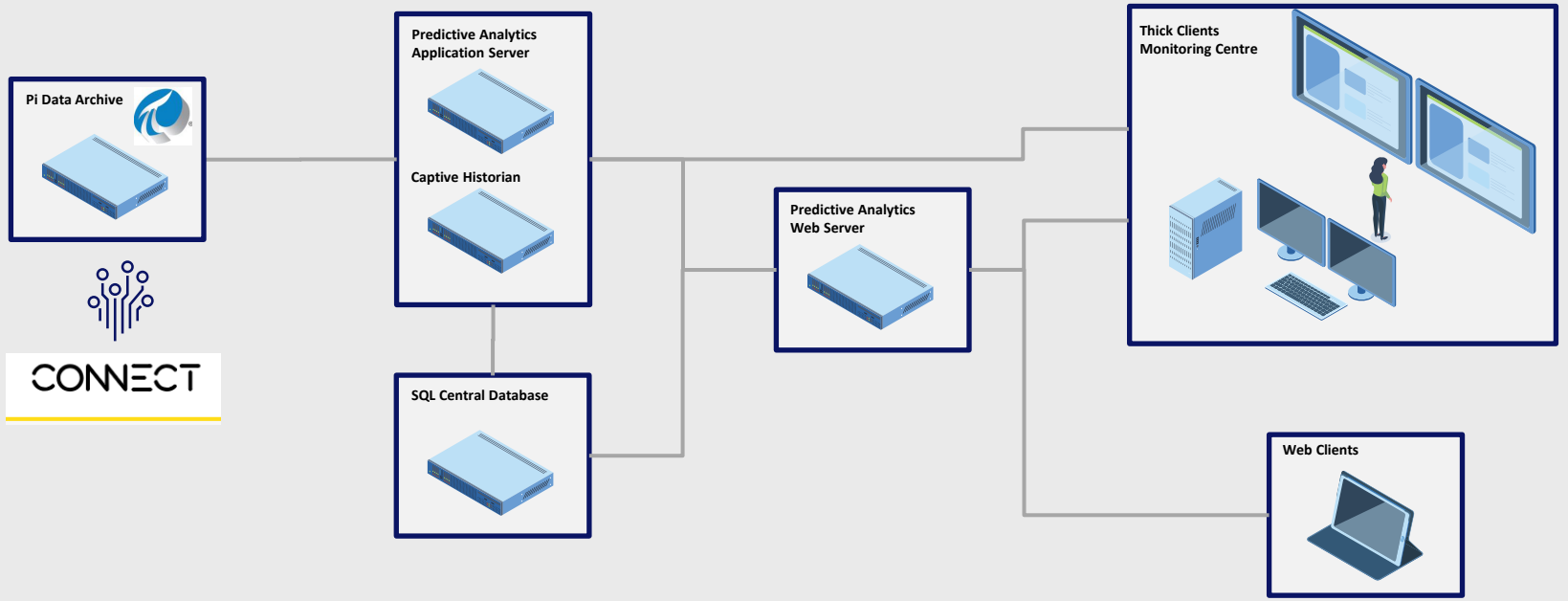
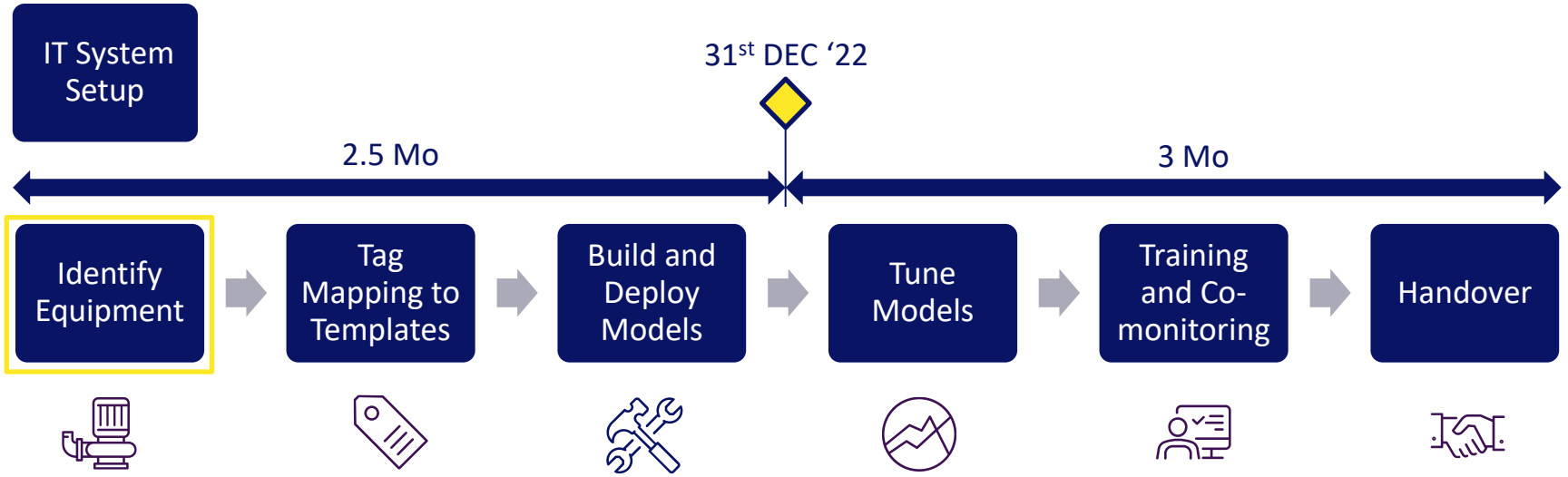




Implementation



STEAM TURBINE: Performance, Mechanical, Gland Steam

GENERATOR: Mechanical, Stator Cooling, Hydrogen, Oil Seals

TRANSFORMERS: Thermal

PA, FD, ID, BOFA Fans: Process, Mechanical, Motor Thermal

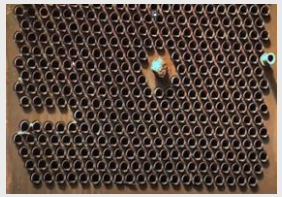
AIRHEATERS: Process, Mechanical

BIOMASS FEEDERS / MILLS: Process, Mechanical

BOILERS: SH / RH Process, Tube Leak, Fouling

FEED PUMPS: Process, Mechanical, Turbine

CONDENSATE PUMPS: Process, Mechanical, Motor



CONDENSER: Process

FW HEATERS: Process

BIOMASS STORE & FUEL HANDLING

Implementation

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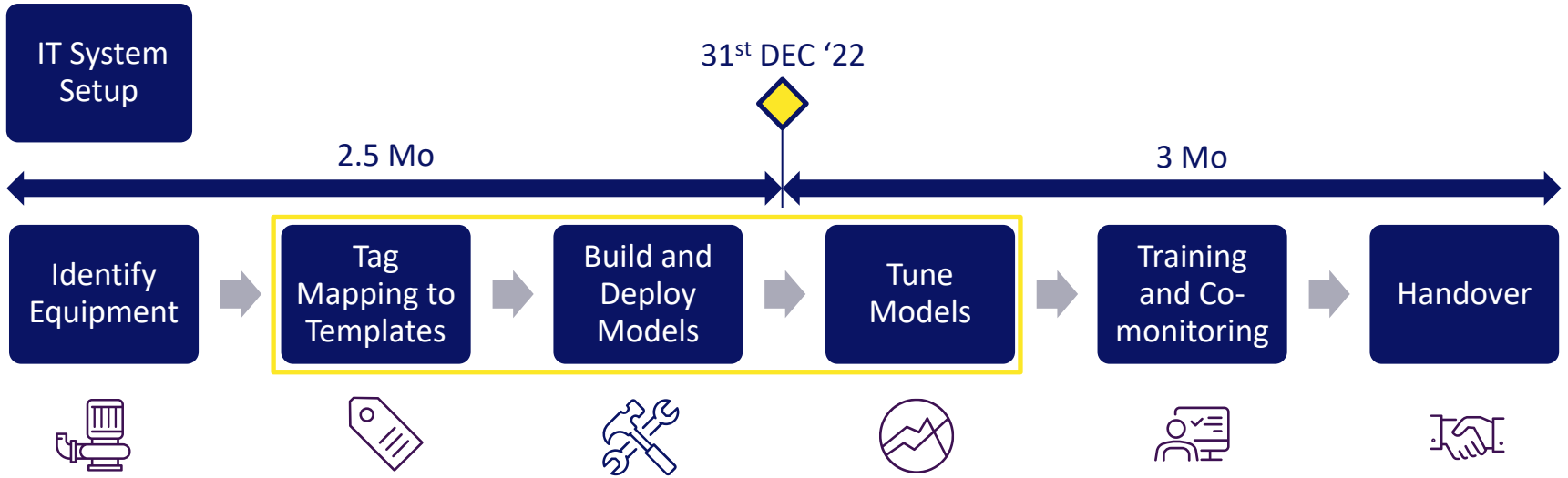
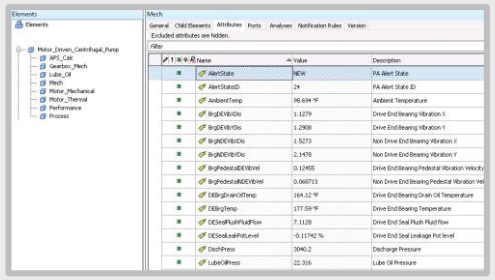
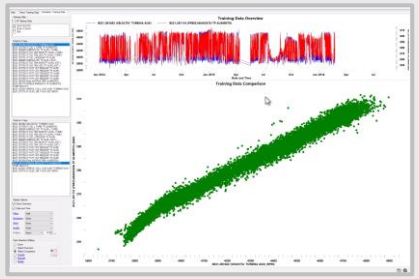




AVEVA Pi System

AVEVA Predictive Analytics Templates

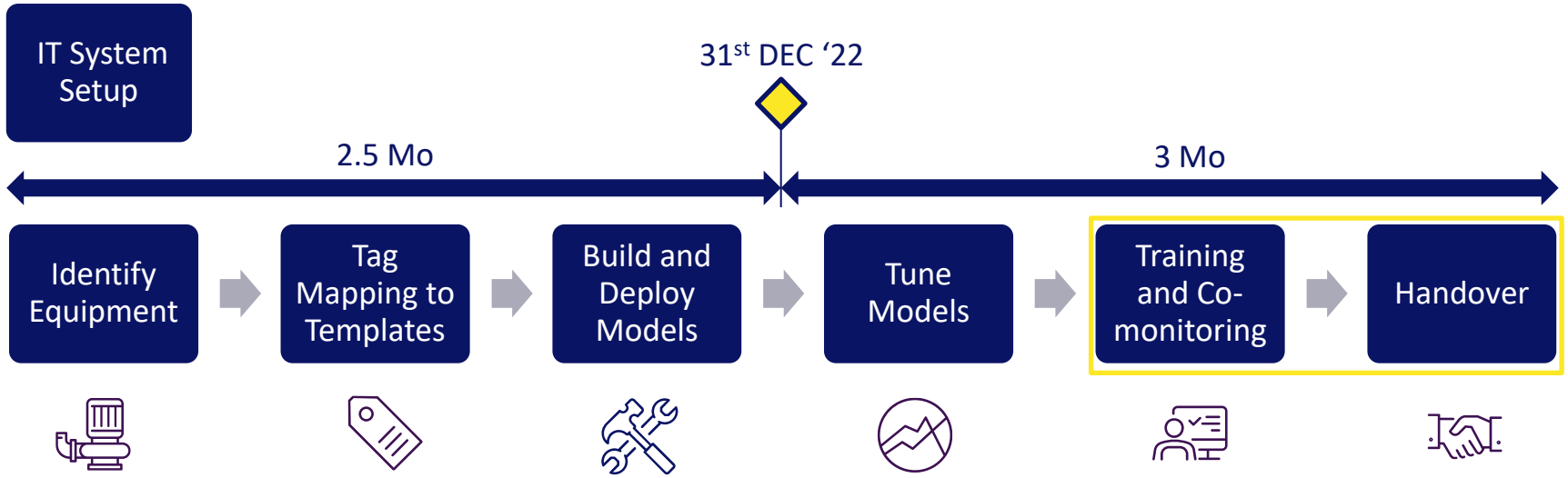


AVEVA Predictive Analytics Model Building

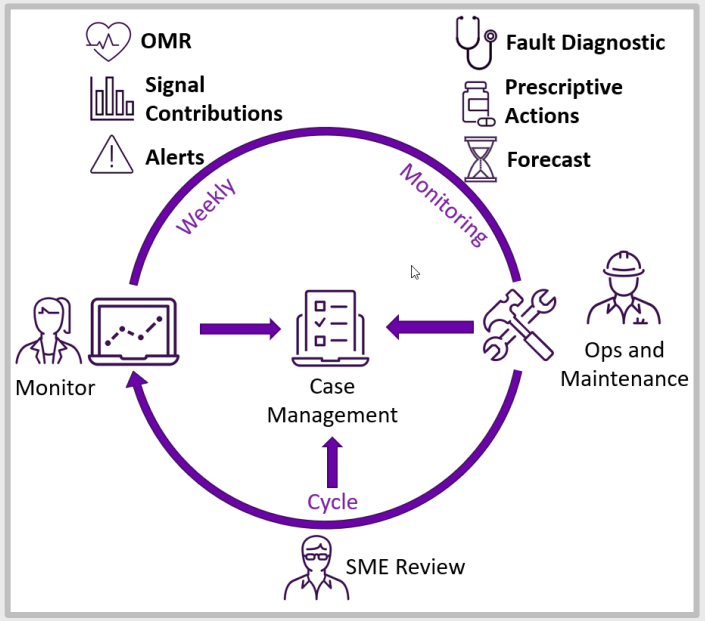
AVEVA Predictive Analytics Monitoring

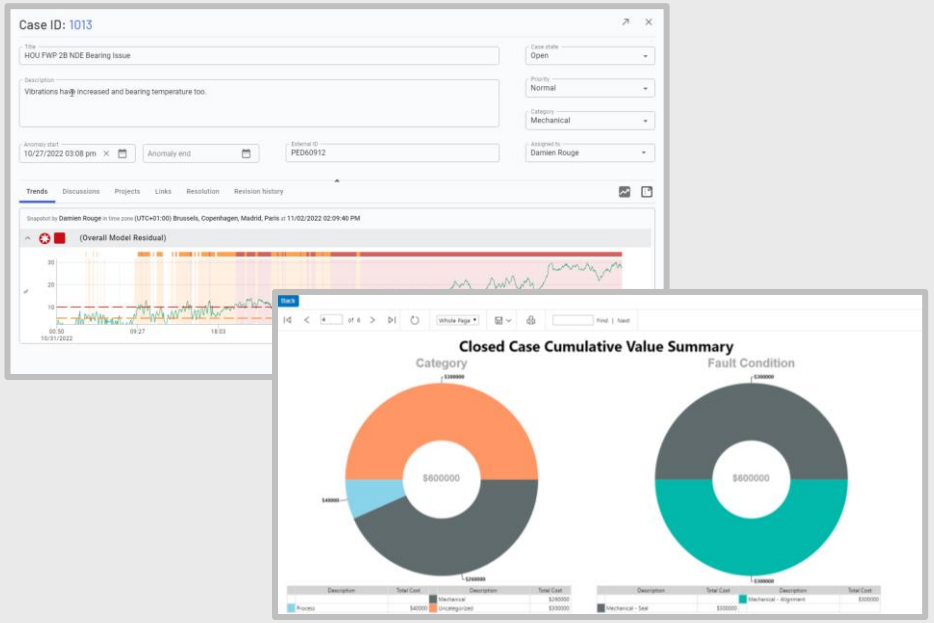
452 models comprising > 6000 Pi Tags

Implementation



- 3 Days classroom training for super-users
- 3 Months co-monitoring and handover
- Weekly co-monitoring meetings
- Further training on advance features





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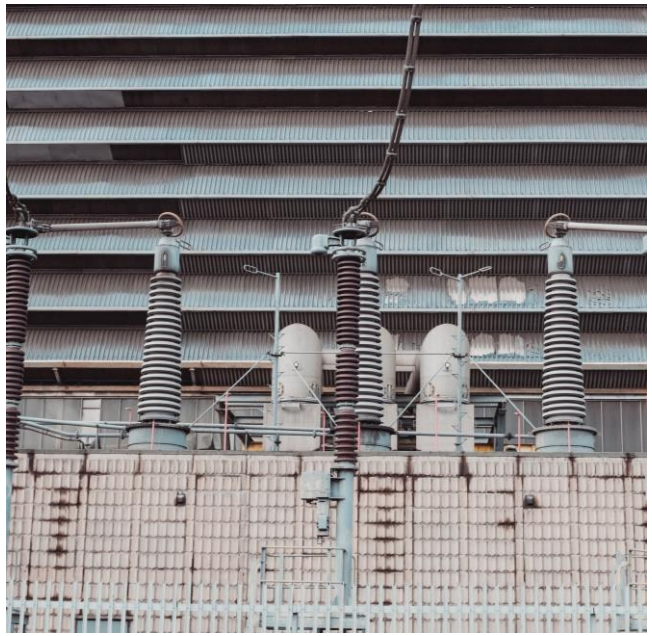
Early Successes

Unknown issues

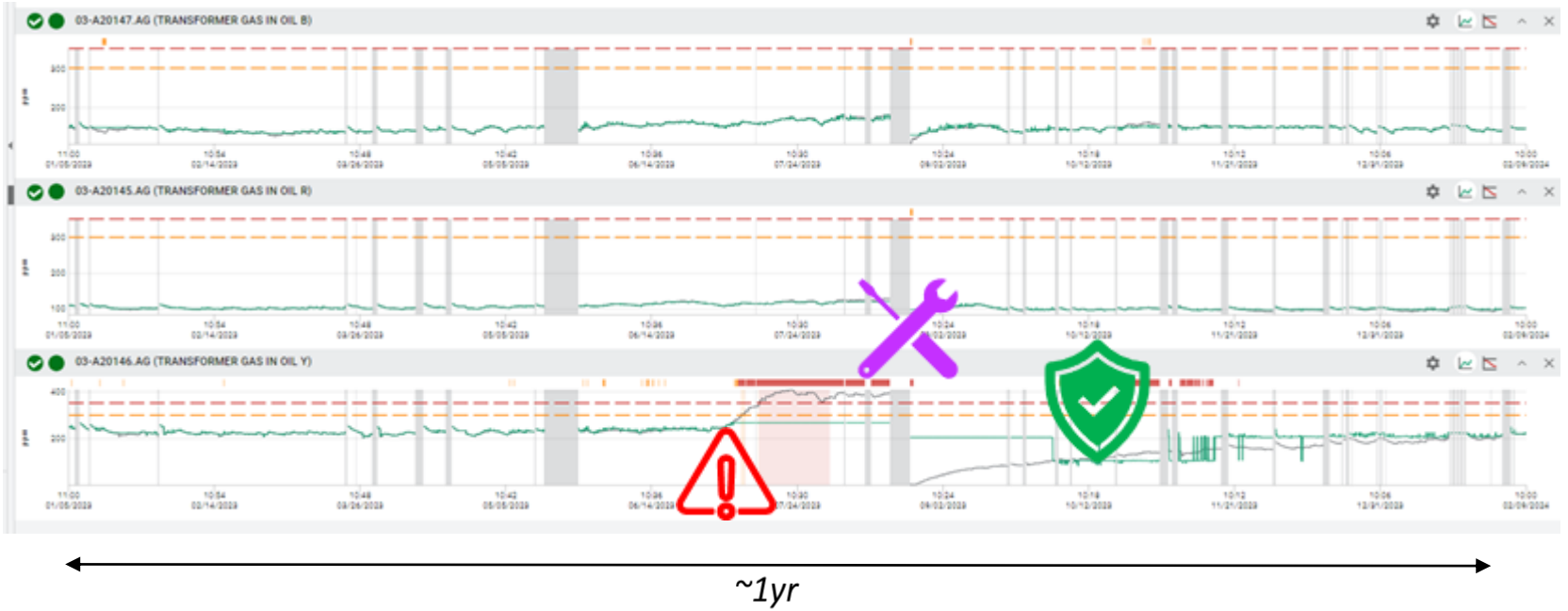
Success Examples – Early Intervention

Generator Transformer

Rapid gas in oil increase



- Generator transformer gas in oil suddenly increased; detected before scheduled oil sampling was due
- Tap positions restricted and 5 day outage to de-gas oil to enable continued operation until next outage
- An identical transformer had previously failed due to similar issues which resulted in a 4 week unplanned outage **(£1.5 million loss, best case)**



Turbine Generator

Bearing vibration on return to service

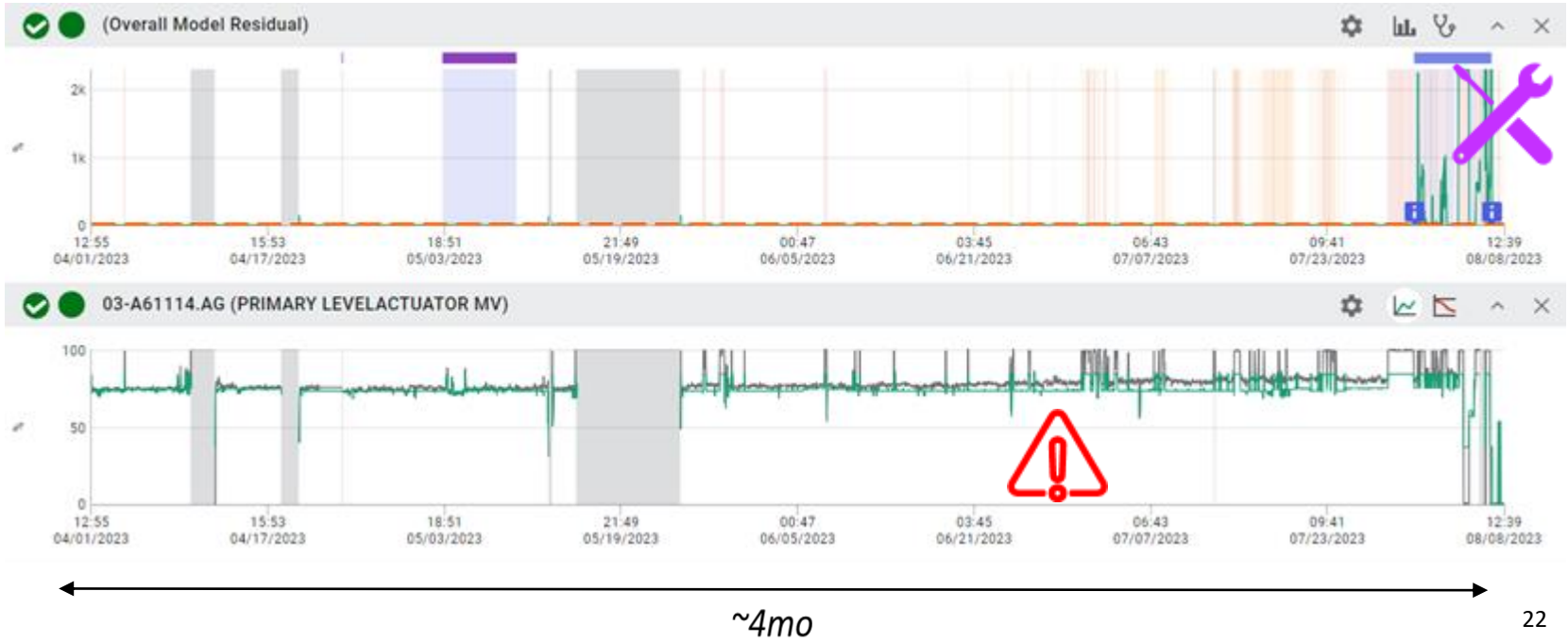
- Following major outage turbine generator returned to service with vibration issues on one of the bearings
- Found to be out of balance
- A trim balance was performed which resolved the issue
- Failure would result in full unit loss which is could be **upwards of £1 million per day depending on price**

~10mo

Feed water heater control valve

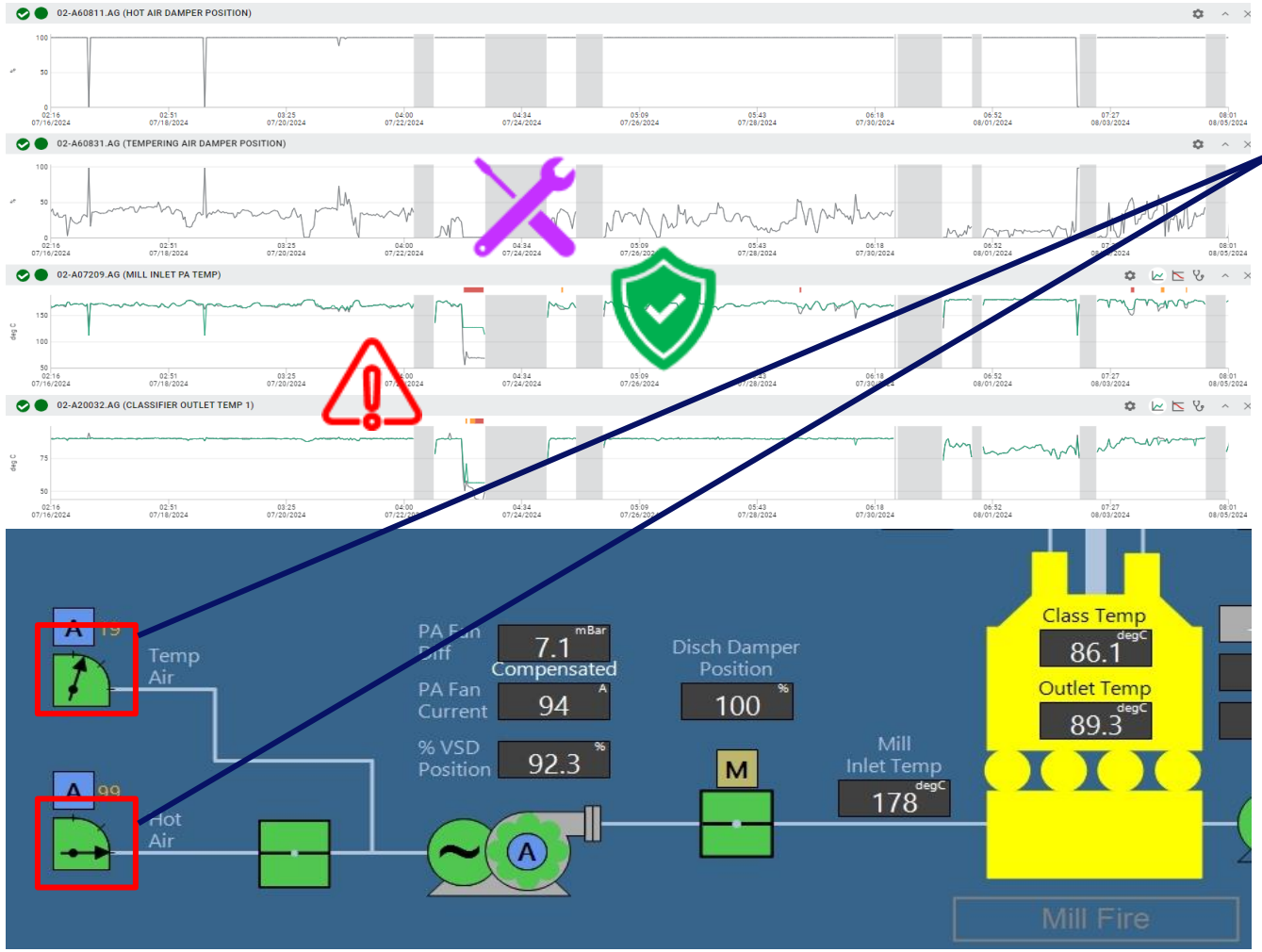
Tube leak hidden by control valve

- A feed-water heater control valve was gradually opening further to maintain the heater level
- A tube leak was diagnosed and a repair was executed on-load with the feed system isolated
- ~ **£3K a day** depending on how bad the tube leak is



Tempering Air Damper

Damper linkage sheared

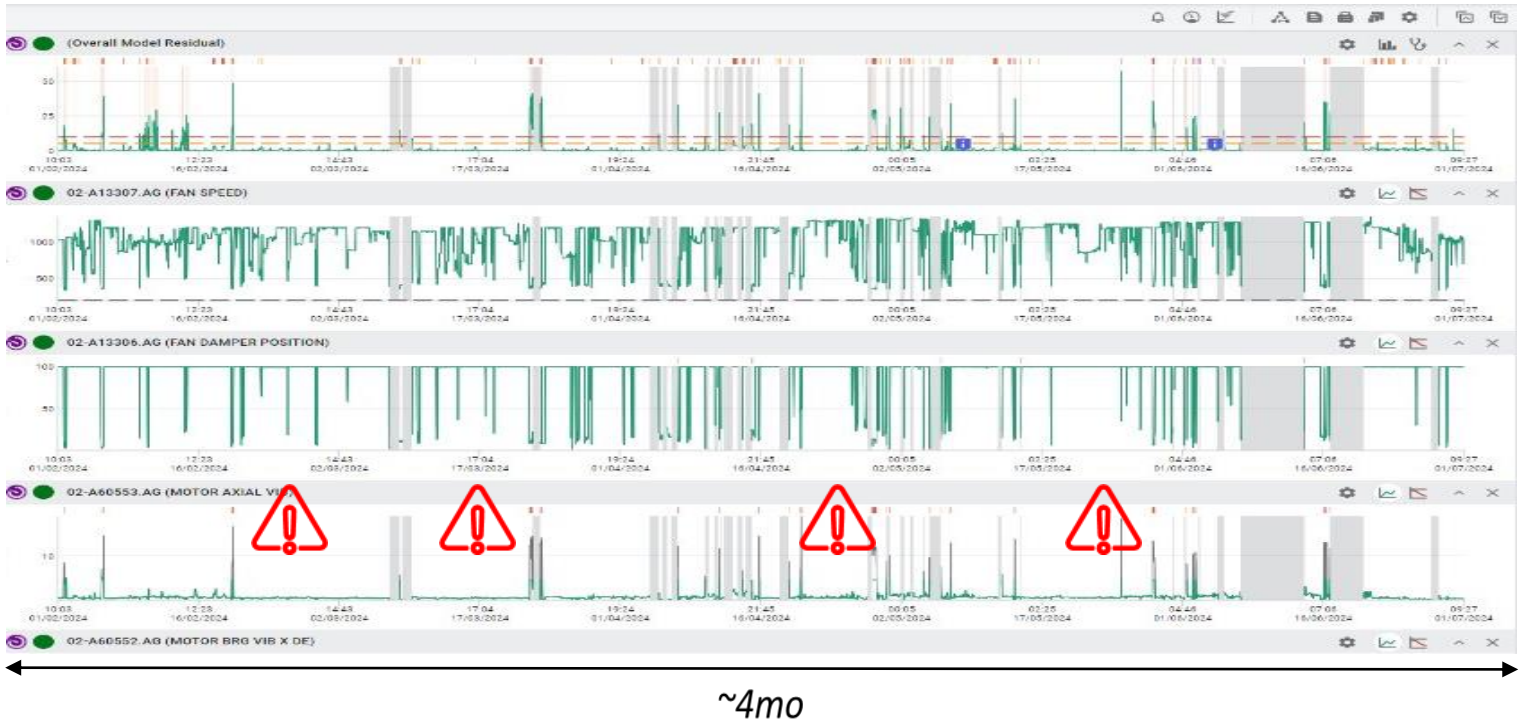


- Night shift operations experienced a moment of numerous mills tripping at the same time- this caused a blip to the primary air system.
- This caused a damper linkage to break on the tempering air damper that caused the damper to fully open. The mill inlet air temperature dropped to 69 degrees which in normal operation should be around 170 degrees
- Tempering air damper and hot air damper work together to control to a mill outlet temp of 90 degrees
- Operations didn't catch this due to dealing with the spurious mill trips.
- Warning given to operations; mill taken out of service without load loss
- If alert went un-noticed, potential for a PF line blockage which can cost up to **£200k to rectify**.

BOFA Fan (Boosted Over Fired Air)

Coupling damage from changes in operation

- High vibration at lower fan speeds coupled with damper positions in a certain position.
- Vibration causing failures of couplings and bearings.
- Operation of the fan had changed over time, fan upgraded in the past, then lower operational limits reduced years later
- Unplanned failure would cause a trip of the full unit. Potential missed opportunity of up to **£70k per hour**



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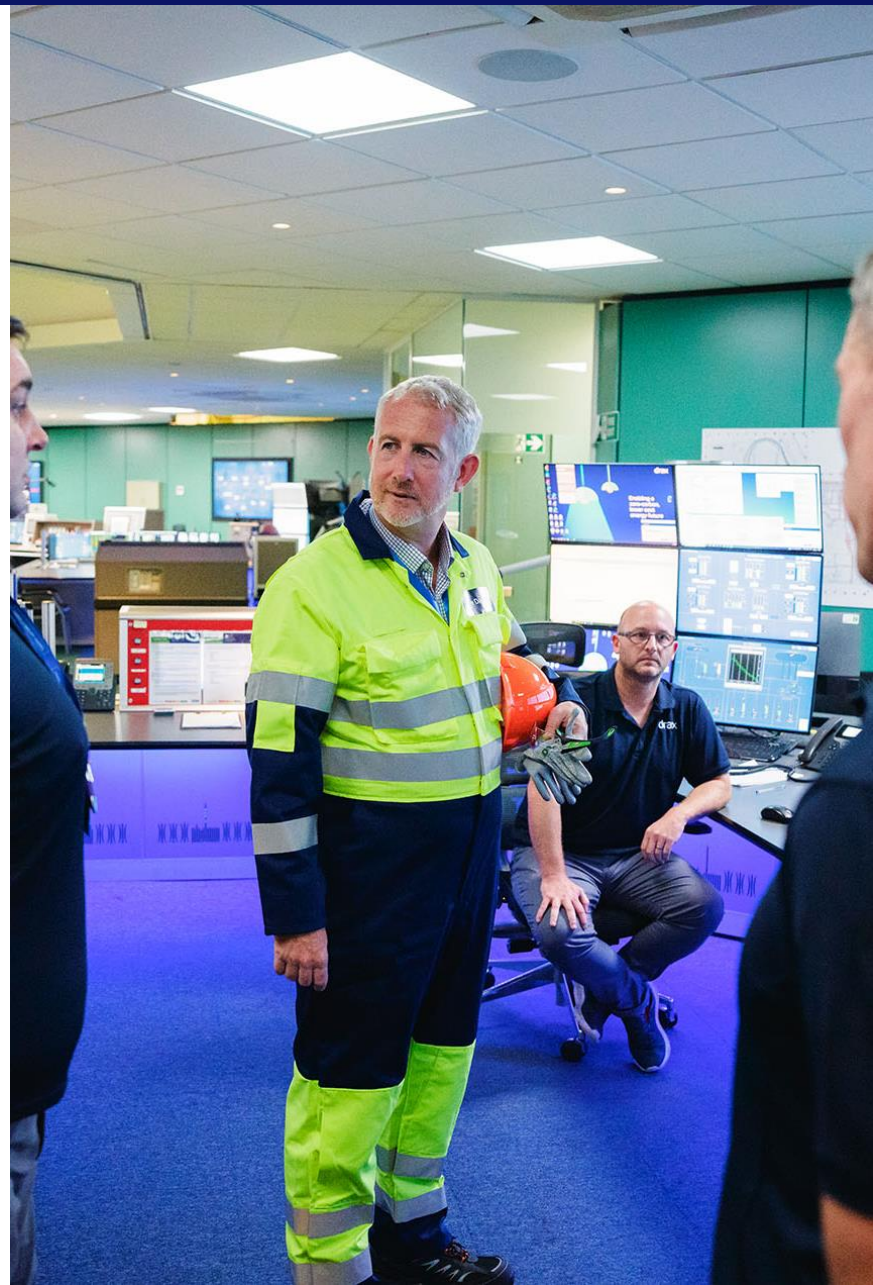
Success & Next Steps

Where do we go next?

Smooth Transition

- Assets previously monitored continued to be monitored
- Speed of response greatly improved
- Constant improvement of models to reduce false positives
- Large input from site SME's to improve models, create new and create new based off specific re-occurring problems
- 2-3 people monitoring all assets but only part time, good coverage with small resource
- Teams utilizing for specific issues and current concerns that they cannot determine



Create a central monitoring hub for the global assets

- Fully integrate predictive analytics at Drax power station
- All teams on board utilizing and collaborating to identify solutions
- Operators owning alerts/assets, investigating deviations at point of concern
- Evolve maintenance strategy where we can to predictive instead of reactive or time based
- Performance calculations to help run the plant more efficiently, identify efficiency losses earlier
- Expansion to the wider group (hydro, pellet, BECCS)
- Central predictive analytics hub

POWER AND UTILITIES | UNITED KINGDOM

Drax embraces predictive analytics in changing times for the business

Challenge

- Remote monitoring contract ending, assets no longer monitored, introduces risk on site.
- Drax contracts ending in 2027. A need to change to a more cost-effective maintenance strategy.
- Improve reliability despite change from stable/constant operations to flexible.

Solution

- Deployed AVEVA Predictive analytics and utilized our unused history of data to help adapt our maintenance strategy. Moving towards a predictive and risk-based strategy. Away from time based and breakdown/reactive maintenance.

Results

- **Predictive analytics implemented utilizing years of historic data, creating operational profiles which now identify previously unknown issues. Defects identified would have resulted in multi million-pound losses.**
- **Reliance on last resort alarms is easing, no longer waiting too late.**
- **Easy to use software available to expand to global portfolio**

Thank you

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ABOUT AVEVA

AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

Learn more at www.aveva.com

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