



Augmented Intelligence-based Approach to Predictive Maintenance

VGB Powertech Maintenance of Wind Power Plants 2021

GRAY

AUGMENTED INTELLIGENCE

In 2005, Steven Cramton and Zackary Stephen, with world ranking 1685 and 1398 respectively, beat the grandmaster Vladimir Dobrov and his teammate in a freestyle chess tournament that allowed players to use computers to support decision making.

Despite being heavily out-ranked, Cramton and Stephen were victorious due to their superior ability to use the computer as a tool within their overall strategy.

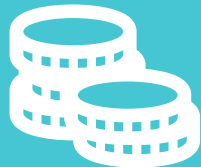


High level optimisation targets of wind turbine fleet operators

Manage Risk



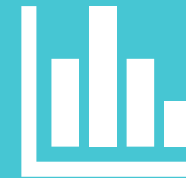
Reduce Operating Cost



Improvements KPIs



Benchmark Fleet

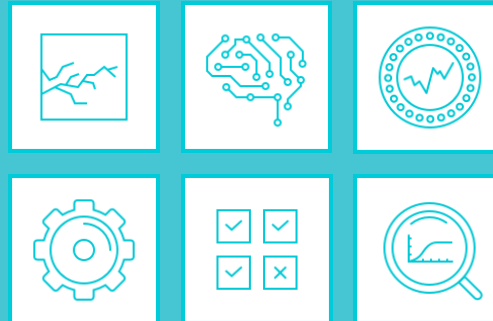


i4SEE Optimisation



Our experts work with you to optimise your wind fleet O&M.

i4SEE Applications



We use internally developed, best-in-class analytics tools.

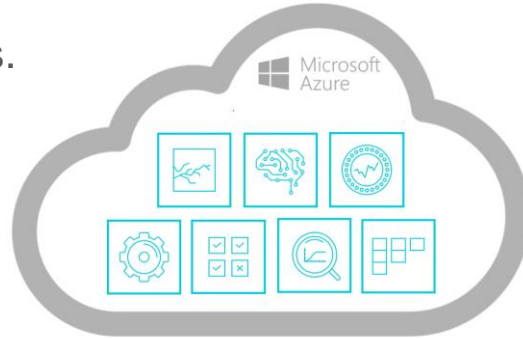
i4SEE Data Science



We provide support from highly trained data scientists, as needed.

■ SCALABLE

Low-cost MS Azure resources.
Modular design, using APIs &
Containerization. Designed
for very large fleets.



■ AUTOMATED

Turbine onboarding, auto-config,
batch scheduling, alarm limits,
auto-retrain.



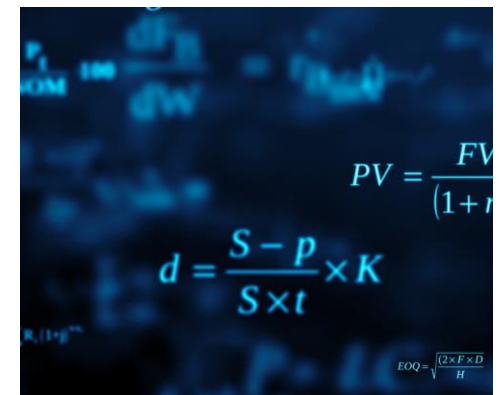
■ INTELLIGENT

Self learning, adaptive models
to simulate healthy turbine
behaviour and detect faults.



■ TRANSPARENT

Augmented Intelligence:
Physics-based models
combined with data science.

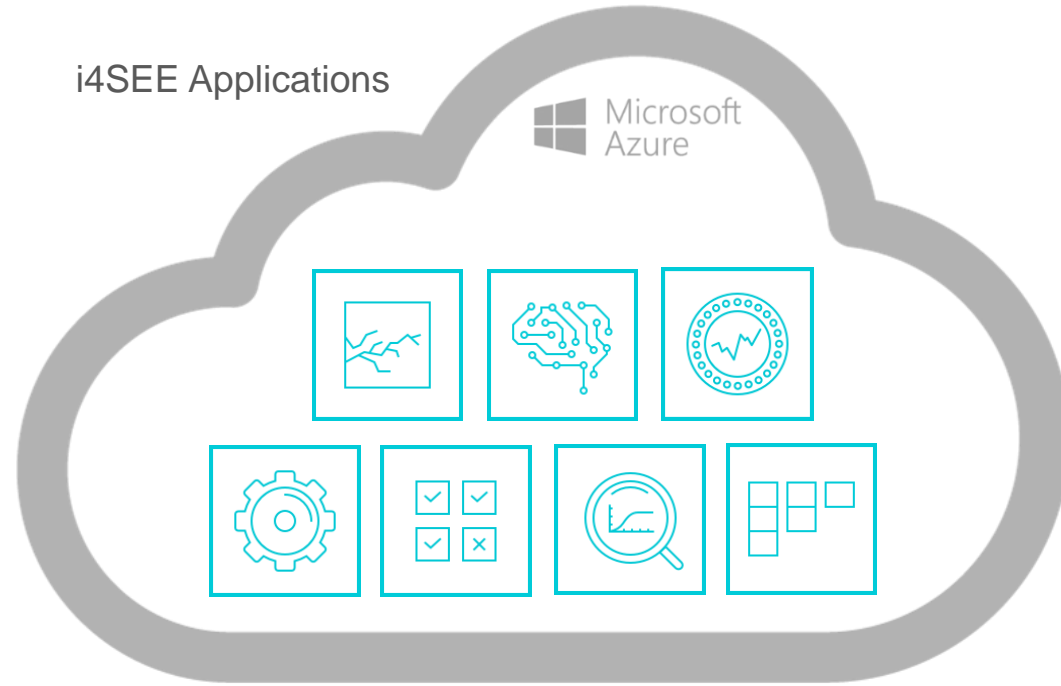


i4SEE INTEGRATION

6 GW of assets
connected and analysed
in last 24 months

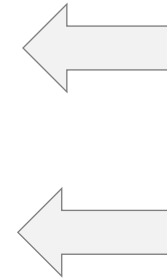
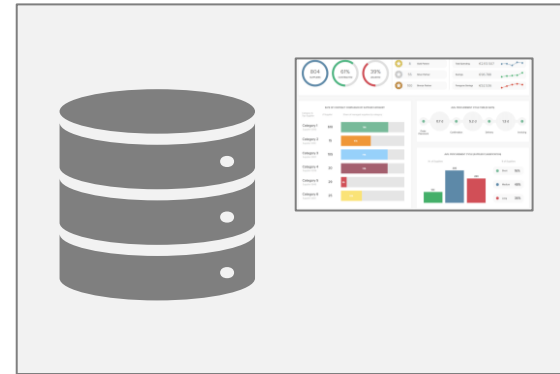
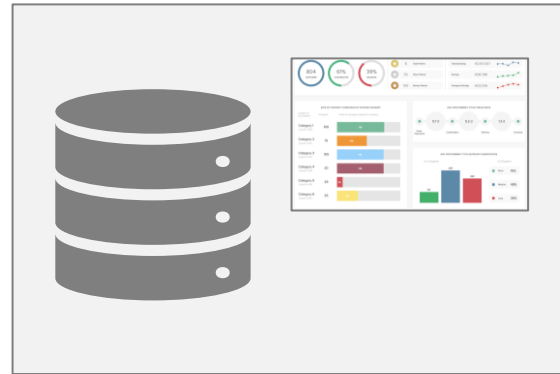
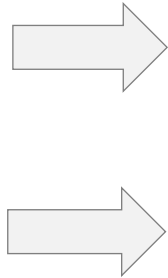
i4SEE Applications

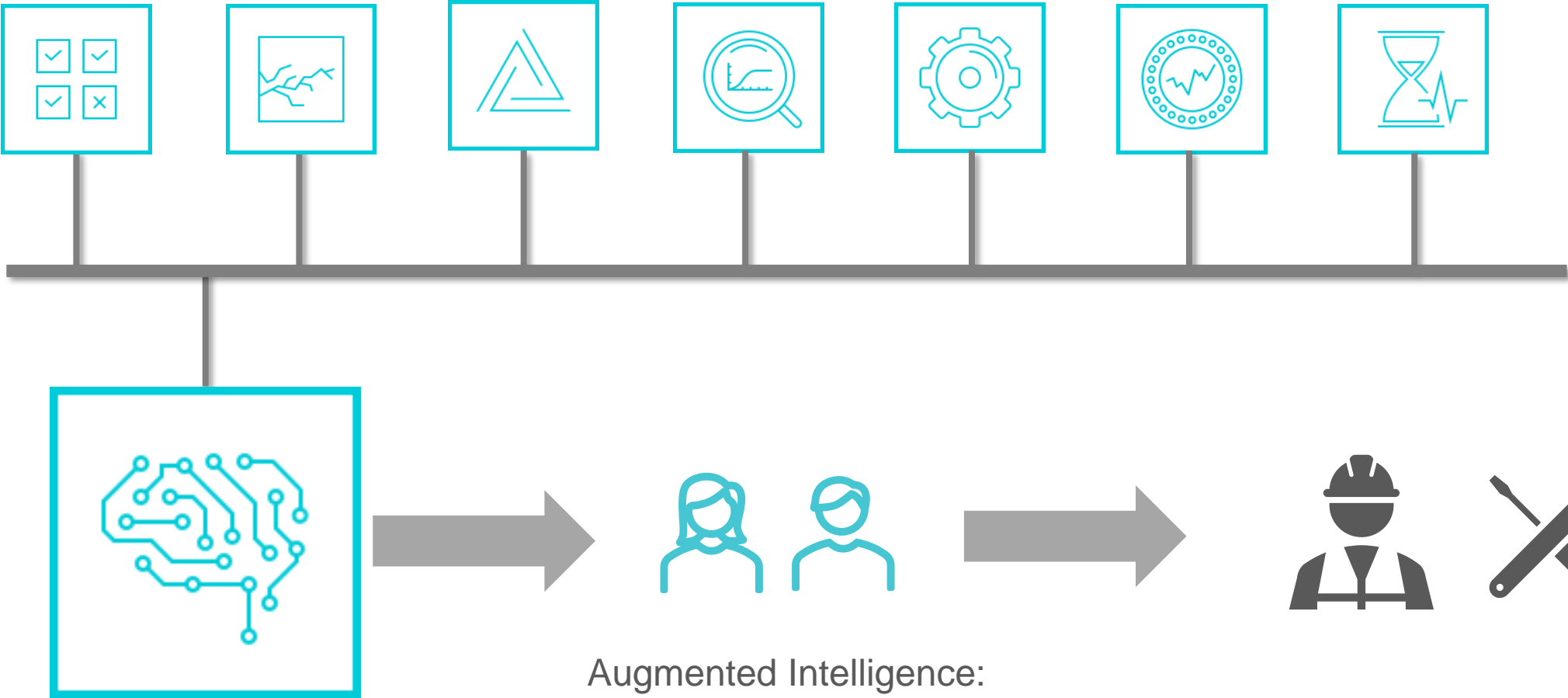
Microsoft
Azure



2nd level SCADA "A"

2nd level SCADA "B"





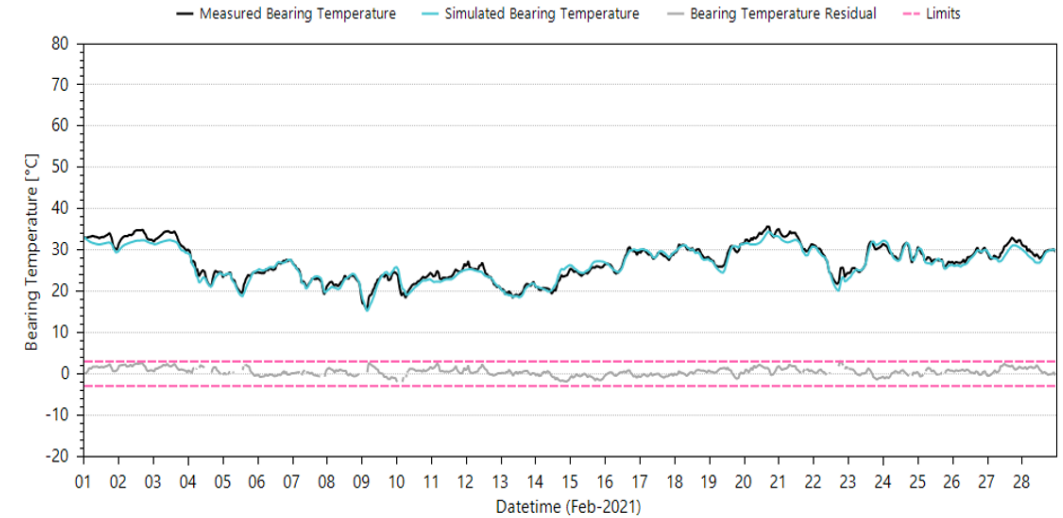
Augmented Intelligence:
Enhanced decision making

EXAMPLE OUTPUT

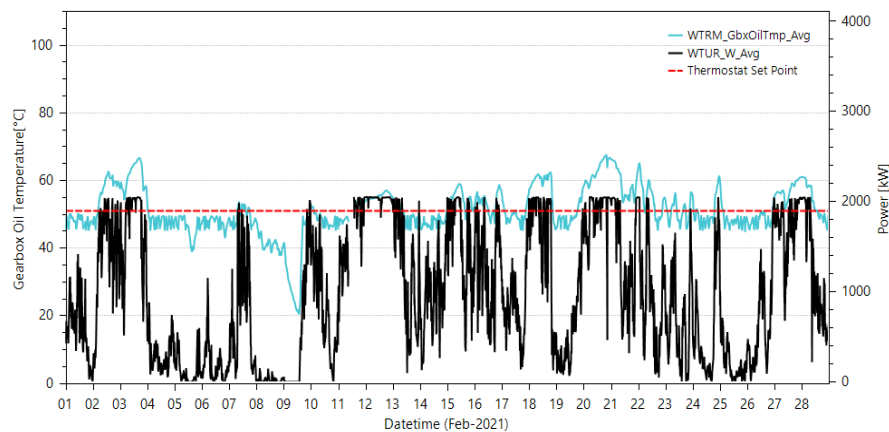
Fully automated, human readable diagnostics:

“The turbine experienced frequent short stop events, indicating an intermittent fault. Check SCADA event logs for evidence of intermittent failure, performed detailed analysis.”

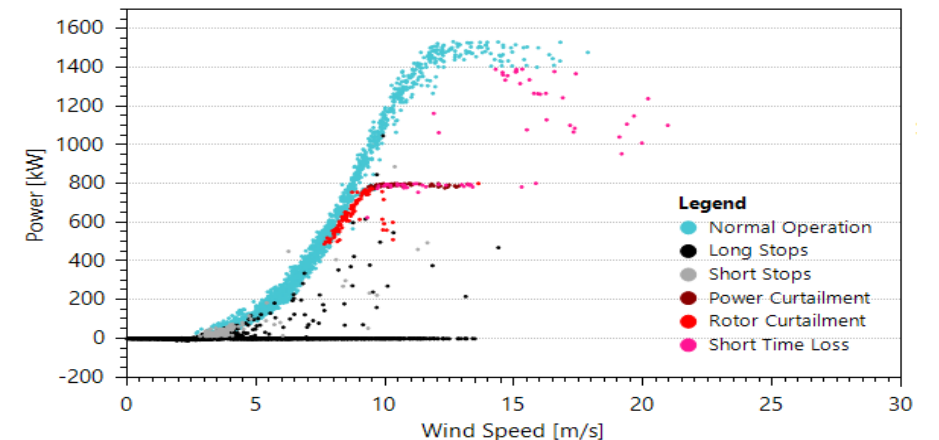
Main Bearing Temperature: Measured vs Simulated



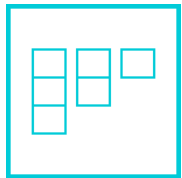
Gearbox Oil Temperature Monitoring



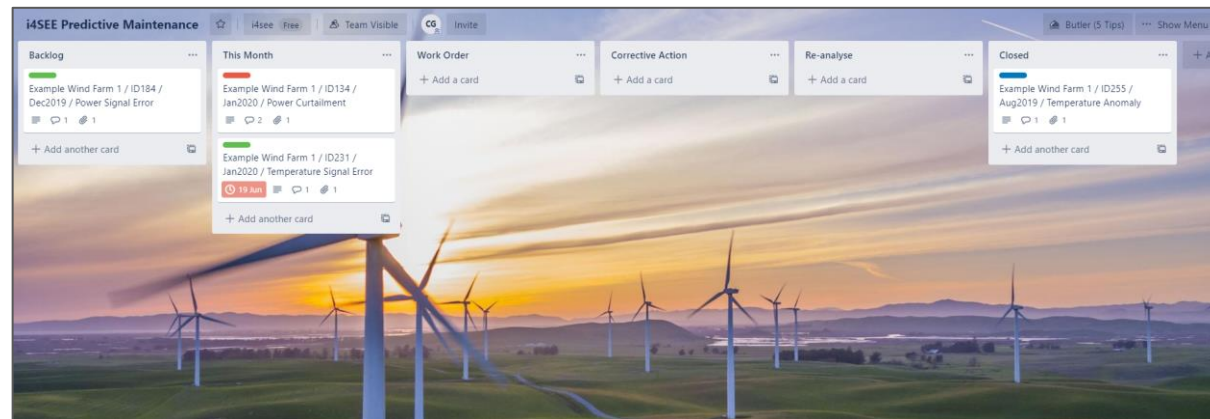
Filtered, Corrected Power Curve



WORKFLOW INTEGRATION



i4SEE Flow™



Kanban workflow management with "Trello"

- Available wind turbine operational data, when used effectively, can support optimised O&M strategy.
- Machines do not replace humans! But highly automated analysis and diagnostics can provide decision support.
- The integration of outputs into operational processes must be carefully managed to generate value.





The logo features the text "i4SEE" in a large, stylized, teal-colored font. The "i" has a square dot, and the "4" is a simple outline. The "S" and "E"s are highly stylized with multiple parallel lines. Above the "4" and "S" is a long, thin, teal horizontal bar. Below "i4SEE" is the word "TECH" in a smaller, teal, sans-serif font, centered and flanked by two horizontal teal lines.

i4SEE
TECH