CUSTOMER CASE STUDY

Meridian Energy: Reducing unplanned outages with proactive maintenance

Meridian Energy - www.meridianenergy.co.nz
Industry - Power generation

Challenges

- Lack of visibility into generating assets, which are 100% renewable (wind, water, sun)
- Required plant outages and routine maintenance to investigate the degradation of its generating assets, with less outage flexibility due to market constraints
- Insufficient data to drive condition-based maintenance decisions

Solution

- Deployed AVEVA™ PI System™ and AVEVA™ PI Vision™ to collect, analyze, and contextualize critical metrics within its generating assets

Results

- Created processes to collect and contextualize generating asset information to optimize plant outages and engage in condition-based maintenance
- Developed a centralized platform to present data at different depths to accommodate all levels of interest
- Built the foundation for future more complex analytics and data-driven decisions across the organization

AVEVA

Meridian Energy, New Zealand's largest energy generator, has over 2,800 megawatts of installed capacity and supplies approximately 30% of the country's electricity. This energy is 100% renewable, with seven hydro stations, five wind farms with two more underway, and grid-scale battery energy storage systems (BESS). Sustainability is built into the company's ethos. Saif Fawzi, Data Analyst at Meridian, says, "Our purpose is clean energy for a fairer and healthier world, which is actually at the center of everything we do."

These sustainability goals require Meridian to operate as efficiently as possible, which includes maintenance of its generating assets. The organization wanted to improve its maintenance processes from a routine-based approach to a condition-based one—and this meant generating real-time asset data and putting it to work to keep the lights on in Kiwi homes.

"Our goal was to move towards a condition-based approach, to optimize resources through condition-based monitoring. That's where AVEVA PI System came in."

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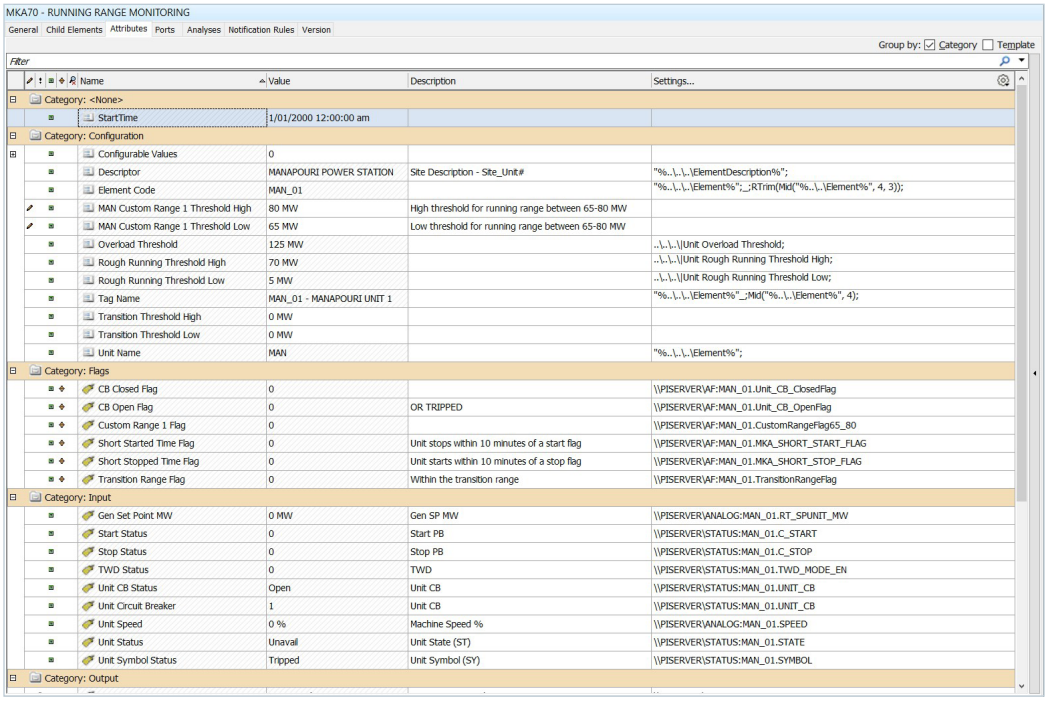
Saif Fawzi
Data Analyst, Meridian

Insights into asset health with real-time data

In the past, the Meridian team had to schedule outages to see how their generating assets were performing and to get insight into equipment degradation. These shutdowns became increasingly less feasible as energy demand rose, and Meridian's conservative routine-based approach to maintenance no longer made sense. It needed a way to see how its generating assets were performing in real time, without having to force an outage.

So Meridian created a data infrastructure using AVEVA PI System to see and use its real-time operational data for more informed maintenance decisions. Meridian's generating assets communicate real-time data from sites across the country, which gets stored in AVEVA PI System's data archive. It uses the asset framework function of AVEVA PI System to build analytical models to format and contextualize that data. Then, using AVEVA PI Vision and Dimension Software's Asset Intellect, Meridian collates, filters, and presents all the relevant data necessary to make decisions that improve asset health.



Collecting and contextualizing data using AVEVA PI System's asset framework function allows Meridian to move from a routine-based maintenance strategy to a condition-based one.

Root cause analysis leads to proactive maintenance

The Manapōuri hydro power station is Meridian's largest, with a capacity of about 875 MW. Within the station, Meridian has seven generating units. One of these units wasn't stopping like it should, so the team had to force an outage to see what was going on. Was it a wicket gate obstruction, degrading brake pads—or was it something else entirely? This lack of knowledge means a loss of potential energy generation from having to shut down the unit.

Using AVEVA PI System's asset framework, Meridian was able to create event frames for each unit's stopping sequence using different start and end triggers—element templates could be created for one unit and then easily rolled out to any unit, making it easy to scale. Meridian captured raw data, both real-time and historical, performed analytics, filtered the information, then imported it into AVEVA PI Vision for engineers to analyze.

This visualization showed engineers and operators the values of selected stop outputs. For example, the "stop initiate duration" value shows the time it takes the unit to go from 100% speed to 95%. This helps them isolate any pre-stopping sequence events, such as opening the circuit breaker, from the mechanical events of interest, such as the wicket gates closing and the braking pads being applied.

Users can see all previous stopping events, speed graphs that show the three-month rolling average to track degradation using trends, or a station view that compares units and speeds to give engineers some context about a unit's behavior. In the case of the Manapōuri unit, the team used this information to pinpoint what was preventing it from stopping. Meridian then fixed the issue before it became an operational liability.

Displays allow engineers and operators to see exactly how units in the Manapōuri hydro power station are stopping

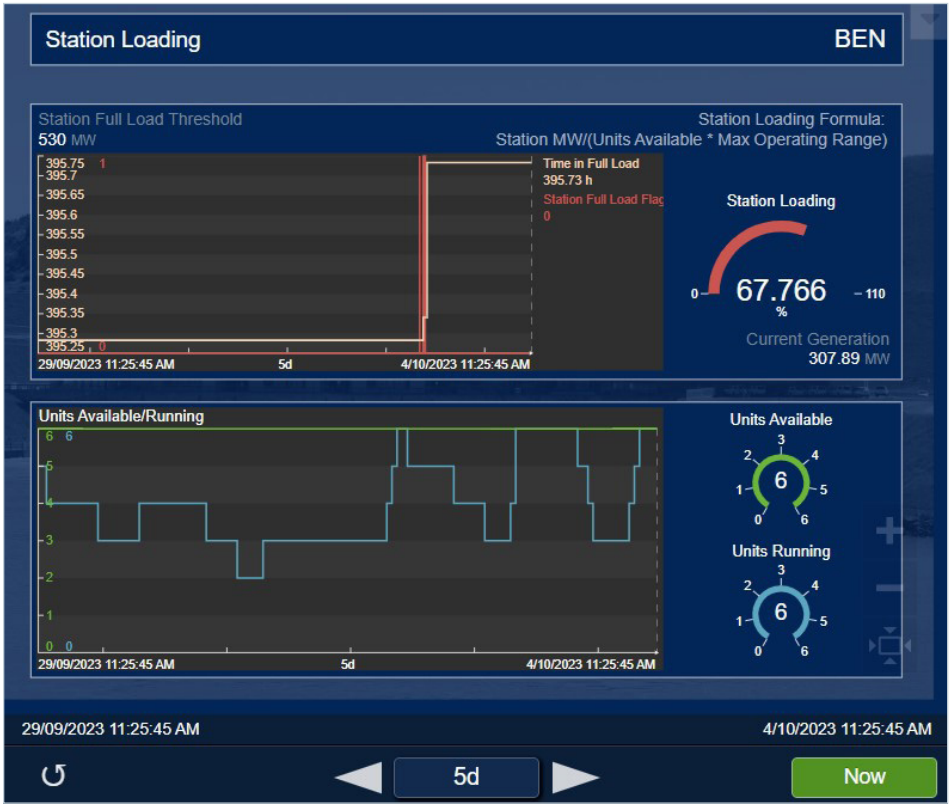
Monitoring hydro unit fatigue with time-series data

Another challenge Meridian wanted to tackle was that it didn't have any real sense of unit fatigue. It was difficult for the team to make condition-based maintenance decisions because they lacked visibility into real-time operational data. Using time-series data from AVEVA PI System, along with the asset framework function and AVEVA PI Vision, the team could gain insights into operational metrics such as unit starts and stops, Tailwater Depression (TWD) operations, station loading, and the time each unit spends inside or outside the manufacturer's operating range.

Instead of event frames, the team made use of flags, known as digital states in AVEVA PI System's asset framework function, to compare raw data using configurable thresholds.

Filtering out irrelevant data, the team used this information to determine the actual generation range of each unit compared to thresholds. Displays in AVEVA PI Vision show station views with the capacity to drill down into unit specifics.

Users can quickly see unit status and how long units have spent within various generation ranges—time spent not running, time spent in TWD, time spent at "rough running range" or below the ideal operating range, above this range, or in overload. Additionally, the team can create a display once and apply the configurations to all similar assets.



This display shows the overview of the station with overall unit information and station load, with actual megawatt output divided by the total capacity the station is capable of

More advanced analytics for more efficient operations

Meridian is already working on incorporating more complex analytics in its maintenance approach. One model it's currently working on is the "overload analysis" model. The team wants to calculate, using the data they gathered from their unit fatigue analysis, the revenue they're making against the power they're generating with the aim to push their units a little harder. By pulling in and integrating external data from an SQL database into AVEVA PI System, the team can decide whether it's worth pushing their units a little harder, which will cause more frequent maintenance, in exchange for more power generation and revenue.

In addition to more advanced vibration-based alarms, Meridian is planning on creating a component condition heat map. The team plans on taking all component metrics to form a single metric that accurately delineates the fatigue of assets and then visualize it in a simple color-coded condition map. This way, they can run units similarly to degrade at similar rates to deploy maintenance resources at the same time, rather than separately, which is a lot less efficient.

> "AVEVA PI System has given us a foundation to build upon with the hopes of creating more complex analytics in the future."
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> **William Herewini**
> Engineering Data Analyst, Meridian

Better understanding of how assets operate helps the operations team plan resources across the organization and move toward a more proactive condition-based maintenance model. Data transparency, with data presented to users in relevant formats, helps the team make better data-driven decisions. Looking to the future, Meridian plans on building even more foundational models and using more complex analytics, integrating a bidirectional channel between AVEVA PI System and Meridian's work management system, as well as improving how it monitors alarms and notifications. Additionally, the company is looking to use more web- and cloud-based applications, including integrating PI Web API into its data-management system. Meridian is continuing its mission to lead decarbonization efforts with the help of smart data management, keeping New Zealand powered through the cold winter months.

Watch the full presentation

References:

Fawzi, Saif and Herewini, William. "Meridian Energy: Implementing condition monitoring using the AVEVA PI System to drive condition-based maintenance." https://resources.osisoft.com/presentations/meridian-energy--implementing-condition-monitoring-using-the-aveva-based-maintenance