



Deployment of a prognostic asset management solution at a hydroelectric power station

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CASE STUDY

# Condition-based malfunction forecasts for power generation



### The challenges

The plant operators needed a method to determine the RUL of key components in their hydropower stations, which included assets such as hydroturbine-generator units, transformers and control equipment. The objective was to avoid critical malfunctions and failures, and optimize maintenance activities. With information on asset RUL, the scope of the scheduled maintenance could be limited to the truly required services, part replacement and repair, reducing maintenance costs.

In addition, operators were looking for insight on how to optimally operate these assets to maximize utilization over RUL. For example, if a maintenance task were not feasible for the next 10 weeks, could the asset be operated at a reduced load so that it did not break down before maintenance was performed? The alternative would be to risk running the asset to failure prematurely, incurring much higher maintenance costs and lost revenue from the disruption to production.

To meet their needs, the company selected Lumada Asset Performance Management (APM).

### The customer

A major Swiss power generation and distribution utility produced around 40% of its power through owned or shared hydroelectric plants. However, an increasing number of its plants were reaching the end of their designed operational life, with some facilities being over 100 years old and others refurbished several decades ago. The company needed a state-of-the-art solution to help determine, extend and manage the remaining useful life (RUL) of their generating assets.

### The solution

Lumada APM was first deployed at a 40+ year old hydropower station that was last refurbished in the late 1990s. All available historical data from these assets (e.g., vibration, temperature, pressure, flow and electrical condition) was used to configure and train the stochastic model for computing asset RUL.

Working in close collaboration with the on-site plant engineers, the APM team reviewed asset condition data histories and correlated condition parameters with critical asset malfunction modes to determine future malfunction risk profiles.

For example, analysis revealed that a generator's increasing level of bearing vibration was driving the risk of future asset malfunction, and was highly sensitive to load. The solution was then able to calculate when the bearing would malfunction if the generator continued operation at the previous load, and recommend the optimal load for achieving stability of the vibration gradient

**The results**

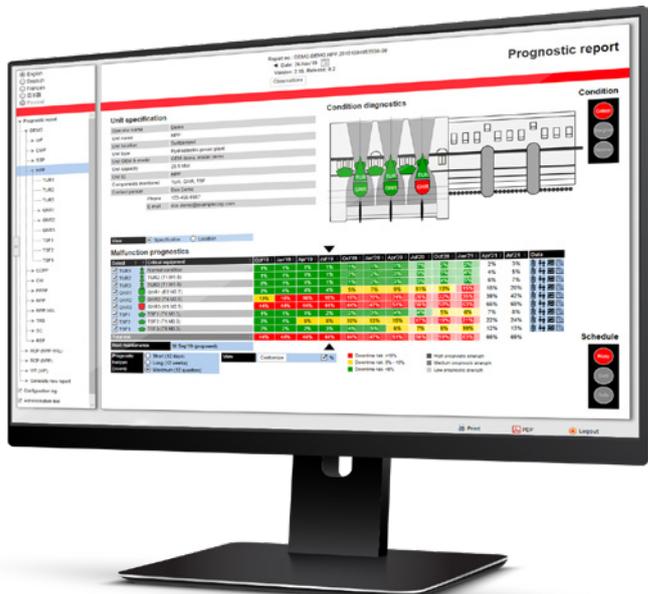
The Lumada APM solution is able to successfully compute future malfunction risk and estimated RUL when presented with current condition and process data. The results are visually summarized on the prognostic dashboard, which enables operators to quickly spot potential upcoming failures and drill down to identify the exact parts that need replacement.

Lumada APM also allows operators to simulate various operating conditions to see how they would affect future malfunction risk and RUL. Based on simulation results, operators can safely operate high risk assets at an appropriately adjusted load, to wait for a better maintenance window or availability of parts and crew, or to extend the RUL of the entire plant. Now outages can be scheduled to have the least financial impact, for example during seasons with low demand and low power prices.

Once trained, the asset models can be easily applied to the entire fleet. Which is why, a year later, the solution was extended to two other hydroelectric power stations.

With its state-of-the-art prognostic functions, Lumada APM has delivered many benefits:

- Significantly extended the utilization and RUL of generating assets
- Minimized maintenance costs and lost production revenue from better planning and scheduling of maintenance activities
- Saved an estimated US\$3 million through load balancing
- Extended the overall RUL of a plant with a hydroturbine-generator unit that had a latent defect with an inconclusive root cause



“While we use proprietary power demand and price forecasts on the market side, [Lumada APM] is filling an important gap with availability forecasts on the generation side. We are intrigued by their prognostic technology and excited about their overall value proposition. We expect their solution to become a standard tool in the power industry, especially for technologically progressive and commercially ambitious unregulated utilities.”

SVP of Power Trading



**Hitachi Energy**  
marketing-update@hitachienergy.com  
hitachienergy.com