



**Success Story**

# OPTIMIZING PARTIAL LOAD TO AVOID CAVITATION

Peaking operation is now the requirement for the eight cascade power stations, but the partial load places special burden on the hydro units. Cavitation was observed, presumably occurring during operation around what was considered to be the permissible minimum load. With the help of Brüel & Kjær Vibro's Compass 6000™ condition monitoring system, the minimum load limits were re-evaluated and re-defined ... and the cavitation disappeared.

**MACHINE/INDUSTRY/PROCESS**

Machine	22 hydroelectric generating units with Kaplan turbines
Company/Process	DEM (Dravske Elektrarne Maribor) hydropower, Slovenia
Monitoring System	Brüel & Kjær Vibro Compass 6000™
Monitoring Strategy	Protection and comprehensive condition monitoring with specialized generator monitoring for some units (air gap and magnetic flux).

**OBSERVATION/DIAGNOSIS**

Since peaking operation was implemented on the hydro units, it has often been required to operate at low loads. As a result, cavitation was observed to occur. The machines had to be consequently shut down so the runner blades could be re-welded for reconditioning the blade surfaces. Using Compass 6000™, the previously established minimum load limit of 21 MW was re-evaluated and determined to be too low. The tell-tale high frequency vibrations associated with cavitation disappeared above 24 MW, so this has become the new minimum load limit.

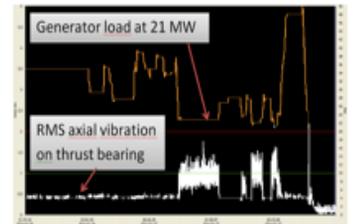
**BENEFITS**

Cavitation ceased to be a problem after the new minimum partial load limit was established, so it was no longer necessary to stop the machines after a period of time to re-weld the runners.

Since Compass 6000™ and other diagnostic systems were commissioned on all the hydro units in the cascade power stations, a large percentage of the maintenance work that was interval based has now become predictive maintenance based. This has significantly reduced the maintenance expenses and increased uptime. Moreover, the interval between inspection shutdowns for the hydrogenating units has also increased from 25,000 to 30,000 hours for the Zlatoličje hydropower plant. Plans are already underway to implement this turnaround time for the other power stations.



*Figure 1. Runner cavitation before the minimum partial load limit was redefined.*



*Figure 2. High vibration due to cavitation is seen on the thrust bearing when the hydro-electric generating load drops to 21 MW or lower.*

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