

FRANCIS TURBINE REFURBISHMENT

Mangahao power station had a modern 30 MW Francis turbine installed in 1995. Problems with erosion and some cavitation issues required a replacement runner and wicket gates.

The turbine operates on a 255m net head, with an ambitious turbine setting.

HydroWorks won the contract against international opposition to redesign and manufacture the runner to reduce cavitation and develop strategies to reduce the erosion.



HYDROWORKS ANALYSIS CAPABILITY



HydroWorks has significant computational fluid dynamics (CFD) resources with both in-house and commercial codes available. Together with advanced FEA and vibration modal analysis, a modern replacement runner was designed.

The new runner offers a 0.2% efficiency increase, removal of the inlet cavitation (blade lean treatment), and a reduction in trailing edge cavitation.

Additional support services included runner seal ring and coolant circuit redesign to allow synchronous condenser operation, hydraulic transients analysis and index testing.

EROSION TREATMENT

Two strategies were adopted to mitigate erosion. The first strategy was to locally reduce fluid velocities in regions of high erosion by specific runner design. The second strategy was to increase the hardness of the surface. The runner was selectively sprayed using a HVOF tungsten carbide process. The wicket gates were plasma nitrocarburized.

