MOVED BY *challenge*

The history of all of us is marked by challenges, and it was no different with the history of Hacker. In 1951, Carlos Hacker needed a solution for generating his own energy in the unelectrified interior of 1950s Brazil. It was then that, in 1951, he manufactured his first hydraulic turbine, a small crossflow turbine with a diameter of 185 mm, capable of generating about 500 W of power. The challenges grew, and with them, the solutions did too. Larger machines, new technologies, more complex projects. Problems also arose, and with them, we learned how to do more and do better. Today, Hacker enjoys a privileged position, with over 70 years of history, a solid factory, cutting-edge technology, skilled engineering, and the same capacity to innovate that is so necessary nowadays to solve the challenges of a mature and at the same time complex market like the energy market in Brazil.

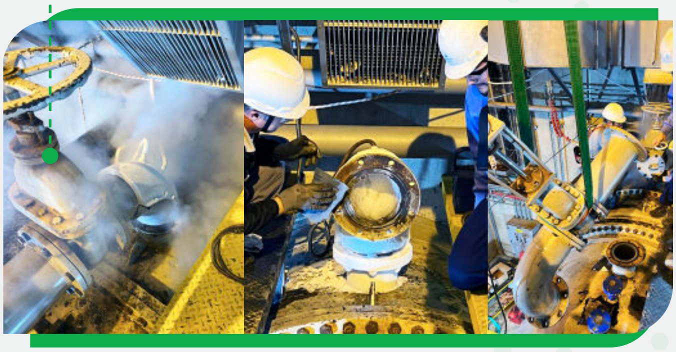
There is no shortage of examples of how to solve challenges in complex projects, but here are some recent success stories worth mentioning.

Complex transients

HPP Guarau 4MW is a project implemented at the water treatment plant of the same name, part of the Cantareira system, which supplies the city of São Paulo.
Comprising a pre-existing tunnel approximately 5 km long, originally designed for water supply rather than energy generation, diligent work was required to appropriately size the intake system, as well as the restrictive elements, surge tank, and the generating unit, a Kaplan S upstream turbine.
Hacker performed all transient calculation for the plant's hydraulic circuit, considering both existing and new elements, simulating all operating conditions, particularly load acceptance and rejection, in direct connection with the specific hydraulic characteristics of the turbine.
Mechanical and hydraulic techniques were employed to mitigate pressure surge effects, and all rotating elements were sized to withstand high transient rotations without any negative impact on unit operation or durability. The Guaraú Small Hydropower Plant was successfully commissioned in 2023 and has been operating without restrictions since, generating over 4 MW of energy.

*Foto: João Kramp

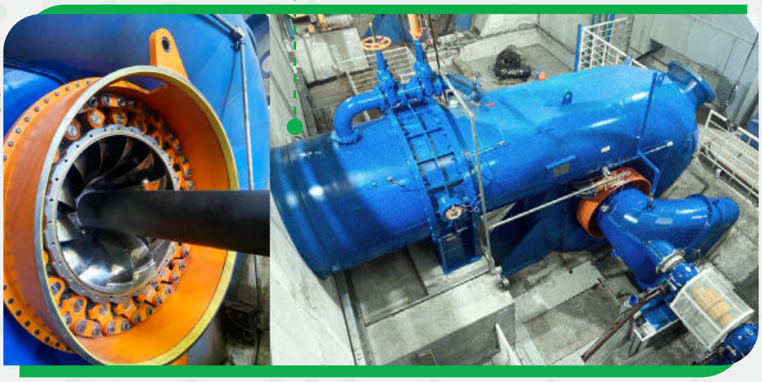
Specialized maintenance



Double Francis Turbine, Unit Power of 7.8 MW
Upon receiving communication from the client regarding the complexity of the drainage system of the plant's intake tunnel, we conducted a comprehensive study to address the maintenance and replacement of a valve in the turbine's By-Pass system, located in the pressurized section of the conduit.
During the engineering planning, we chose to employ the pipe freezing process upstream of the By-Pass valve, in order to facilitate the replacement of the component.
The freezing was perform through controlled injection of liquid nitrogen into the outer wall of the pipe. The freezing procedure lasted approximately 4 hours, ensuring the necessary time and safety to carry out the component replacement. This approach optimized machine downtime and mitigated risks associated with draining the plant's intake tunnel.

Reinstatement of full range operation

Double Francis Turbine, Unit Power of 5.2 MW
Following the incident of turbine shaft failure due to shearing, Hacker was contacted to proceed with the dismantling of the equipment (which was not Hacker's equipment) and investigate the causes of the component failure.



During the engineering analysis, critical points were identified in the original equipment design. Based on these findings, a complete reverse engineering of the equipment was conducted, followed by computational analyses to redesign the entire system using the most up-to-date engineering practices.
Through field evaluation, comprehensive remodeling of the Generating Unit, Computational Fluid Dynamics (CFD) simulations, and integrated rotodynamic analysis, hydraulic profiles of the guide vanes, wicket gates and runner, were optimized to increase efficiency and improve hydraulic disturbances across all operational ranges of the turbine.
Following engineering development, all components were manufactured and installed on the original powerhouse mounting structure. Subsequently, commissioning tests and turbine instrumentation were performed to physically validate all engineering calculations and simulations, resulting in operational excellence.

In addition to manufacturing high-performance turbines that are already well known in the market, Hacker can assist in the enhancement of projects from their conception, suggesting the best layout conditions, hydraulic circuit sizing, energy calculation, and operational evaluation to maximize performance and consequently the financial results of your investment.
Through our dedicated Service department, we are also able to intervene to solve operational problems, repairs, or uprating of generating units, with the necessary experience for a positive outcome.
Talk to who have history to tell, and count on Hacker's quality for your project!

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hackerindustrial
hacker-industrial-ltda
Xanxerê, Santa Catarina, Brazil