ANDRITZ' FOOT PRINT

In the European **Pumped Storage** Market

Following the European pumped storage boom between 1970 and 1990, a long development drought finally broke around 2010 when a second boom in pumped storage projects began across Europe.

As one of the global leaders for hydraulic power generation, ANDRITZ made its mark, in particular with its expertise in low-head pump turbines. For example, with the contract award to supply the pump turbines for the Baixo Sabor Cascade on the Sabor River in northern Portugal, ANDRITZ began a new era of pumped storage development on the Iberian Peninsula. The upstream power station of the Baixo Sabor Cascade is equipped with two pump turbines of 77 MW each. It operates across a very wide head range of between 69 and 105 m. The two pump turbines at the downstream power station operate at a very low head of between 26 and 35 m. In the downstream station each of the units provides a rated capacity of 18 MW. Both grid-connected power stations were built to both generate electricity and create a strategic reserve of water in the region.

A couple of years later, in late 2011, ANDRITZ received an order to supply equipment for another pumped storage plant in Portugal – the 234 MW Foz Tua pumped storage power station. The dam, with two pump turbines, is located on the lower branch of the Tua River. It forms part of a national effort to increase power generation from renewable sources.

Beyond the Iberian Peninsula, ANDRITZ experience in pumped storage technology has allowed other nations to benefit from pumped storage hydropower capacity. For instance, two of the largest pumped storage power plants in Europe use equipment from ANDRITZ.

The Goldisthal plant in Germany was the first variable speed pumped storage power plant outside Japan. The pump turbines at Goldisthal are able to regulate energy not only in turbine mode, but also during pump operation. Additionally, the plant supplies advanced grid services, improving reliability and stability across the national transmission system.

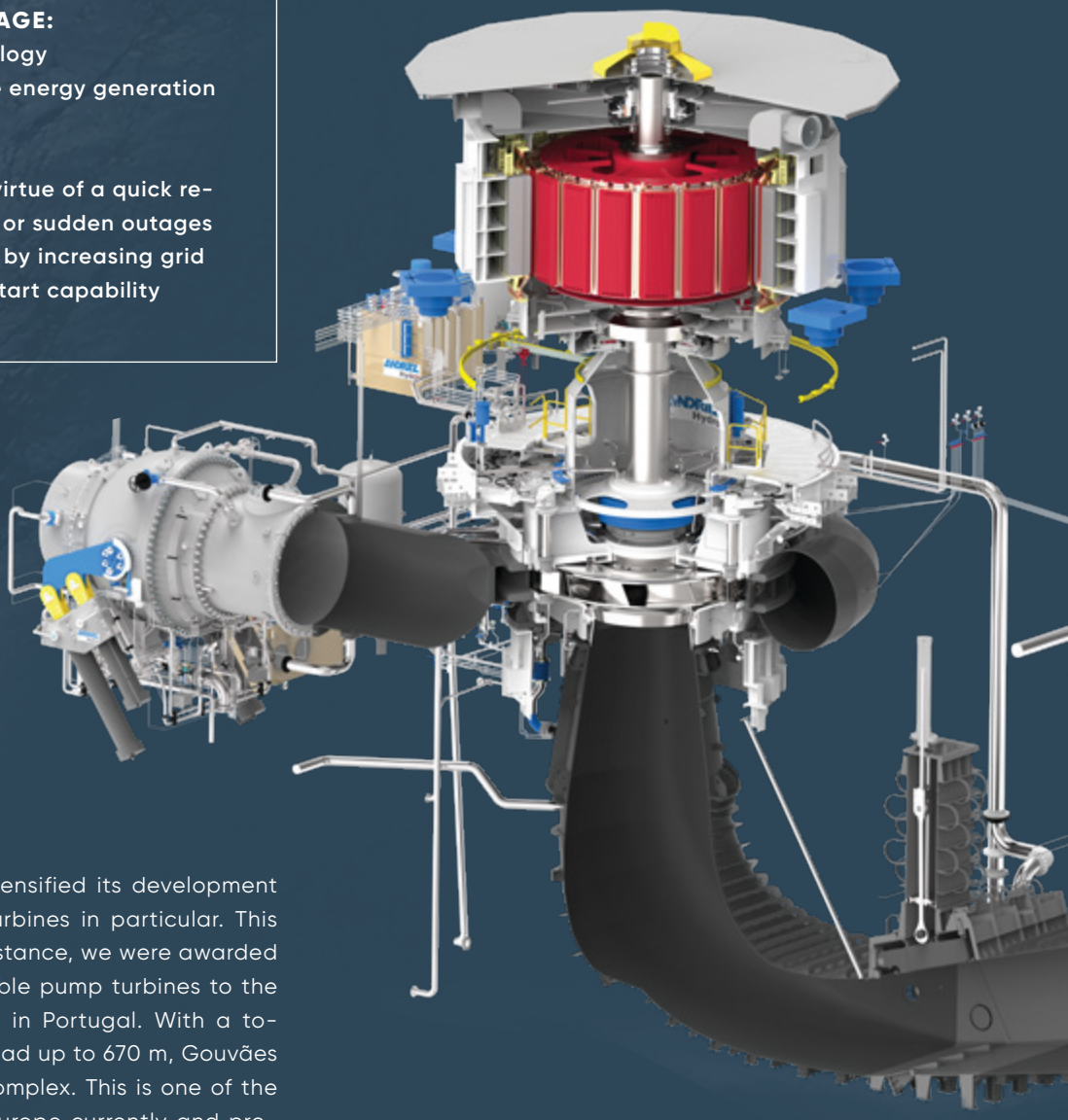
In 2015, the second largest pumped storage plant in Europe, the Vianden power station in Luxembourg, was extended with an 11th pump turbine unit supplied by ANDRITZ. The addition of this new unit, with a rated capacity of 200 MW, boosted the total capacity of the power station to almost 1,300 MW.

Ternary sets and multi-stage units are also an important part of ANDRITZ' extensive pumped storage technology portfolio. The ternary set of Kops II, Austria, as well as the four-stage pump turbine of Nestil, Switzerland, are operated with ANDRITZ equipment, for example.

In 2017, the six-stage storage pump Oschenik 1 at the Innerfragant hydropower station in Austria was successfully commissioned. With a rated capacity of 30 MW the storage pump is able to pump water up to 950 m from the lower to the upper reservoir.

BENEFITS OF PUMPED STORAGE:

- Best-proven, low-risk technology
- Balancing volatile renewable energy generation with demand
- Managing grid bottlenecks
- Supporting grid stability by virtue of a quick response to changing demand or sudden outages
- Contributing to grid stability by increasing grid inertia and providing black start capability
- Very long facility lifetime



In recent years, ANDRITZ has intensified its development program for high-head pump turbines in particular. This effort is paying off. In 2016, for instance, we were awarded a contract to supply four reversible pump turbines to the Gouvães pumped storage plant in Portugal. With a total capacity of 880 MW and a head up to 670 m, Gouvães is at the heart of the Tâmega Complex. This is one of the largest hydropower projects in Europe currently and produces about 1,500 GWh of electrical energy annually. (⟶ see article page 41)

The first power stations developed during the European pumped storage boom in the 1970s are now aging. One after another, rehabilitation of these older units is becoming an increasing necessity in order to ensure reliable operation and to meet prevailing legal and regulatory requirements.

Alongside increased efficiency, improved part load operation is also required to meet the needs of the future energy market. ANDRITZ, for example, recently supplied four new runners to the Bolarque II power station in Spain. This project will make the more than 40-year-old pump turbines ready for the energy market challenges of the coming decades. (⟶ see article page 43)

From the low head of the Baixo Sabor power plant to the high head of the Oschenik 1 multi-stage pump, to the refurbished runners of the Bolarque II power station and the state-of-the-art pump turbines of Gouvães, ANDRITZ supplies the full range of pumped storage technology. As a leading player in global pumped storage development, ANDRITZ is ready to contribute to the improvement and modernization of the European energy market and to meet the changing needs of the future.

PUMPED STORAGE HYDROPOWER PLANTS are well proven as the most cost-effective form of energy storage to date. They offer state-of-the-art technology with low risks, low operating costs and balance grid fluctuations through their high operational flexibility, allowing the successful integration of intermittent renewable power. Thus, they significantly contribute to a clean energy future.