GERMANY

ENERGY TRANSITION TO THE FUTURE

The fourth largest economy in the world and Europe's largest, Germany is a global leader in several industrial and technological sectors. A developed country with a very high standard of living, Europe's second most populous nation is the world's third-largest exporter and importer of goods. Germany holds a very strong position but is facing significant demographic challenges to sustained long-term growth.

Germany has the largest annual electricity demand and generation capacity in Europe, and the largest power system. At roughly 14.7 GW, hydropower installations including pumped storage account for around 7.5% of the total national generation. They produce approximately 20,000 GWh net electricity generation annually.

Within a fleet of about 7,300 hydropower plants, 94% have an installed capacity of less than 1 MW. Around 86% of Germany's annual hydropower energy production comes from the 436 plants with an installed capacity of more than 1 MW, corresponding to a share of some 6%.

Currently, several new hydropower projects are under development and were expected to come online by 2020. However, due to current market and policy conditions, some projects have been postponed or canceled. Nevertheless, there are notable requirements for modernization and large overhauls at a number of facilities over the next few years.

Germany is committed to the Paris Climate Agreement and has set medium-term targets for CO_2 emissions and renewable energy sources that are even more ambitious. They include plans to reduce CO_2 emissions by 40% and achieve an 18% share of gross energy consumption from renewable sources by 2020. The energy transition (Energiewende) is the transition to a sustainable economy by means of energy efficiency and renewable energy. Alongside wind and solar PV, hydropower will play a major role here.

ANDRITZ HYDRO IN GERMANY

The foundations of our Ravensburg location were laid in 1856 as subsidiary of Escher, Wyss & Cie Switzerland, now part of the ANDRITZ technology group. Today, the ANDRITZ Hydro workshops in Ravensburg are among the biggest hydropower turbine workshops in Europe.

Our products and services make a significant contribution to environmentally-friendly, renewable power generation. The latest modern ecological concepts are combined with 160 years' of extensively documented experience building hydropower plants. Our employees are providing excellent and highly-skilled international service.

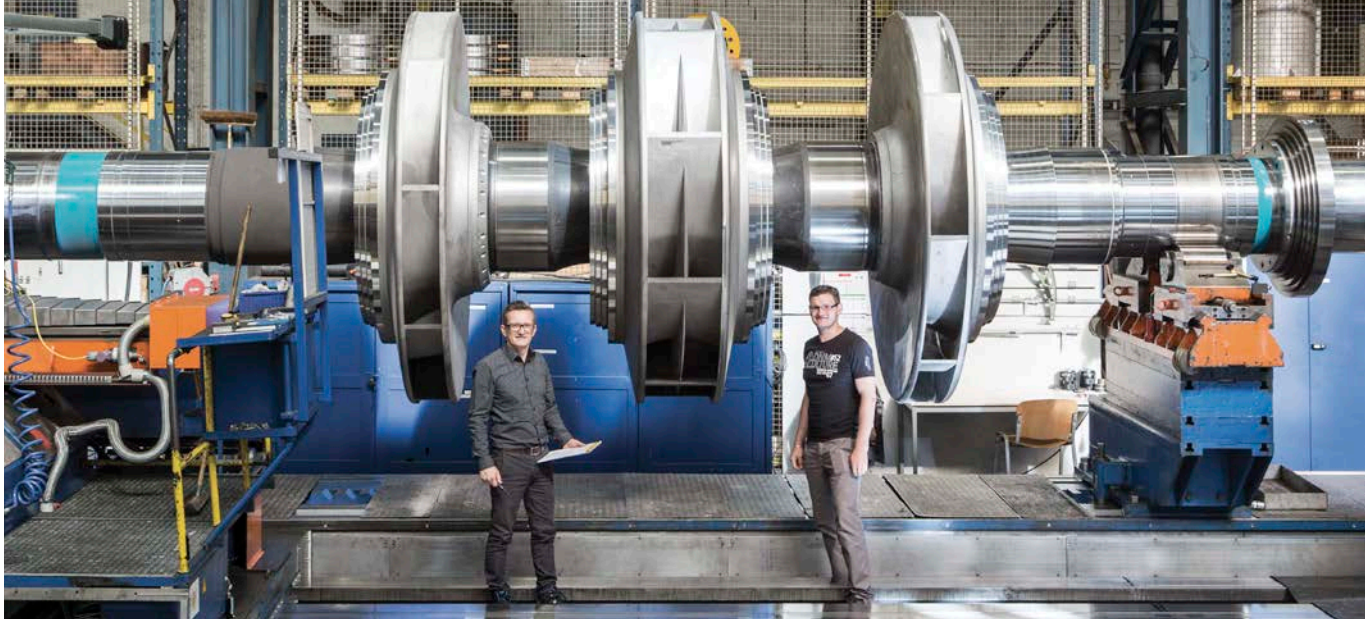
As well as almost all the hydroelectric plants on the river Rhine, projects such as Goldisthal and Markersbach – the two largest pumped storage power plants in Germany – and the oldest commercial pumped storage plant of the world, Niederwartha, are among the impressive references of ANDRITZ Hydro in Germany.

CONTROLLABLE PITCH PROPELLERS

Since 1934 our Escher Wyss controllable-pitch propellers have provided outstanding performance for naval and coast guard vessels, mega yachts, and special marine vessels.

LANGENPROZELTEN, BAVARIA

Two of the world's most powerful single-phase hydropower motor generators (94 MVA apiece) were put into operation at the Langenprozelten pumped storage power plant in July 2016 and February 2018, respectively. The contract



Erzhausen, Lower Saxony

for the modernization of Deutsche Bahn's primary peak-load power plant posed a huge challenge as the generators are specifically designed for the railway's 16.7 Hz traction power network. Featuring a superlative pre-forge shaft raw weight of about 150,000 kg, world record-breaking mechanical pole loads of 34,000 kg each and centrifugal forces on the poles of 27,000 tons at 756 rpm, these engineering masterpieces are a unique worldwide achievement.

ERZHAUSEN, LOWER SAXONY

The Erzhausen pumped storage power plant is located near the small town of Erzhausen between Hannover and Göttingen in Lower Saxony and was first commissioned in 1964. In 2011 and 2016, ANDRITZ received orders for the general rehabilitation of units #2 and #4, which were successfully completed in 2012 and 2017, respectively.

GARS, BAVARIA

In order to increase the production potential of the existing barrage, it was decided to build a further hydropower plant at Gars. ANDRITZ was awarded a contract in 2011 for the supply of a compact Bulb turbine with a rotor diameter of 3,650 mm and an output of 5 MW. The contract included a directly coupled synchronous generator (6.3 kV) as well as the complete process control and electro-technical equipment. Using an additional 100 m^3/sec of water flow some 13.7 million kWh was produced. About 3,400 households have been supplied with electricity from renewable energy ever since, saving around 11,000 tons of CO_2 each year.

RAG WALSUM

ANDRITZ supplied three large heavy-duty mining (HDM) submersible motor pumps for a German mining company for a prestigious project to save millions of liters of drinking water. (→ see article page 55)

Langenprozelten, Bavaria

TO KNOW

GENERAL FACTS

Population: **82,695 Mio.**
Access to electricity: **100%**
Installed hydro capacity: **14,782 MW**
Share of generation from hydropower: **3%**
Hydro generation per year: **19,700 GWh**
Technically feasible hydro generation potential: **24,700 GWh**

ANDRITZ HYDRO IN THE COUNTRY

Installed and/or rehabilitated capacity: **6,761 MW**
Installed and/or rehabilitated units: **2,257**
Locations: **Ravensburg, Berlin**

Source Facts:The World Bank, IHA, CIA Factbook, Hydropower & Dams World Atlas 2018