HYDRONEWS

№39

ENGLISH Magazine of ANDRITZ Hydropower / №39 / 11-2025

POWER AND THE RIVER OF LIFE

Energy, economy, and diversity: Why rivers are more than just water

ANDRITZ

Latest News & Highlights

India

Integration of renewables gains momentum

Gandikota pumped storage plant will help balance the growing share of solar and wind energy.

ANDRITZ has received its third consecutive order from Adani Green Energy to supply seven units for the 1,800 MW Gandikota project – strengthening India's renewable energy supply. The plant will play an important role for energy storage and assist in grid stability from intermittent renewable energy. ANDRITZ's turnkey delivery includes design, manufacturing, installation, and commissioning.

👉 Gandikota, Andhra Pradesh, India: 1,800 MW
🛠 Seven reversible pump turbines, motor generators, and related electromechanical equipment on a turnkey basis

Thailand

Thailand's hydropower legacy gets a makeover

Srinagarind hydropower plant enters the next chapter with ANDRITZ.

The Electricity Generating Authority of Thailand (EGAT) has awarded ANDRITZ the contract to modernize the two 180 MW pump turbine units at the Srinagarind hydropower plant, reinforcing Thailand's commitment to sustainable energy. The upgrade will enhance efficiency and significantly extend the plant's operational life.

ANDRITZ continues its five-decade legacy of hydropower innovation in Thailand.

👉 Srinagarind, Kanchanaburi, Thailand: 360 MW
🛠 Pump turbines, motor generators, and related electromechanical equipment and auxiliaries

India

Driving clean energy growth

Tarali pumped storage plant to boost India's renewable grid.

ANDRITZ will equip Adani Green Energy's 1,500 MW Tarali pumped storage plant in Maharashtra, supporting India's clean energy goals with advanced hydropower solutions. This repeat order highlights ANDRITZ's trusted role in India's hydropower expansion.

The project will help balance variable renewables and strengthen grid reliability.

👉 Tarali, Maharashtra, India: 1,500 MW
🛠 Pump turbines, motor generators, and related electromechanical equipment

Slovenia

Going next gen

The **Formin hydropower plant** is being completely refurbished.

Dravske elektrarne Maribor (DEM) partners with ANDRITZ to upgrade the 45-year-old Formin hydropower plant, increasing its capacity to 130 MW and enhancing Slovenia's renewable energy output.

This is the final plant in DEM's fleet on the Drava River to undergo modernization. The project reflects a shared commitment to sustainability and energy efficiency.

👉 Formin, Drava River, Slovenia: 130 MW
🛠 Design, manufacturing, installation, testing, and commissioning of the refurbished and uprated units along with associated auxiliaries

Italy

Alpine innovation

Valpelline hydropower plant is set for a high-tech transformation.

Compagnia Valdostana delle Acque (CVA) has selected ANDRITZ for a turnkey rehabilitation of the historic Valpelline hydropower plant, delivering EU Grid Code-compliant upgrades and future-ready performance.

The project includes complex logistics and precision engineering across several ANDRITZ locations. Work will begin in 2027, with completion scheduled for 2029.

👉 Valpelline, Aosta Valley, Italy: 150 MW after rehabilitation
🛠 Two new synchronous generators, four new Pelton runners, four new spherical valves, new injectors penstock components, and a complete cooling and electrical system upgrade

Ireland and Northern Ireland

Future-ready grid

Four **new synchronous condenser** projects awarded for the Low Carbon Inertia Service in Ireland and Northern Ireland.

ANDRITZ and ELECNOR secure contracts to deliver cutting-edge grid stability solutions for the substations Glencloosagh, Coleraine, Quarry Lane, and Coolkeeragh, enabling zero-carbon resilience. These facilities will replace fossil-fueled grid services with clean alternatives.

The projects are key to meeting net-zero targets in both Ireland and Northern Ireland.

👉 Glencloosagh, Co. Kerry, Ireland:
🛠 250 MVA salient pole

👉 Quarry Lane, Ballysumaghan Co. Sligo, Ireland:
🛠 250 MVA salient pole

👉 Coolkeeragh, Maydown in Derry-Londonderry, Northern Ireland:
🛠 250 MVA salient pole

👉 Coleraine, Causeway Coast and Glens, Northern Ireland:
🛠 110 MVA salient pole

FROM WATER-TO-WIRE our comprehensive hydro expertise

Our hydropower service and product portfolio supports the entire lifecycle of a hydropower plant, from design and engineering to manufacturing, installation, on through to commissioning and training. Whether the project at hand concerns hydromechanical and electromechanical equipment for new hydropower plants or the modernization and automation of existing facilities, we are constantly striving to meet our customers' needs and requirements with top-tier technology and innovative energy solutions.

ANDRITZ provides custom-tailored solutions "from water-to-wire" – all from a single source.

ANDRITZ A GLOBAL LEADER IN TECHNOLOGY AND INNOVATION

More than **80** countries

More than **280** locations

More than **30,000** employees

FOR GROWTH THAT MATTERS

ANDRITZ HYDROPOWER

More than **185 years'** experience in turbine design

More than **492,000 MW** of installed and modernized power capacity

More than **33,300** turbine units delivered

More than **135 years'** experience in electrical engineering

ANDRITZ AND ANDRITZ HYDROPOWER FACTS & FIGURES

ANDRITZ AG FINANCIAL FIGURES BUSINESS YEAR 2024

Order intake
8.3 billion EUR

Order backlog (as of end of period)
9.7 billion EUR

Revenue
8.3 billion EUR

Operating results (EBITA)
743 MEUR

Technology and the energy transition: Building a green future

Dear valued customers,

Welcome to the new issue of our customer magazine HydroNews.

The key challenge of our time is to successfully develop a stable, sustainable, and equitable energy system. Hydropower already plays a key part in this endeavor as the world's single largest source of low-carbon energy. But just as important is the role hydropower can play in enabling other forms of renewable energy.

Frédéric Sauze

Harald Heber

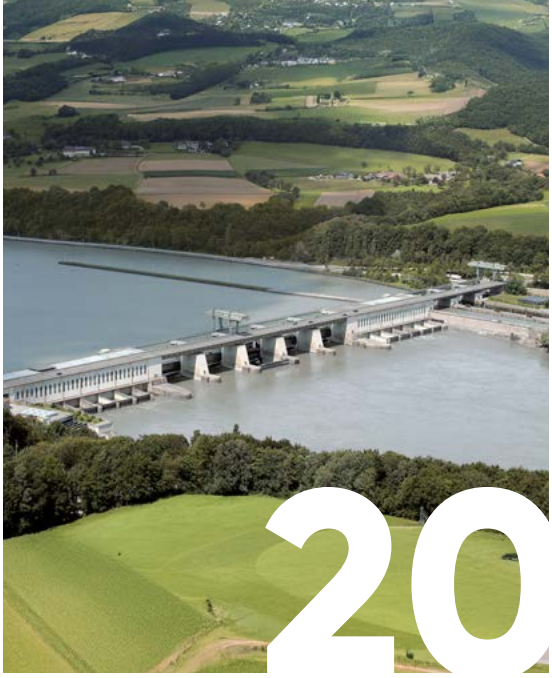
Gerhard Kriegler

Pumped storage capacity is a prime example, acting as a simple and efficient route to responsive, reliable, and long-term bulk energy storage and helping to smooth the inherent variability of wind or solar energy. Examples of successful pumped storage power plants that support the energy transition in this issue include Zhen An in China and Abdelmoumen in Morocco. In India, ANDRITZ received major orders for pumped storage power plants this year. In India, ANDRITZ was awarded major contracts for pumped storage plants this year. But with the rise of renewable resources, new issues are emerging. One is the growing difficulty in maintaining stable grid frequency and voltage. Previously large rotating machines with a high mechanical inertia such as the steam turbines in fossil-fuelled power stations could overcome any fluctuations that emerged. Now, as these plants are phased out, stability is becoming harder to achieve. Hydropower is a key solution, working in harmony with other technologies.

The breakthroughs aren't limited to hydropower alone though. As a global supplier of electromechanical equipment and services, ANDRITZ offers a whole suite of products that can make a significant contribution to grid stability and resilience. The ANDRITZ Synchronous Condenser as installed in Tucumã and Feijo in Brazil is an example which is able to provide the grid services that are ultimately needed to enable greater development of renewables. ANDRITZ has received a new contract in the USA for the Bakersfield substation, where our synchronous condensers will make a vital contribution to meeting the growing energy demand in Texas. Under the Low Carbon Inertia Service program, ANDRITZ was selected to supply four synchronous condensers to Ireland and North Ireland to make the grid fit for the future.

ANDRITZ has used its expertise and experience – underpinned by extensive R&D capabilities – to serve the needs of the energy system and our customers, and will continue to do so as a new renewable energy era emerges.

Yours sincerely,
Frédéric Sauze, Harald Heber, Gerhard Kriegler



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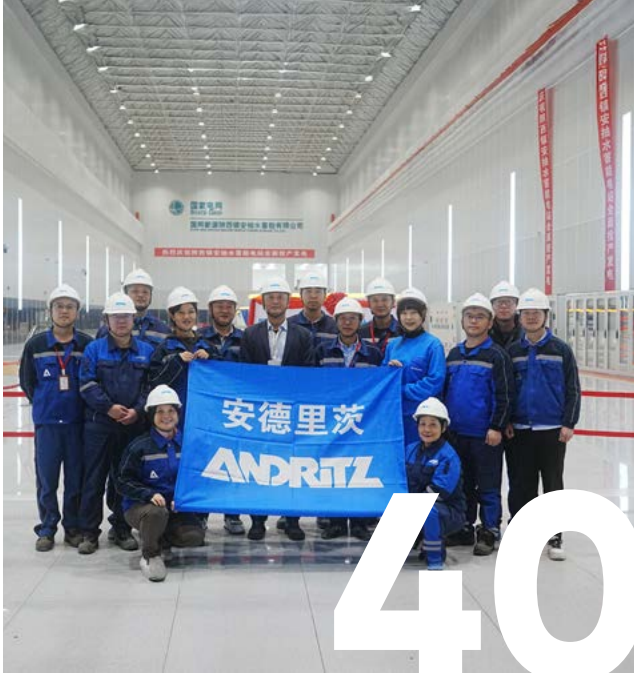

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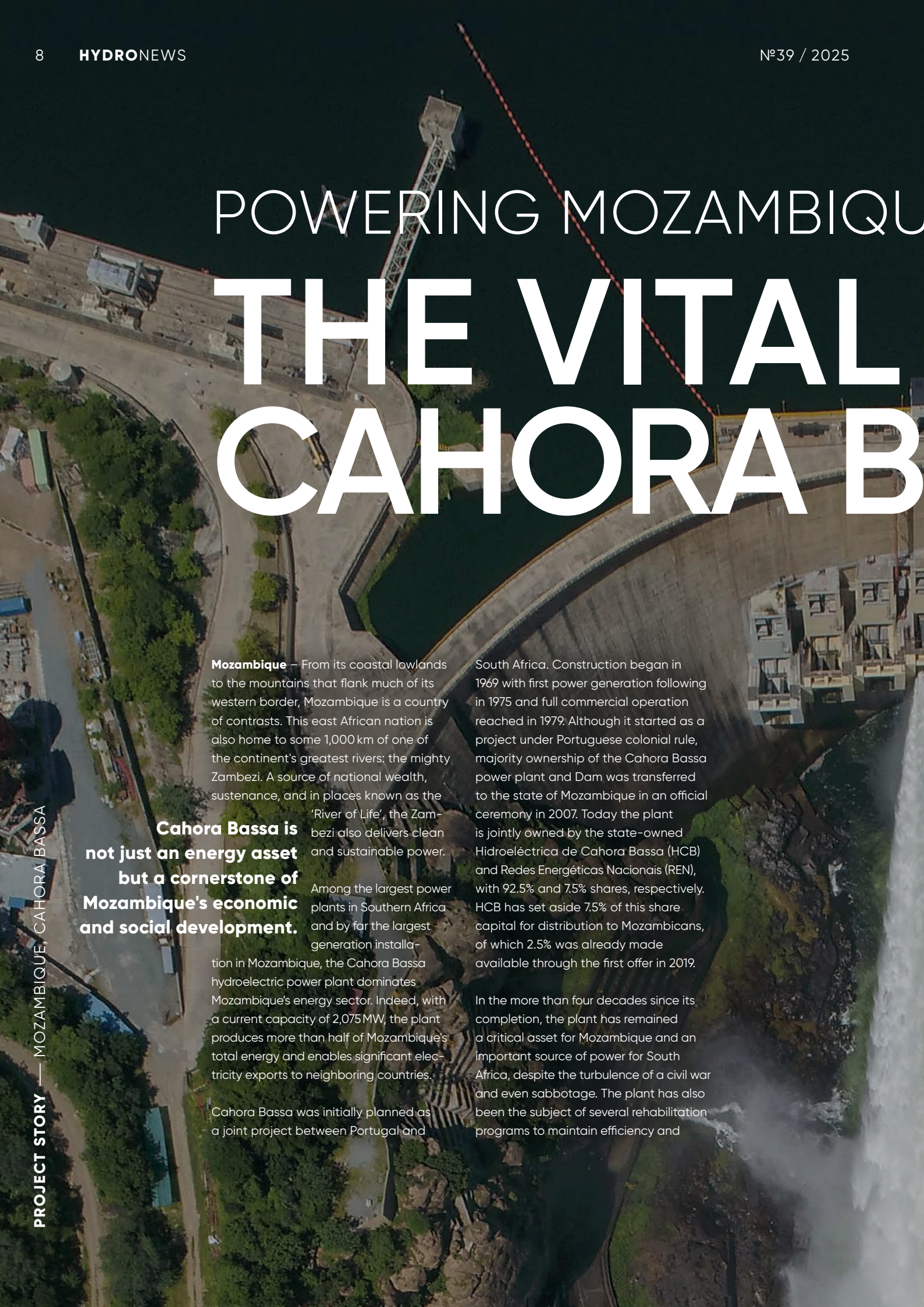
SPECIAL TOPICS

OUR PROJECTS

PROJECT UPDATES



POWERING MOZAMBIQU

THE VITAL CAHORA B

PROJECT STORY — MOZAMBIQUE, CAHORA BASSA

Cahora Bassa is not just an energy asset but a cornerstone of Mozambique's economic and social development.

Mozambique – From its coastal lowlands to the mountains that flank much of its western border, Mozambique is a country of contrasts. This east African nation is also home to some 1,000 km of one of the continent's greatest rivers: the mighty Zambezi. A source of national wealth, sustenance, and in places known as the 'River of Life', the Zambezi also delivers clean and sustainable power.

Among the largest power plants in Southern Africa and by far the largest generation installation in Mozambique, the Cahora Bassa hydroelectric power plant dominates Mozambique's energy sector. Indeed, with a current capacity of 2,075 MW, the plant produces more than half of Mozambique's total energy and enables significant electricity exports to neighboring countries.

Cahora Bassa was initially planned as a joint project between Portugal and South Africa. Construction began in 1969 with first power generation following in 1975 and full commercial operation reached in 1979. Although it started as a project under Portuguese colonial rule, majority ownership of the Cahora Bassa power plant and Dam was transferred to the state of Mozambique in an official ceremony in 2007. Today the plant is jointly owned by the state-owned Hidroeléctrica de Cahora Bassa (HCB) and Redes Energéticas Nacionais (REN), with 92.5% and 7.5% shares, respectively. HCB has set aside 7.5% of this share capital for distribution to Mozambicans, of which 2.5% was already made available through the first offer in 2019.

In the more than four decades since its completion, the plant has remained a critical asset for Mozambique and an important source of power for South Africa, despite the turbulence of a civil war and even sabbotage. The plant has also been the subject of several rehabilitation programs to maintain efficiency and

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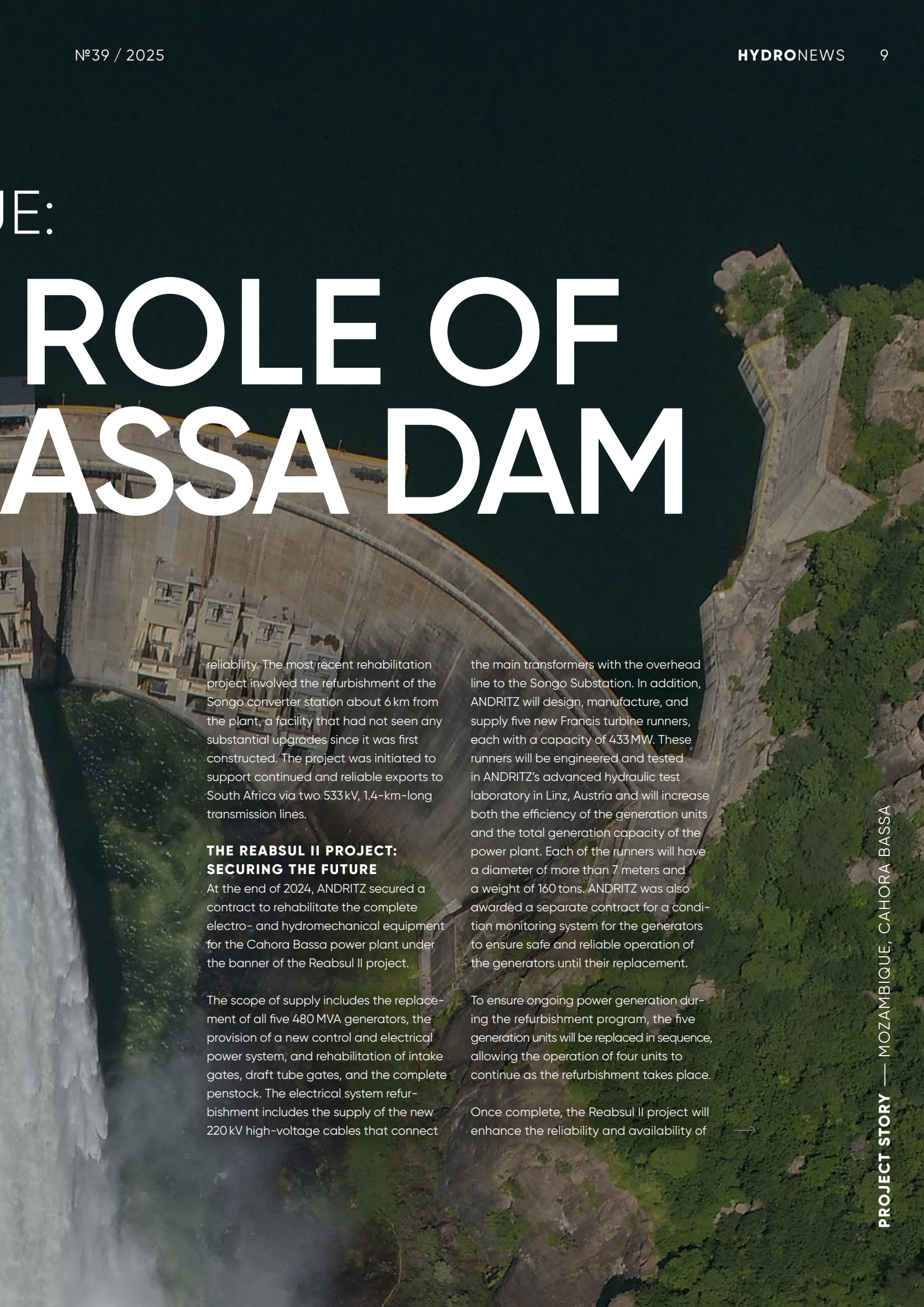
ROLE OF ASSA DAM



reliability. The most recent rehabilitation project involved the refurbishment of the Songo converter station about 6 km from the plant, a facility that had not seen any substantial upgrades since it was first constructed. The project was initiated to support continued and reliable exports to South Africa via two 533 kV, 1.4-km-long transmission lines.

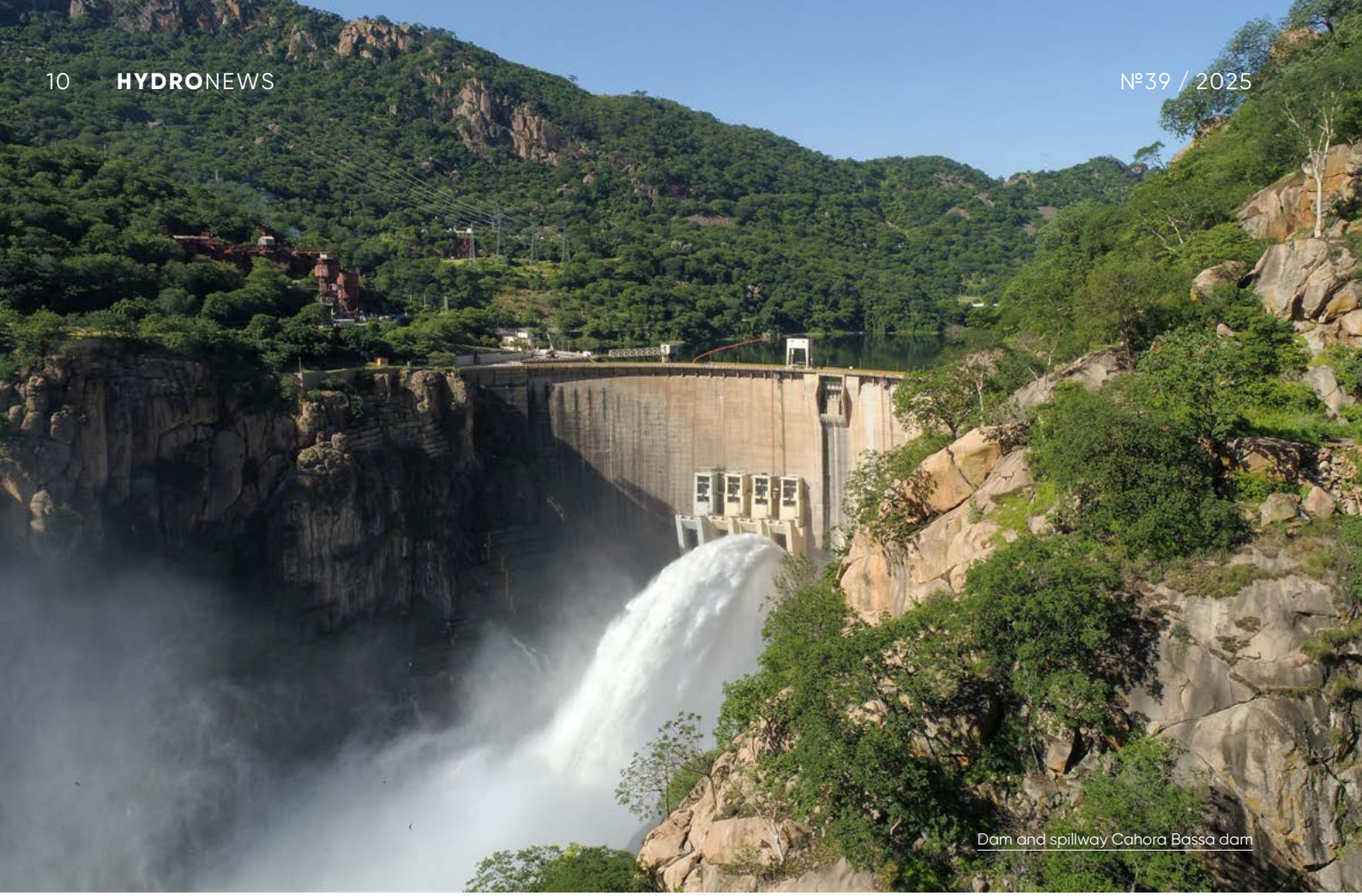
THE REABSUL II PROJECT: SECURING THE FUTURE

At the end of 2024, ANDRITZ secured a contract to rehabilitate the complete electro- and hydromechanical equipment for the Cahora Bassa power plant under the banner of the Reabsul II project.

The scope of supply includes the replacement of all five 480 MVA generators, the provision of a new control and electrical power system, and rehabilitation of intake gates, draft tube gates, and the complete penstock. The electrical system refurbishment includes the supply of the new 220 kV high-voltage cables that connect the main transformers with the overhead line to the Songo Substation. In addition, ANDRITZ will design, manufacture, and supply five new Francis turbine runners, each with a capacity of 433 MW. These runners will be engineered and tested in ANDRITZ's advanced hydraulic test laboratory in Linz, Austria and will increase both the efficiency of the generation units and the total generation capacity of the power plant. Each of the runners will have a diameter of more than 7 meters and a weight of 160 tons. ANDRITZ was also awarded a separate contract for a condition monitoring system for the generators to ensure safe and reliable operation of the generators until their replacement.

To ensure ongoing power generation during the refurbishment program, the five generation units will be replaced in sequence, allowing the operation of four units to continue as the refurbishment takes place.

Once complete, the Reabsul II project will enhance the reliability and availability of →



Dam and spillway Cahora Bassa dam

this nationally and regionally vital power plant for decades to come.

In addition to the installed hydropower capacity, a 400 MW solar plant is also planned for a site next to the Cahora Bassa Dam, which will both diversify and expand HCB's generation capacity. This solar project is being developed as part of a collaborative agreement between HCB and the International Finance Corporation (IFC).

Cahora Bassa Dam stands out as one of the largest on the African continent with a capacity of 2,075 MW, providing a major part of Mozambique's total energy.

Thanks to the Zambezi, hydroelectric power dominates Mozambique's energy mix today and is expected to make further significant contributions to more widespread electrification and economic development in the future. With a population of less than 36 million, Mozambique is characterized by its young population, with an average age of just over 16. The majority live in rural areas, although urbanization is increasing. The country has seen significant development over recent decades with the electrification rate improving from 5% in 2001 to 31% in 2020. The government is set to continue this impressive rate of development by setting a target to achieve universal electricity access by 2030. Given the scale of the infrastructure needed to meet this goal, an electricity law was passed in 2022 to promote private-sector investments with the aim of expanding the electricity transmission and distribution network and increasing renewable energy contributions to the energy mix.

Mozambique is rich in natural resources and enjoys a diverse economy driven primarily by agriculture. Although this sector employs the majority of the workforce, the industrial and services sectors are also significant. Alongside its hydropower potential, Mozambique is also rich in other renewable resources like solar and wind as well in coal, natural gas, and minerals. Despite some challenges, the nation's location on the Indian Ocean, young population, and natural resources represent ongoing opportunities for

economic growth – and the economy has been growing steadily.

To help meet growing energy demand and ambitious development goals, further transformation is expected from the nation's estimated hydropower potential of 12,000 MW. Planned key projects include an extension of the Cahora Bassa power plant on the North Bank of the river, which will use the same reservoir and add additional capacity of about 1,300 MW.

Downstream of Cahora Bassa, another significant hydropower initiative is the Mphanda Nkuwa project. This power plant is expected to add a further 1,500 MW of hydropower capacity to the national fleet and Mozambique is already collaborating with an EDF-led consortium to advance this development. Several other substantial hydropower projects are also under consideration, including the 1,000 MW Chemba project in Sofala, the 650 MW Lupata project in Tete, and the Boroma hydropower plant with a planned capacity of 210 MW.

These projects will join Cahora Bassa and other nationally significant hydropower plants including the 25 MW Massingir hydroelectric power station located on the Olifants (now Lapelle) River, the 44 MW Chicamba hydroelectric power station located in Manica Province, and the 41 MW Mavuzi hydroelectric power station, all of which are vital to Mozambique's electricity infrastructure.

ANDRITZ is proud to be awarded the prestigious contract for the Reabsul II project, which highlights Cahora Bassa's commitment to supporting Mozambique's hydropower market. This project will help ensure clean and sustainable energy for the future, supporting the people of Mozambique on their journey to an equitable, accessible, and sustainable energy system.

View upstream of Cahora Bassa

Signing of the contract for the rehabilitation project REABSUL II of Cahora Bassa

TECHNICAL DETAILS

Cahora Bassa:

Output: 5 × 433 MW (2,165 MW after rehab)
Head: 103.5 m
Speed: 107.14 rpm
Runner diameter: 7,145 mm
Runner weight: 160 tons

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A PARTNERSHIP POWERING SOUTH AMERICA

ANDRITZ AND YACYRETÁ

Argentina, Paraguay – The Yacyretá hydroelectric power plant, located on the Paraná River on the border between Argentina and Paraguay, has long stood as a cornerstone of South America's energy infrastructure. Since beginning commercial operations in 1994, the plant has supplied clean, renewable power to millions. Boasting an installed capacity of 3,200 MW, it is one of the continent's largest power stations.

At the heart of Yacyretá's continued success is a long-standing and trusted partnership with ANDRITZ. For over two decades, ANDRITZ has provided innovative solutions and technical expertise to help evolve and modernize the plant. This collaboration reached a milestone in 2021 when ANDRITZ signed an important contract with Entidad Binacional Yacyretá (EBY) for the supply of 18 new excitation systems based on the cutting-edge HIPASE-E technology.

Executed by ANDRITZ Hydropower's expert teams, this project encompassed full-scope engineering, manufacturing, testing, and commissioning. It amply demonstrates the company's ability to deliver complete, customized solutions. Completed successfully in early 2024, the project significantly enhanced the control and efficiency of the generating units, laying the foundation for future upgrades.

TECHNICAL DETAILS

Yacyretá:

Total output: 3,200 MW

Scope output: 4 × 172 MVA

Head: 20 m

Av. Annual power generation: 20,091 GWh

Building on this success, a new and even more ambitious contract was signed in early 2025 between ANDRITZ Hydropower Brazil and EBY. The scope: to rehabilitate four of the plant's generators. This comprehensive rehabilitation project includes the design, manufacturing, and installation of four new stator windings, field services, and commissioning. With a project duration estimated at 36 months, the modernization will further boost the safety, stability, and reliability of the generating units.

"The execution of this project will bring significant benefits to the Yacyretá plant by improving operational safety and unit stability. Stator windings are critical and sensitive components for efficient energy generation and modernizing these parts will ensure greater reliability for the system," explained Vinicius Martinelli, Head of Sales for the Service & Rehabilitation division at ANDRITZ in Brazil.

ANDRITZ's role in this rehabilitation effort reinforces its strategic focus on service and rehabilitation in South America. The contract is the largest ever awarded to the company's Service & Rehabilitation division in Brazil and stands as a testament to the trust and confidence placed in ANDRITZ by EBY.

Key to winning the contract was the close cooperation and knowledge exchange between ANDRITZ and EBY during the preliminary site assessment phase. This collaborative approach enabled a thorough understanding of the condition and requirements of the plant's equipment, paving the way for an efficient and effective modernization strategy.

A lasting partnership fuels modernization and reliability at one of the continent's largest hydro plants.

As engineering details are finalized and the manufacturing phase begins, ANDRITZ will continue to uphold its commitment to quality, safety, and sustainable development. The modernization of Yacyretá is not just a technical achievement, it represents a vision for the future of hydropower in the region.

This latest initiative underscores the power of partnership and the impact of long-term collaboration. ANDRITZ and Yacyretá are not only preserving a legacy of clean energy, they're building a stronger, more resilient future for South America's power supply.

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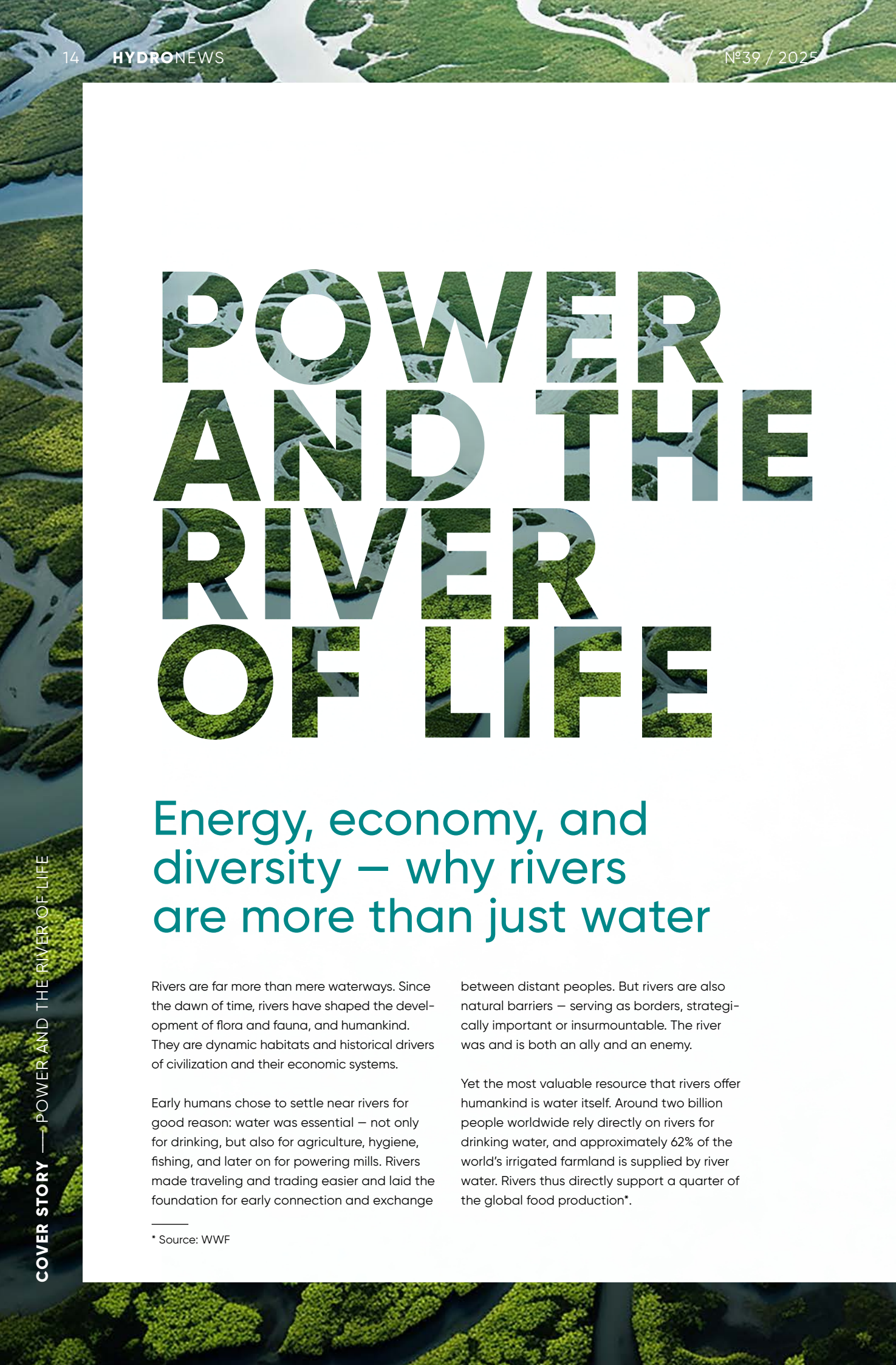

POWER AND THE RIVER OF LIFE

Energy, economy, and diversity — why rivers are more than just water

Rivers are far more than mere waterways. Since the dawn of time, rivers have shaped the development of flora and fauna, and humankind. They are dynamic habitats and historical drivers of civilization and their economic systems.

Early humans chose to settle near rivers for good reason: water was essential — not only for drinking, but also for agriculture, hygiene, fishing, and later on for powering mills. Rivers made traveling and trading easier and laid the foundation for early connection and exchange between distant peoples. But rivers are also natural barriers — serving as borders, strategically important or insurmountable. The river was and is both an ally and an enemy.

Yet the most valuable resource that rivers offer humankind is water itself. Around two billion people worldwide rely directly on rivers for drinking water, and approximately 62% of the world's irrigated farmland is supplied by river water. Rivers thus directly support a quarter of the global food production*.

* Source: WWF

“Where water flows, life begins – not just in nature, but in civilization.”

Today, rivers are also central pillars of energy production, and their water reliably supplies electricity to millions – sustainably and low in CO_2 emissions. However, gathering this economic and social value also comes with challenges. Hydropower plants must balance energy generation, navigation, and environmental protection.

"The Danube knows no borders – it connects people, nations, and ideas."

Flood control, fish migration, and ecological compensation are just as important in planning hydropower projects as turbine technology or reservoir management. Modern projects are only approved after years of planning, environmental assessments, and public participation – all taking place under the strictest environmental regulations.

PRESERVING BIODIVERSITY – WHY A HEALTHY RIVER MEANS MORE THAN WATER

Rich in biodiversity, riverbanks and riverbeds are home to countless plant and animal species – many of them highly specialized and sensitive to disruption. Protecting this biodiversity is a major priority today. Every human intervention, whether riverbank reinforcement, hydropower development, or agriculture, affects this finely balanced ecosystem.

The Danube-Auen National Park stretches 38 km from Vienna to the confluence of the Morava and the Danube. Created in 1996, it is one of the largest intact and continuous floodplains in Central Europe.

Central to today's discourse is renaturation. In many regions, old river courses are being restored, artificial straightening is being reversed, and floodplain forests are being revitalized. Why? Because near-natural rivers not only provide habitats for animals, but also key services to people. They buffer floods, improve water quality, and support the river's self-purifying abilities.

A central issue is fish migration. Many species, such as salmon, huchen, or eel, travel long distances to spawn. Dams, weirs, or fortified banks can potentially block their path. Without continuous river systems, spawning new generations becomes almost impossible and entire populations may face extinction. This is why all modern hydropower plants are now equipped with fish passages. Some are spectacular, such as "fish lifts", but there are also less obvious bypass streams designed in a natural style.

Yet our rivers are not only threatened by technical obstacles. Climate change is causing increasing droughts, lower water levels, and overheating. Rivers lose volume and at the same time the risk of extreme weather rises: Heavy rainfall hits dried-out soil, and floods are becoming more frequent.

THE DANUBE AS A PROMINENT EXAMPLE

The Danube is a prime example of these challenges. At 2,850 km long, it is Europe's second-longest river, flowing from the mountainous regions of the Black Forest in Germany to the coastal plains of the Black Sea. With a catchment area of

Vienna, the capital of Austria with over 2 million inhabitants, lies on the Danube. The artificially created Danube Island between the Danube and the New Danube protects against flooding and also provides an important recreational area for the city's population.

817,000 km², it connects 10 countries and passes through many major cities including Vienna, Bratislava, Budapest, and Belgrade. It is a vital lifeline for millions of people, the economy, and the environment.

Along the entire Danube, from source to mouth, numerous hydropower plants and dams have been constructed over the years for both energy generation and navigation. In Germany, the Donau power plants are well known for supplying electricity to the railway, for example. In Austria, there is a large number of power plants on the Danube, including Aschach, Ottensheim-Wilhering, Wallsee-Mitterkirchen, Ybbs-Persenbeug, Melk, Altenwörth, Greifenstein, and Freudenau. These form the backbone of the national electricity supply. There are also significant hydropower plants in Slovakia, Hungary, Croatia, Serbia, Bulgaria, and Romania. Among them is the Iron Gate, with its Romanian (Portile de Fier I) and Serbian side (Đerdap I) combined, forming the Danube's most powerful hydropower facility with more than 2,300 MW.

Numerous international initiatives are underway focusing on renaturation, navigation optimization, and energy production – highlighting the complexity of managing such a river. The Danube is a symbol of the delicate balance between use and protection, and of cross-border cooperation.

Programs and institutions such as viadonau, the International Commission for the Protection of the Danube River (ICPDR), the Danube Commission, or the EU LIFE Network Danube Plus demonstrate the opportunities and this spirit of collaboration. Through these projects, ecological corridors are being restored, and joint protective measures are implemented. Sustainability truly knows no borders.

ANDRITZ – HIGH-TECH, SUSTAINABILITY, AND RIVER ENGAGEMENT

As one of the world's leading suppliers of hydropower technology, ANDRITZ has a unique connection to rivers. For decades, our expertise has shaped the development of modern, efficient, and environmentally friendly power plant solutions – from small hydro plants to large-scale river projects across both Europe and worldwide.

Along the Danube, ANDRITZ has been involved in more than half of all projects to date, often as an Original Equipment Manufacturer (OEM) – including the

"Technology alone is not enough. It takes responsibility, foresight, and respect for the river."

Alexander Schwab, Senior Vice President ANDRITZ Hydropower

Freudenau run-of-river plant in Vienna. This is a showcase project for balancing navigation, energy, and fish protection. The turbine and generator technology for many other key sites also originates from ANDRITZ. They include Aschach, Ybbs-Persenbeug, Wallsee-Mitterkirchen, and Altenwörth plants, to name a few.

In addition to providing generation equipment for hydropower, ANDRITZ's portfolio also includes a product and service range covering all types of hydro-mechanical equipment, including gates, weirs, power plant intakes, and outlet structures. Two highlights along the Danube are the flood protection gates in the ports of Vienna and Linz, which make the Danube and its surroundings safer and better protected.

"The power of water is ancient – our technology makes it futureproof."

Alexander Schwab, Senior Vice President
ANDRITZ Hydropower

ANDRITZ also focuses on fish-friendly solutions, combining hydraulic expertise with biological insight to ensure efficient technology and healthy fish populations. In addition to improving efficiency and flexibility to maximize the economic potential of hydropower plants, a key research area is the minimization of their environmental impact. Of special interest are fish-compatible designs, which are becoming increasingly important for new hydropower investments.

Hydraulic and mechanical design choices in hydro turbines can significantly affect fish survivability, with features like reduced runner gaps, minimized cavitation design, and blunt runner blades. ANDRITZ has incorporated fish-friendly designs in its technology since the early 1990 using CFD-supported biological assessment tools to evaluate stressors on fish. ANDRITZ has also supplied over 130 Kaplan turbines with oil-free runner hubs to reduce water contamination and enhance the environmental sustainability of hydropower plants. These innovations continue to be driven by dedicated R&D efforts.

Efficiency, durability, and ecological optimization are not mutually exclusive. In pilot projects and in cooperation with operators, universities and ecologists, ANDRITZ continuously works to minimize the impact of hydropower on nature. Ongoing advances of our industry include improved turbine technologies, new operational schemes, new fish passage

One of the new Kaplan turbine runners for the Ybbs-Persenbeug power plant, a run-of-river power plant on the Austrian Danube, which was renovated as part of the Ybbs 2020 rehabilitation project.

Lowering of generator rotor at the Wallsee-Mltterkirchen power plant. ANDRITZ is not only the OEM for, but is also involved in the comprehensive refurbishment of the electromechanical equipment.

The Freudenau Power Plant is a run-of-river plant on the Danube in Vienna, the Austrian capital, and is the tenth and last of the Austrian Danube power plants.

systems, smart flood control technologies, and resource-efficient material use on all rivers around the world – from A to Z - from the Amazonas to the Zambezi.

OUTLOOK: A FUTURE WITH AND FOR THE RIVER

Rivers are the ultimate lifeline – ecologically, economically, and emotionally. They deserve our full attention and care. The challenges – climate change, rising energy demand, and biodiversity protection – are considerable, but so too are the opportunities. Hydropower plays a key role in producing clean, reliable, and local energy. With cutting-edge technology, sustainable planning, and a deep understanding of the value of river habitats, hydropower provides energy in harmony with nature so that we can secure the future of our rivers.

With its core values of foresight and care, ANDRITZ will continue to innovate responsibly, ensuring that rivers remain powerful and full of life – sources of energy of energy, places of biodiversity, and symbols of unity.

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HOW DOES A RUN-OF-RIVER PLANT WORK?

Run-of-river power plants generate electricity using the natural flow of rivers without large reservoirs. Water is directed through turbines, and output depends on river flow and head. These plants are eco-friendly but sensitive to droughts. They include river power plants, built directly in the river, and diversion plants, which guide water through a channel before returning it to the river. Both types of run-of-river power plants are regulated to maintain a minimum environmental river flow.

Run-of-river power plants are highly reliable, continuously operating facilities that generate electricity around the clock. They play a key role in covering the base load in the power system.

2 billion people

Around two billion people worldwide rely directly on rivers for drinking water.

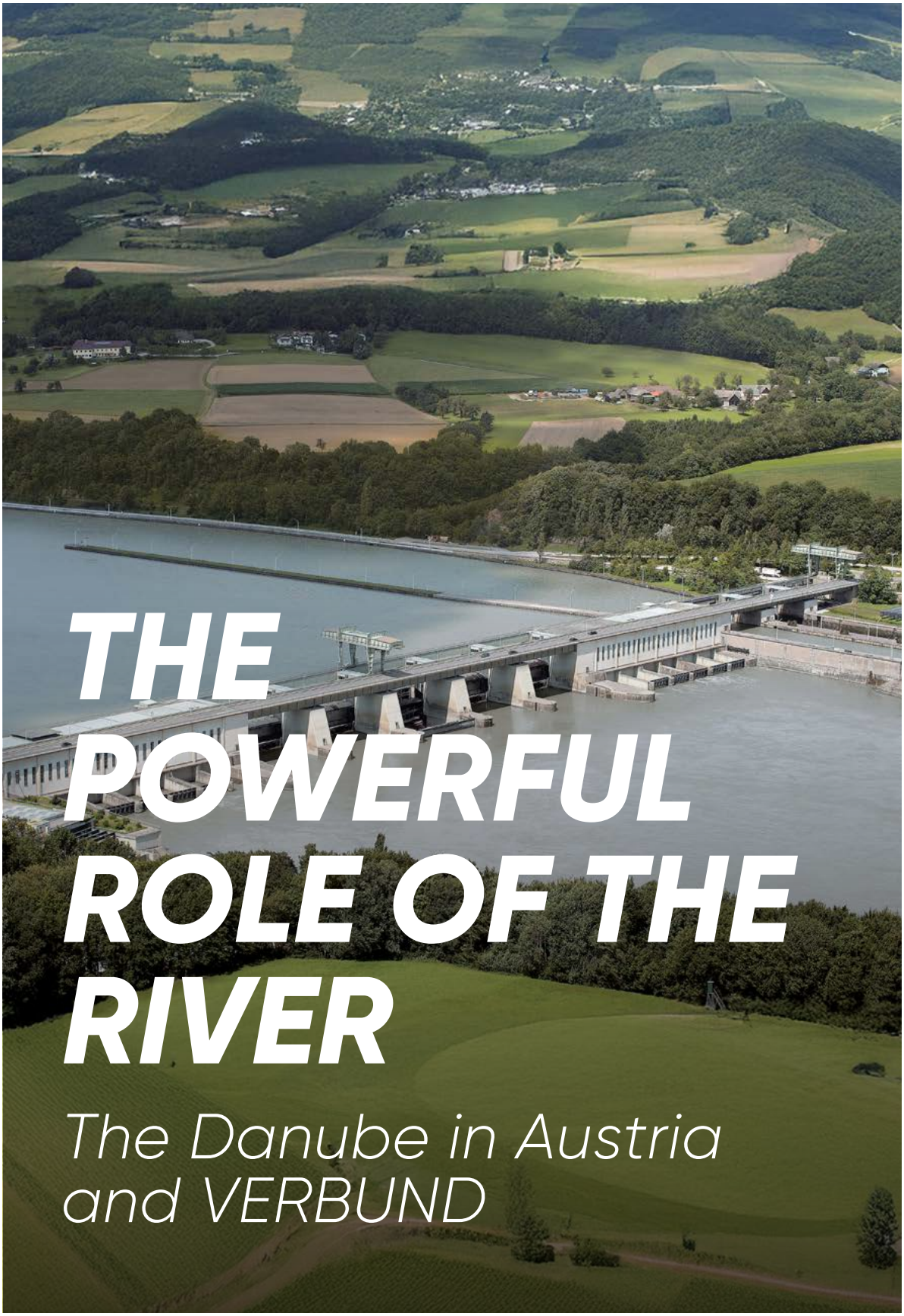
25% of the global food production

Rivers directly support a quarter of the global food production.

62% of irrigated farmland

Approximately 62% of the world's irrigated farmland is supplied by river water.

Source: WWF



THE POWERFUL ROLE OF THE RIVER

The Danube in Austria and VERBUND

Ybbs-Persenbeug run-of-river power plant on the Danube @Johannes Wiedl

How Austria's largest hydropower producer, VERBUND, connects energy, the environment, and the future: In conversation with Dr. Karl Heinz Gruber.

Interview with Dr. Karl Heinz Gruber

Managing Director of VERBUND Hydro Power GmbH

Since 2007, Dr. Gruber has been Managing Director and Member of the Executive Board of VERBUND Wasserkraft, responsible for all hydropower activities in Austria, Germany, Albania, and Spain, and active in national and international associations in the field of power generation. He is Chairman and Spokesman for Generation at Oesterreichs Energie (representing the interests of all electricity companies in Austria), a member of the Executive Board of the Bavarian Energy and Water Industry Association, a member of the Committee for Energy and Climate Policy at the Bavarian Industry Association, and Chairman of the Hydropower Group at vgbe Energy, the European association of around 500 energy suppliers.

Dr. Gruber, could you please give us a brief overview of VERBUND?

VERBUND is Austria's leading energy company, operating 135 hydropower plants in Austria, Germany and Albania. It is also one of Europe's largest hydropower producers. 96% of our 37 TWh of generated electricity in 2024 came from renewables – primarily hydropower (90%). In addition, we are investing in wind power, photovoltaics, batteries, and green hydrogen. Besides electricity generation, we also operate Austria's transmission grid, connecting industries and households with green energy.

What role does the Danube play for VERBUND?

The Danube forms the backbone of our annual electricity production. It runs through Austria for about 350 km, offering a natural gradient of over 150 meters. Along the Danube, we operate eleven power plants – from Jochenstein on the German border to Freudenau in Vienna. With an installed capacity of 2.24 GW and an energy production of 14.7 TWh, it accounted for around 44% of our total hydropower output in 2024.

What technical challenges do the power plants on the Danube face, especially given increasing flood risks?

Our Danube power plants are run-of-river without large storage reservoirs. During floods, operations are precisely governed by officially approved operating procedures. We must shut down the turbines and open the weirs, and during extreme events also open the lock gates.

Hydropower is not just a source of energy, it also impacts ecosystems. How does VERBUND address this responsibility?

Even before the EU Water Framework Directive was adopted, we had already begun to ensure river continuity at our power plants. We've also implemented measures to improve river structures and restore habitats. Together →

VERBUND FACTS & FIGURES

(AS OF 2024)

Founded: 1947

Employees: ~ 4,400

Revenue: €8.2 billion
($9.6 billion)

Number of hydropower plants in AT, DE, AL: 135 (of which 117 are operated by VERBUND)
→ Capacity: **8.5 GW**
→ Generation: **33.5 TWh**

Annual electricity generation:
~ 37 TWh
(of which around **90%** is from hydropower)

Share of Austria's electricity demand: ~ 35%

Power plants on the Danube: 11
→ Capacity: **2.24 GW**
→ Generation: **14.7 TWh**
(**~ 44%** of VERBUND's hydropower output)

(Pumped) storage power plants: 23
→ Capacity: **3.9 GW**
→ Generation: **7.2 TWh**

Verbund

with partners like the BOKU University in Vienna, the Technical University of Munich, and the waterway operator viadonau, we carry out large-scale river restoration projects – especially along the Danube, but also on all other rivers, like Inn, Enns, and Traisen.

Can you name specific initiatives?

Some of our projects are European benchmarks: As part of the renaturation project LIFE+ Traisen, a 9.5 km straightened river section was transformed back into a near nature floodplain. At the Ottensheim-Wilhering plant, a 14.2 km-long bypass watercourse was created, which won the prestigious EU Natura 2000 Award. To date, we have invested over €200 million ($234.5 million) in such efforts, with an additional €200 million planned by 2030. The goal is to create a continuous river system with habitats for humans, animals, and plants alike.

Lowering of generator rotor at the Wallsee-Mitterkirchen power plant.
@Johannes Wiedl

What is the significance of the international award for your Life+ project "Danube Network" ?

The LIFE project set new standards in ecological river development – not only due to its scale, but also because of the results achieved. It demonstrates that technical flood protection, electricity generation, and nature conservation are not mutually exclusive. The "Distinguished Project Award" at the Fish Passage Conference 2024 was a special recognition of that success.

What roles do research and ecological development play?

Research plays an essential role. Together with universities and partners, we continuously develop new technologies, for example, in sediment management, hydropeaking

mitigation, or fish migration behavior. At the Christian Doppler Laboratory MERI in Vienna, we systematically analyze the ecological impact of our measures. In the "ÖkoReSch" initiative, together with the Christian Doppler Laboratory for Sediment Research and Management and other partners, we're developing standards for evaluating the ecological potential of residual flow sections. Since 2004, we have supported more than 160 research projects with a total investment volume of around €350 million ($410 million).

Hydropower is considered a mature technology. Are there still innovations?

Absolutely. Proven also means reliable and long-lasting, which is especially important now, as we fully transition our energy system to renewables. That's why I am deeply convinced that all our currently operational plants – which, by the way, have the highest value-added share among all renewable technologies in Europe – will continue to safely and efficiently generate and store domestic, CO_2-free electricity for the next 100 years and beyond.

The innovation potential is huge. Beyond the ecological projects on fish migration and river continuity, we are continuously working on more efficient turbines and generators, as well as smarter control systems. Digitalization is key: Real-time data analysis, predictive maintenance, robotics, digital twins, remote diagnostics, and enhanced cybersecurity all help make our plants safer, more efficient, and environmentally friendlier. Industrial partners like ANDRITZ play an important role in this.

One key project is the Operation & Security Center Hydro. Can you tell us about that?

We are centralizing the control of our 117 company-operated power plants in one single control center: the OSC Hydro. The goal is to enhance supply security, asset protection, and

Jochenstein run-of-river power plant on the Danube at the border between Austria and Germany. @Johannes Wiedl

IT security. Together with partners like ANDRITZ, we are currently building this high-security center with investments of over €100 million ($117 million). It will start operation in stages in 2026, beginning with a 24/7 control room. (See related article on page 26.)

What is VERBUND's modernization strategy?

Many plants were built in the 1950s to 1970s. We're investing in technical upgrades while also increasing efficiency. At the Ybbs-Persenbeug plant, for example, modernization of turbines and generators increased the annual output by about 80 GWh. We're currently modernizing nine plants along the Danube, Inn, Mur, and Drau rivers – including Jochenstein, Ottensheim-Wilhering, and Wallsee-Mitterkirchen, with a planned generation increase of 385 GWh.

In total, we are currently working on 14 projects in Austria and Southern Germany, including also pumped storage power plants, which will increase the annual electricity production by 470 GWh, turbine capacity by 660 MW, and pump capacity by 555 MW. →

What are your long-term expansion plans?

Our project pipeline includes over 40 projects – 80% of which are modernization measures, and 20% new builds. These also include new pumped storage power plants such as Riedl (300 MW) and Schaufelberg (480 MW). Overall, we plan to invest more than €4.7 billion ($5.5 billion) to generate an additional 1.1 TWh of electricity a year and provide 1,600 MW of new capacity.

The climate crisis is the defining issue of our time. How is VERBUND contributing to climate goals?

A rapid and economically viable transformation to a CO_2-free energy system is the order of the day. This transformation requires massive investments in all forms of renewable energy not just hydropower, but wind, photovoltaics, and green hydrogen, as well as the expansion of grid infrastructure and energy storage.

Austria, for example, aims to cover 100% of its electricity demand from renewables by 2030 and to be climate-neutral by 2040. Hydropower alone is to be expanded by 9–10 TWh by 2040. As the country's largest electricity producer, VERBUND plays a key role in this with its investment program.

We are expanding our production capacities at home and abroad, building new storage facilities, strengthening grids, and developing end-to-end solutions for green hydrogen with the goal of becoming an important European hydrogen player. Our strategy "Mission V" combines supply security with climate protection and value-generating growth.

The Danube Learning Workshop near the Ybbs-Persenbeug run-of-river power plant. @Johannes Wiedl

What role does hydropower play in combating climate change?

Of course, climate change affects hydropower and its impact on energy production is currently being studied in an interdisciplinary research project. At the same time, hydropower plays a central role in the fight against climate change: It generates 100% renewable electricity and enables the effective integration of wind and solar power. This flexibility helps store excess electricity, stabilize the grid, and support the phase-out of fossil fuels.

How is VERBUND addressing the future and the shortage of skilled workers?

We place great emphasis on in-house training. Currently, we are training about 160 apprentices in dual qualifications (electrical and mechanical engineering) at our locations in Kaprun, Ybbs-Persenbeug, and Töging. The graduation rate is nearly 100%. With our new "LernWerkStatt Donau" (Danube Learning Workshop), we offer a modern environment for hands-on training. At our technical center in Schwarzach we combine engineering expertise with the practical knowledge of experienced technicians to enhance the plant know-how of our employees. At the same time, we promote continuing education for all employees with an average of 40 training hours per year.

Finally, what is your personal wish for the future of hydropower?

I hope for stable, reliable, and fair regulatory conditions and equal treatment with all other renewable energy sources. That would send a strong signal to the industry and to everyone who believes in the power of water.

Thank you for your time, Dr. Gruber.

AUTHOR

Interview conducted by Marie-Antoinette Sailer, hydronews@andritz.com

Europe's longest fish pass (14.2 km) at Ottensheim-Wilhering restores Danube connectivity and fish-passability, renatures tributaries, creates habitats, and won the EU Natura 2000 Award. @Johannes Wiedl

LIFE+ Traisen: Austria's largest river revitalization project created a 9.5 km meandering "New Traisen," restoring wetlands, boosting biodiversity, and enabling fish migration to the Danube. @Johannes Wiedl

BIODIVERSITY & ENVIRONMENT
VERBUND'S COMMITMENT

LIFE PROJECTS IMPLEMENTED:

4 completed, **4** in progress

TOTAL INVESTMENT IN ECOLOGICAL MEASURES (2001–2030):

over **€400 million** ($469 million)

KEY HIGHLIGHTS:

Traisen river mouth:
9.5 km of floodplain restored

Ottensheim-Wilhering:
14.2 km bypass watercourse,
received the EU **Natura 2000 Award**

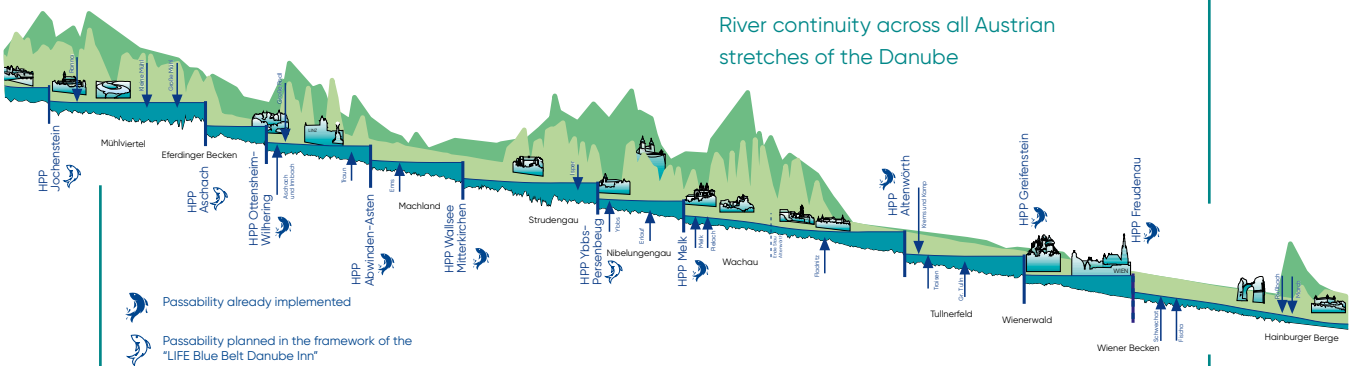
Altenwörth:
12.5 km bypass river,
connecting three **Natura 2000** areas

RESEARCH PARTNERS:

BOKU Vienna, TU Munich, CD labs
MERI & Sediment Management

GOAL BY 2030:

River continuity across all Austrian stretches of the Danube



On its journey through Austria, the Danube covers 350 km, dropping more than 150 m on the way. The average flow rate at Passau is 1,450 m³/s, and by Vienna has risen to 1,990 m³/s.

@VERBUND

HYDRO AUTOM

REALIZING THE BENEFITS OF UNIFIED AUTOMATION AND CONTROL

Automation systems within hydropower plants perform a number of vital technical functions. This includes applications on the machine level such as generator excitation, protection, turbine governor and synchronization, as well as the overall function of unit and plant control and control center systems.

As a leading supplier of electromechanical equipment, ANDRITZ Hydropower offers a full portfolio of automation systems where decades of experience are combined to deliver optimal solutions. For hydropower automation systems, ANDRITZ equipment and services includes hardware and software products and solutions, installation, commissioning, and operator training based on the specific operational strategy of individual power plants. This is based on factors such as plant age, the local energy market, and whether the unit is manned or not. Automation is needed to guarantee safe and secure operations, maximize efficiency and plant life, and keep operational expenditure to a minimum.

With the advent of digital technologies, control, regulation, and automation systems for hydropower plants have been completely transformed. Today, the optimal solution is to bring all the different elements of automatic control and regulation onto a single common platform.

HIPASE – THE NEW GENERATION OF INTEGRATION

HIPASE is the automation platform developed by ANDRITZ Hydropower and has evolved from both machine-level and overall plant protection and control systems to deliver a single harmonized solution. HIPASE development was driven by integrating the specific requirements of various applications – including excitation (HIPASE-E), electrical protection (HIPASE-P), and turbine governor (HIPASE-T) and grid synchronization

POWER MATION

(HIPASE-S) – bringing them together with the extended HIPASE-250 control center system under one harmonized product platform.

The HIPASE platform combines software and embedded devices specifically designed for use in hydropower together with a modern control center system and a unified cross-platform engineering tool, thus ensuring a harmonized engineering workflow across the whole platform.

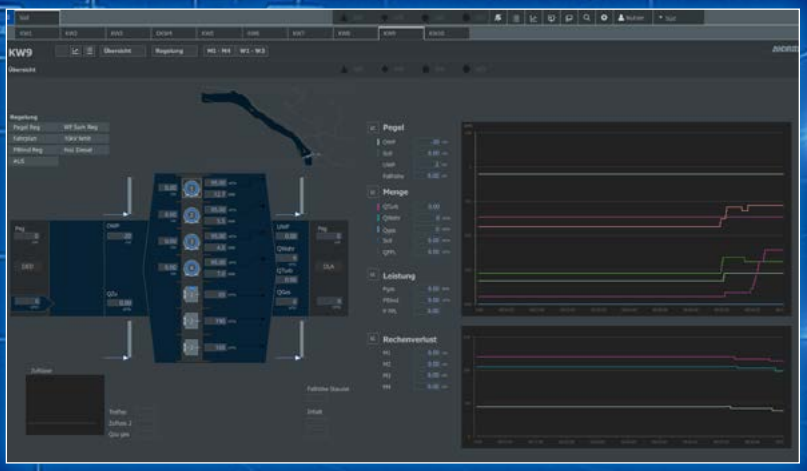
All HIPASE applications are based on a modular and harmonized approach for both hardware and software components. HIPASE optimizes maintenance and life-cycle management and delivers reduced risks, simplified engineering, maintenance, training, and spare part management. Due to the harmonized platform approach, HIPASE not only offers multiple synergies, such as intuitive and efficient operation via an up-to-date user interface, but provides advanced overall cybersecurity measures.

Additionally, HIPASE-embedded devices are optimally protected against unauthorized external and internal access through a comprehensive and consistent hardware-supported security architecture that meets the latest security standards. Regular security updates ensure continuous compliance with future security requirements.

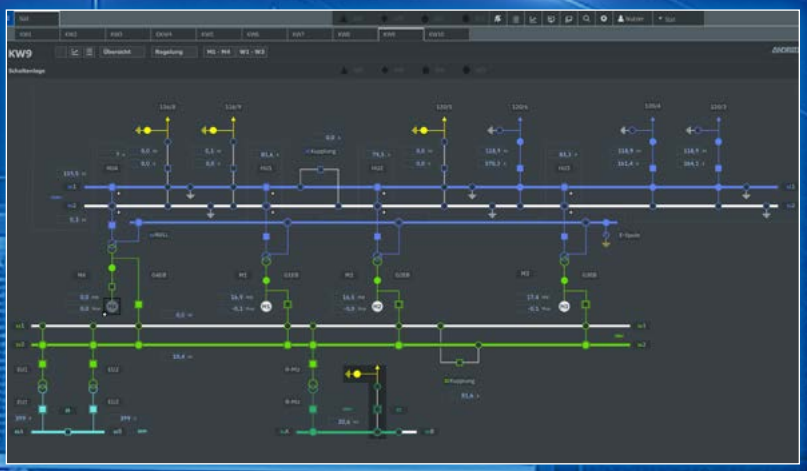
The HIPASE-250 control center system offers a completely redesigned user interface that has been developed according to the latest state-of-the-art technology in industrial design. It features comprehensive

HIPASE, the unified automation platform

HIPASE-250 control center system; Joint control



HIPASE-250 control center system; Plant overview



HIPASE-250 control center system; Substation

human-machine-interface functionality such as operating, monitoring, and controlling for all plant processes. Scalability has always been part of HIPASE-250's DNA. It is scalable from local touch operation for unit and gate control up to large central control rooms.

FIRST SUCCESSFUL DEPLOYMENT

As part of the unified HIPASE platform integrating all these elements, HIPASE-250 has been deployed at the central control center for the Austrian utility company VERBUND Hydro Power GmbH, who operates 117 power plants and more than 300 individual generating units with an installed capacity of more than 8 GW. The main goal of this project was to set up a new central control center to control all the hydropower assets from a central point in Austria. During the project planning phase, it was decided to install an emergency control system in parallel with a new unified and secure platform including the HIPASE-250 control center system. In addition, a centralized engineering tool and a redundant control system were deployed, including independent backup systems for the main and 34 regional fallback control rooms. Furthermore, a separate network infrastructure was installed for the backup system.

This project has enhanced the operational security and efficiency of the company's hydroelectric power plants and serves as an outstanding example of the benefits that can be achieved by hydropower plant operators.

"At VERBUND Hydro Power GmbH, we attach great importance to the standardization of our distributed control systems – especially in the area of human-machine interfaces. The new HIPASE-250 precisely fulfils this requirement: It is a flexible HMI with an adaptable data structure that can be easily adapted to individual customer requirements and is designed to be object-oriented." states Stefan Summerer from VERBUND Hydro Power GmbH.

"ANDRITZ Hydropower stands for professional cooperation at eye level. The team acts with initiative and proactively responds to all requirements."

Stefan Summerer, Project Manager, VERBUND Hydro Power GmbH

HIPASE-250 marks a significant milestone in the evolution of the HIPASE platform, delivering a unified, scalable, and fully integrated control solution for hydropower automation. Leveraging decades of ANDRITZ's expertise, it seamlessly connects machine-level systems with high-level plant and control center operations. With its multi-hierarchical architecture and comprehensive functionality, HIPASE-250 ensures full control and visibility across all levels of hydropower processes – bringing efficiency, reliability, and harmonization to the forefront of plant automation.

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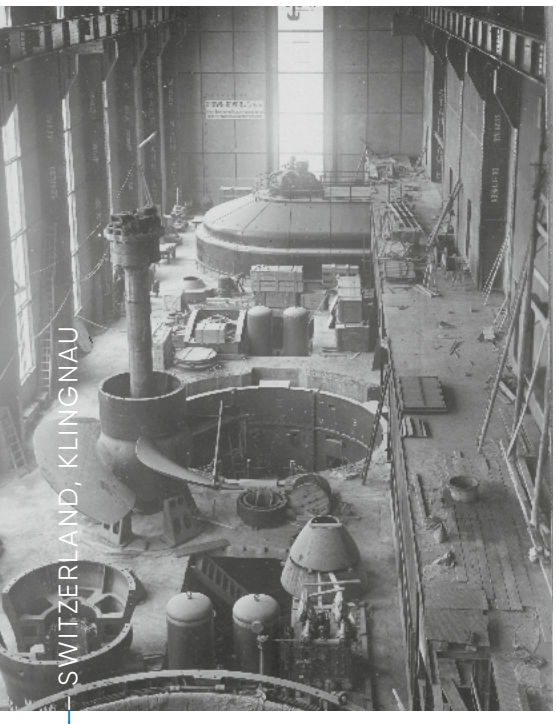
WHERE TRADITION

PROJECT STORY — SWITZERLAND, KLINGNAU



Initial installation work in the 1930s

KLINGNAU PLANT SET FOR MAJOR UPGRADE

Switzerland – After nearly nine decades of continuous operation, the Klingnau hydropower plant on the River Aare in Switzerland is set to undergo a full-scale modernization. As one of the important hydropower stations in the country, Klingnau plays a vital role in the region's electricity supply. Now, its next chapter is about to begin.

The Swiss arm of international technology group ANDRITZ has secured a major contract to refurbish Klingnau's turbines. The project, commissioned by Aarekraftwerk Klingnau AG – a joint venture owned by Axpo (60%) and AEW Energie AG (40%) – marks a significant investment in the long-term sustainability of one of Switzerland's key hydroelectric assets.

First commissioned in 1935 in the canton of Aargau, the 43 MW Klingnau plant is nearing its 90th year of operation and is due for a comprehensive modernization. Over the next six years, all three of its vertical, double-regulated Kaplan turbines will undergo a full general overhaul. The goal: to improve efficiency, extend service life, and boost power generation by 11%.

Once the refurbishment is completed, in 2032, the plant is expected to generate around 210 GWh annually – enough to power 55,000 four-person households. This is around 3,000 more than before.

A HISTORIC PLANT AT A STRATEGIC LOCATION

Klingnau is the last hydroelectric facility on the River Aare before it flows into the High Rhine near Koblenz. Fed by the Klingnau reservoir, now a protected nature reserve, it is one of the most important stations along the Aare's eleven-step cascade. This cascade, which runs between Lake Biel and the Rhine, allows a 100 m elevation drop to be harnessed for clean energy.

Two of the original turbine units were supplied by Escher Wyss – now ANDRITZ – making ANDRITZ not only the original OEM supplier but also the chosen contractor for the refurbishment of the three vertical, double-regulated Kaplan turbines and auxiliary systems. ANDRITZ's Swiss team will manage the entire refurbishment project, including planning, logistics, turbine disassembly and reassembly, and commissioning.

MEETS INNOVATION

TECHNICAL DETAILS

Klingnau:

Total output: 43 MW
Turbines: 3 vertical, double-regulated Kaplan turbines
Head: 6.5 m
Voltage: 10.5 kV
Speed: 68.18 rpm
Runner diameter: 6,453 mm
Av. annual energy generation: 210 GWh

A COMPREHENSIVE OVERHAUL

The scope of supply and services provided by ANDRITZ for the refurbishment includes design, engineering, manufacturing of new parts, workshop refurbishment, transport, installation, testing, and commissioning. Highlights include homologous model testing, the supply of new Kaplan runner blades, new oil supply systems, and upgrades to the auxiliary operating units. Additional components to be refurbished or partially renewed include guide vanes and guide vane rings, wicket gates and their control systems, turbine shafts (including FEM calculations), runner hubs, runner casings, turbine covers, draft tube linings, aeration valves, and more.

Model testing will be carried out at ANDRITZ's state-of-the-art test rig in Linz, Austria. Manufacturing of the new Kaplan runner blades and the refurbishment of the large turbine components will take place in Graz, Austria.

SUPPORTING SWITZERLAND'S ENERGY FUTURE

This project aligns with the goals of the Swiss Energy Strategy 2050, which promotes renewable energy and aims to reduce CO_2 emissions. By enhancing the efficiency of an existing plant, the Klingnau refurbishment helps meet increasing demand for clean electricity without building new infrastructure.

Refurbishing nearly 90-year-old turbines is both a technical challenge and a privilege – it allows us to combine legacy engineering with state-of-the-art technology.

ANDRITZ is deeply rooted in Switzerland's energy landscape. Roughly 90% of the country's installed hydropower turbines were originally supplied or refurbished by ANDRITZ or its predecessor companies. The Klingnau contract underscores ANDRITZ's ongoing commitment to supporting the Swiss hydropower sector with a full range of technology and services.

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Current unit hall

E.B. Campbell, Canada

ANOTHER HALF CENTURY OF RENEWABLE POWER GENERATION

Canada – ANDRITZ has just completed a remarkably successful project at the E.B. Campbell hydroelectric power station located on the Saskatchewan River, about 75 km northeast of the town of Nipawin in Saskatchewan, Canada, with the sixth unit entering service from May 2025, reaching commercial operation on July 29th after a 60-day trial run.

ANDRITZ's largest-ever refurbishment contract in Canada – and its most successful project in the past decade – delivered outstanding results in safety, quality, schedule, productivity, innovation, and customer satisfaction.

In April 2017, ANDRITZ signed a contract with SaskPower for the refurbishment of six of the eight units originally commissioned from 1963–1964. The other two units were already refurbished by ANDRITZ eight years before. The goal of this life extension program was to extend by at least 50 years the reliable operation of these units. KGS was the owner's engineer selected by SaskPower to support them on this project. The first unit refurbished reached commercial operation in July 2021. The second unit followed right after in August 2021.

After that, another unit was completed each year with only a 3-month pause between the work completions on one unit and the disassembly on the next. ANDRITZ hired a significant portion of its site labor force from local First Nations communities.

The scope of work included model testing, condition assessment, design, manufacturing, delivery, installation, and commissioning of new Francis runners, new complete distributor (bottom ring, wicket gates, head cover, gate operating ring and mechanism), new shaft seal, new stator frame, core and windings, many refurbished components (for example turbine shaft, thrust and guide bearings, poles, brakes), new caterpillar head gates, trash racks, hoists, refurbishment of gates and trash racks guides, instrumentation, and controls. For the last three units, new lower bracket and thrust and guide bearings were also supplied and generator shaft modified to accommodate the new design.

On-site team of E.B. Campbell March 2025

Model testing was completed successfully in August 2017 at our hydraulic laboratory in Canada during which we met all our performance guarantees. Engineering design activities were released following the achievement of this very crucial milestone. Procurement activities also started in fall 2017. New components were sourced globally whereas refurbished components were worked on locally. Runners, distributor components (one unit), stator frames (five units), coil windings, and gates (four units) were manufactured in ANDRITZ-owned workshops.

The new refurbished units are generating 35 MW each at a rated net head of 32 m.

TECHNICAL DETAILS

E.B. Campbell:

Total output: 289 MW
Scope output: 6 × 35 MW / 43.5 MVA
Voltage: 14.4 kV
Head: 32 m
Speed: 120 rpm
Runner diameter: 4,094 mm

This is the biggest refurbishment contract to date for ANDRITZ in Canada. This project has also been the most successful one in the last 10 years in terms of execution. The project excelled in safety, quality, schedule, productivity, creativity, and customer satisfaction.

ANDRITZ will continue at this power station for one more year to complete the refurbishment of the intake components for two more units – work that was not part of the original scope 15 years ago. Congratulations to the team!

*Cpi: Cost Performance Index

PROJECT FACTS:

- Project was awarded the ANDRITZ Global Site Safety Award
- Continued decline in the incident rate from 2019 to 2025
- More than 20 weeks without any incident at site twice
- More than 300,000 hours worked at site
- More than 400 workers/staff participated in this success
- More than 30 subcontractors used on-site
- More than 10% of labor hours came from First Nations
- Overall Cpi* above 1 on each unit
- The first two unit refurbishments were executed during the pandemic (2020)

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USA, Bakersfield

SECURING TEXAS'S CLEAN ENERGY FUTURE

TECHNICAL DETAILS

Bakersfield:

Total capacity: 350 MVAr

Scope: 2 × 175 MVAr

Synchronous Condenser Systems

Synchronous Condenser manufactured for the EnergyConnect project in Australia. The component for Bakersfield will be nearly identical.

Power transformator at the Bakersfield substation, USA. @GE Vernova

USA — In the heart of West Texas, where the sun blazes and the wind never rests, a quiet revolution is underway. The recent contract awarded to the GE Vernova-ANDRITZ HYDRO Corp. consortium for the installation of two synchronous condensers for an LCRA Transmission Services Corporation (LCRA TSC) project at the Bakersfield Substation will provide support to help maintain stability of the Texas electric grid.

As the energy landscape changes, driven by the rapid rise of wind and solar generation, grid operators are facing a new challenge: maintaining stability in a system increasingly dominated by inverter-based resources. Unlike conventional thermal power plants, these renewable sources lack the rotating mass that provides essential grid services like inertia and short-circuit contribution. The result? A grid more vulnerable to frequency fluctuations and voltage instability.

Enter the synchronous condenser — a proven technology experiencing a renaissance. These rotating machines operating without any mechanical load offer a number of critical services: They stabilize voltage, manage reactive power, and most importantly, inject inertia into the grid. Their ability to store and release rotational energy makes them indispensable in today's low-inertia power systems.

The Bakersfield project, identified as necessary by the Electric Reliability Council of Texas (ERCOT), is a direct response to the region's surging energy demand and the increase in renewable energy sites. Each of the two 175 MVAr units from ANDRITZ will be equipped with advanced control, SCADA, and protection systems, that will be seamlessly integrated by GE Vernova. Together, they will strengthen the backbone of the grid, helping ensure that homes, businesses, and critical infrastructure are supplied with uninterrupted power, even in the event of sudden disruptions.

But this story is not just about machines. It's about people — engineers, planners, operators — working across continents to deliver a solution that balances innovation with reliability. It's also about the communities in Texas that will benefit from a more stable grid. And it's about the global energy transition, where every project like Bakersfield brings us closer to a more reliable, resilient, and sustainable future. ANDRITZ and GE Vernova are committed to providing a timely solution in the ERCOT region and are scheduled to complete the project in the summer of 2027.

"At ANDRITZ, we are committed to delivering advanced synchronous condenser technology that enhances grid stability and reliability."

Daniel Carrier CEO of ANDRITZ Hydropower in North America.

At ANDRITZ, we are proud to contribute our expertise in synchronous condenser technology to this transformative development. With over 5,000 synchronous machines in operation worldwide, our legacy is built on delivering solutions that matter. As the world accelerates toward decarbonization, we remain committed to empowering our partners with the tools they need to navigate this transition safely and sustainably.

The Bakersfield project is more than a milestone. It's a message that with the right technology, people, and vision, we can build a grid that's not only ready for the future, but one that helps shape it.

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NORTHERN BRAZIL: BUILDING THE PATH TO GRID STABILITY

PROJECT STORY — BRAZIL, TUCUMÃ AND FEIJÓ

Tucumã and Feijó substations

Brazil – ANDRITZ Hydropower Brazil delivers two key projects and reinforces its commitment to meaningful growth.

It is with great pride that ANDRITZ announces the successful delivery and installation of synchronous condensers at the Tucumã and Feijó substations, located in the state of Acre, in Northern Brazil. These projects mark a significant contribution to the region's energy infrastructure and reinforce the company's commitment to meaningful and sustainable growth across all its operations.

Tucumã substaton in Acre

Before the installation of the synchronous condensers, Acre and the broader northern region of Brazil faced major challenges in electrical stability and power quality. Voltage fluctuations and drops were common due to the long transmission distances from generation centers to consumers, directly affecting industrial and domestic equipment. Moreover, the lack of stability left the system vulnerable to blackouts and unexpected outages, disrupting homes, businesses, and industries.

The installation of the condensers enables greater integration of renewable energy sources and improved grid reliability, benefiting both businesses and essential services. The implementation of this equipment in the system will allow the region to be interconnected to the National Interconnected System (SIN), which will allow the replacement of local energy generation based on diesel oil.

FEIJÓ I AND II

Through a contract signed with Zopone in late 2022 for the delivery of two condensers, ANDRITZ Hydropower Brazil not only positioned itself as a key player in green transition solutions but also added a new product to its portfolio.

Tucumã substaton in Acre

TECHNICAL DETAILS

Tucumã:
(230 kV substation)
Units: 1 × 150 MVAr
Speed: 900 rpm (8-pole salient)
Short circuit contr.: 546 MVAr
Inertia time const.: 2.4 s (natural)

Feijó:
(230 kV substation)
Units: 2 × 50.5 MVAr
Speed: 1,200 rpm (4-pole)
Short circuit contr.: 195 MVAr
Inertia time const.: 2.2 s (natural)

According to Project Manager Carlos Fontes, the company customized the project to meet public agency requirements and, in partnership with ANDRITZ's Competence Center in Austria, developed a 50 MVAr condenser.

The project officially began in 2023 and was completed in 2025, including equipment delivery and a four-month commissioning period with extensive testing to ensure reliability.

"We can say this project was a success. We delivered the machines with no major issues and performed the reliability tests smoothly, demonstrating our capacity to provide technology that enables our client to offer a stable transmission service," said Fontes.

Approximately 100 professionals were involved across all project stages.

TUCUMÃ

The Tucumã project contract was signed at the same time as the one for Feijó, with the same client, but with a different scope. This contract involved delivering a 150 MVAr condenser to the substation near Rio Branco, the capital and most important city in Acre.

The project garnered regional attention during a November 2024 visit by Austrian Ambassador Stefan Scholz, accompanied by ANDRITZ Hydropower Brazil CEO Dieter Hopf. At the time, the equipment was still being installed, a process completed with final commissioning in January 2025.

"The installation of the synchronous condenser at the Tucumã substation adds great value to the region's development plan led by Zopone in partnership with ANDRITZ. Even during the testing phase, the equipment exceeded all expectations in performance, and we managed to deliver ahead of schedule. This demonstrates our expertise and ability to generate value beyond technology. The northern region will now have a more reliable power grid, positively impacting thousands of people with cleaner, more stable energy," concluded Project Manager Carlos Fontes.

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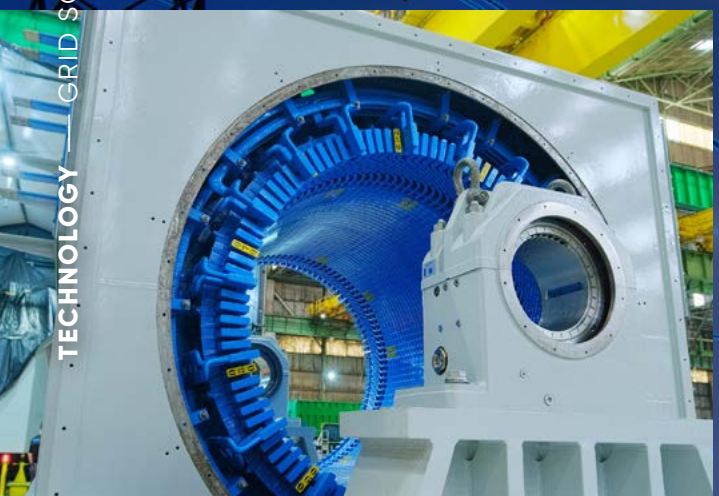
The synchronous condenser for Feijó on the way through Brazil.

The synchronous condenser for Feijó during manufacturing.

STEADY POWER IN A SHIFTING WORLD

As renewables rise and grids become volatile, ANDRITZ delivers the tools to keep electricity flowing safely and smoothly.

To enable a cost-effective energy transition with renewables like wind and solar, maintaining grid stability is becoming increasingly important. Electricity must stay within strict limits of frequency and voltage. Previously, this was easier when most generation came from large rotating machines like steam turbines, which provide natural inertia to support the grid during fluctuations or faults.



Synchronous condenser for Feijó substation in Brazil during manufacturing

While **hydropower** offers unique large scale flexibility, most other renewables are inherently variable and require complementary solutions for reliable grid operation. When voltage and frequency limits are exceeded, or when faults propagate through the transmission system, the consequences can be significant as illustrated this year by the catastrophic collapse of the grid that took place across the Iberian Peninsula.

ANDRITZ has long recognized both the reality of this challenge and the scale of the response needed to address it. Consequently, it is bringing new focus on its wide range of grid stability solutions.

Hydropower's flexibility makes it a vital stabilizer. Advanced turbines and control technologies from ANDRITZ enable rapid response to supply and demand changes, keeping the grid within safe operating limits. **Pumped storage** systems act as large-scale energy reservoirs – absorbing excess power and releasing it when needed to balance renewable intermittency.

Another key technology designed to bolster grid stability and further support grid

ABOUT

CÉLINE AGNÈS MAHIEUX, PH.D.
VICE PRESIDENT, GRID SOLUTIONS (SINCE MAY 2025)

With over 25 years of global experience in energy innovation, operations, and sustainable technologies, Céline Mahieux has led strategic and technical initiatives at Shell, Hitachi Zosen Inova, ABB, and Alstom Power. She combines deep technical expertise with operational leadership to deliver value for customers, strengthen grid stability, and advance the energy transition for the benefit of society.

resilience is the **synchronous condenser.** A reliable and cost-effective solution typically installed in substations, the synchronous condenser is a rotating machine that delivers reactive power for voltage support, short circuit strength, and inertia capabilities essential for grids with high renewable energy penetration. These systems have already been successfully deployed in countries like Australia, Brazil, and the USA.

ANDRITZ's **turbo generators** are meeting the growing demands of sectors such as LNG production and data centers – industries that require high-capacity, stable power. As digital technologies like AI, VR, and cloud computing expand, ANDRITZ is helping ensure the infrastructure behind them remains robust and future ready.

A strong R&D function also plays an extremely important role in supporting new developments in this field. From the world's most powerful turbine test rig to global academic collaborations, ANDRITZ continues to push technological boundaries.

Today, ANDRITZ is being led through the next steps on the journey to comprehensive grid stability by Céline Agnès Mahieux, Ph.D, as new Vice President, Grid Solutions. Dr. Mahieux brings a wealth of experience in technology innovation to the role and is perfectly positioned to advance our Grid Solutions offering.

With decades of experience and a commitment to innovation, ANDRITZ is shaping a stable, sustainable energy future – one solution at a time.

Outlining her vision, Dr. Mahieux said: "The transformation of the energy system needs more than just renewable generation. It requires a suite of complementary tools. With solutions ranging from pumped storage to synchronous condensers, ANDRITZ is ready to meet grid stability needs today and into the future."

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Kidston, Australia - ANDRITZ will supply electro-mechanical equipment for the world's first co-located solar pumped storage hydropower plant.

Manufacturing work on a turbo generator in the ANDRITZ workshop in Weiz, Austria

ADVANCING CHINA'S ENERGY LANDSCAPE WITH PUMPED STORAGE

With a technically feasible hydropower potential of approximately 2,720 TWh per year from its 541.6 GW of capacity, China's hydropower resource is a significant driver of its renewable energy ambitions. China already accounts for about 17% of the world's total installed hydropower capacity and the government aims to increase renewable energy capacity to a 30% share by 2050, with hydropower anticipated to reach about 660 GW by then from numerous projects. Among these is the notable pumped storage project Zhen An.

China – The Zhen An Pumped Storage Power Station, located in Yuehe Town, Zhen An County, Shaanxi Province, represents a significant milestone in China's hydropower development. As the first pumped storage plant in northwest China, this project by the State Grid Corporation of China aims to promote regional development, adjust the energy mix, and support the western development strategy.

Comprising an upper and lower reservoir, a water transmission system, an underground plant, and a switch station, Zhen An has a total installed capacity of 1,400 MW, with each of its four reversible water pump turbine generators rated at 350 MW. Designed to provide 2,341 GWh per year, it connects at 330 kV to support the Shaanxi power grid. Scheduled for completion and operation by 2024, the project features the largest pumped storage units supplied by ANDRITZ, including the excitation system, governor, static frequency conversion starting device, switch disconnector, relay protection, and computer monitoring system.

Celebration of completion of unit 3 of Zhen An pumped storage plant.

Outside view of Zhen An pumped storage plant

TECHNICAL DETAILS

Zhen An:

Total output: 1,400 MW
Scope output: 4 × 350 MW
Head: 440 m
Speed: 375 rpm

Project team of Zhen An pumped storage plant

The Zhen An Pumped Storage Power Plant, the first of its kind in Shaanxi Province, has been successfully completed and put into operation with remarkable outcomes, marked by a series of critical milestones. The project's progress began with the early energization of main transformers in December 2023, which enabled Unit 1's wet commissioning.

Building on this achievement, formal commissioning followed in March 2024, while installation of subsequent units continued smoothly. Notably, Unit 2's stator and rotor — measuring 8.6 m and 5.7 m in diameter respectively and weighing over 650 tons combined — were successfully installed in September 2023, followed by Unit 3 in January 2024 and Unit 4's stator in April 2024.

All four units commenced commercial operation, with Unit 1 starting on September 12 and Unit 4 on December 12, 2024, marking the full-scale launch of the power station. This achievement reflects ANDRITZ's strong execution capabilities and fulfills the owner's goal of full operation within 2024. As of July 2025, the first unit commissioned has been running safely and stably for over ten months, contributing to grid stability and energy regulation in Shaanxi.

"Zhen An features the largest pumped storage units supplied by ANDRITZ."

The Zhen An pump storage project not only highlights China's technical prowess but also its commitment to a diversified and sustainable energy portfolio. ANDRITZ is proud to be part of this important project and to make a significant contribution to China's energy transition with its expertise and commitment to high-quality pumped storage solutions.

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FUTURE ENER

ABDELMOUMEN STRENGTHENS MOROCCO'S POWER

Morocco – By the end of 2023, over one third (approximately 39%) of Morocco's energy mix came from renewable sources. This achievement positions Morocco as a leader in the energy transition within the Middle East and North Africa (MENA) region. Through its ambitious National Energy Efficiency Action Plan (NEEAP), launched in 2009, Morocco aims to decarbonize the energy sector, lower dependence on costly fuel imports, and reduce electricity costs. The strategy has stimulated significant renewable energy investments, including hydropower.

PUMPED STORAGE: KEY TO THE ENERGY TRANSITION

Morocco's energy strategy includes the construction of two pumped storage plants by 2030 with a total capacity of 725 MW: Abdelmoumen (350 MW) and El-Menzel (300 - 400 MW). As wind and solar energy capacities expand, so does the need for efficient, large-scale energy storage solutions. Pumped storage plants are a proven and effective technology to balance natural fluctuations in solar and wind energy generation by moving water between two reservoirs at different elevations to store and release energy.

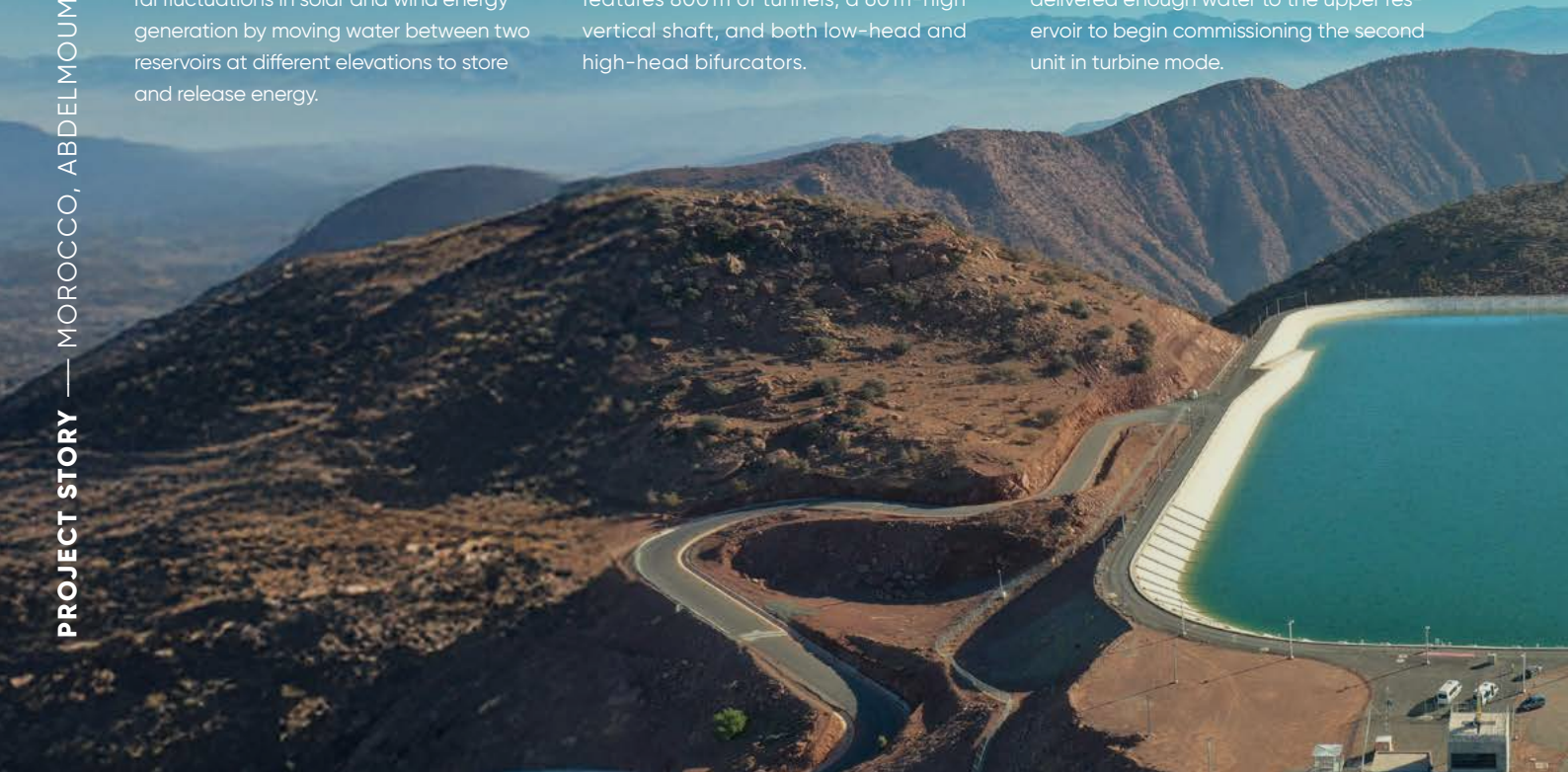
ABDELMOUMEN PUMPED STORAGE PLANT IN THE ATLAS MOUNTAINS

Located near the Issen River in Taroudant province, approximately 70 km northeast of Agadir, the Abdelmoumen pumped storage plant stands above the existing Abdelmoumen reservoir. In 2017, ANDRITZ, as part of a consortium with VINCI Construction, which handled the major construction work, was awarded the contract to supply the electromechanical equipment for the new plant by the Office Nationale de l'Électricité et de l'Eau Potable (ONEE). ANDRITZ was responsible for the design, manufacture, supply, installation, supervision, and commissioning of the reversible pump turbines, motor generators, and electrical energy systems. Together with VINCI Construction, ANDRITZ successfully completed the technically challenging waterway, which includes a freestanding penstock with diameters of 4.8 m, 4.25 m, and 3.6 m, and a length of approximately 1.6 km. This project also features 800 m of tunnels, a 60 m-high vertical shaft, and both low-head and high-head bifurcators.

INNOVATIVE COMMISSIONING CONCEPT

In mid-2024, the project reached a significant milestone with its successful commissioning.

Traditionally, hydropower plants start commissioning with the water flowing in the turbine or power generating mode, spinning at low speed with no loads to allow verification of the mechanical behavior of the unit prior to full-load operation. For Abdelmoumen, ANDRITZ engineers changed the commissioning process and adopted a rare if not unique approach by starting commissioning in pumping mode first. Using the frequency converter, the engineers were able to spin the unit at zero load but nominal speed which allowed for verification of the mechanical behavior but spinning in the opposite direction to conventional commissioning. Having successfully passed this verification step in early 2024, the first of the two Abdelmoumen units began operating in pump mode at 165 MW. Within two hours, this first unit had delivered enough water to the upper reservoir to begin commissioning the second unit in turbine mode.



GY STORAGE

GRID

ANDRITZ is proud to have delivered this time-saving procedure, showcasing excellence in both engineering and innovation.

With a peak load capacity of 350 MW, Abdelmoumen is a key asset to respond flexibly to daily grid demands.

The success of Abdelmoumen underscores the growing importance of pumped storage plants for the future of renewable energy in Morocco and across the African continent.

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Overview of Abdelmoumen with view of the reservoir and the penstock

Commissioning of the switchyard in 2024

TECHNICAL DETAILS

Abdelmoumen:

Total output: 350 MW
Scope: 2 × 175 MW
Head: 555 m
Speed: 600 rpm
Runner diameter: 3,200 mm

WOMEN IN HYDROPOWER

NEW ENERGY. NEW PERSPEC

With growing diversity in training programs, ANDRITZ is shaping a more inclusive, innovative energy industry.

"Embracing equality is not a trend – it's an investment in better solutions and stronger teams."

– Program coordinator, ANDRITZ Hydropower

Technology, sustainability, and diversity are reshaping the working world – and the hydropower industry is no exception. Traditionally a male-dominated field, this sector is undergoing a quiet revolution. Increasingly, women are stepping into technical roles, apprenticeships, and engineering careers. And it's not just about numbers – it's about perspectives, innovation, and inclusive growth.
The future is becoming more diverse.

At the core of this transformation is a strategic commitment to youth development. Apprentices and trainees are not only the next generation of hydropower experts; they are changemakers who bring fresh thinking, digital skills, and social responsibility into our teams. If we want to build a future-proof, forward-thinking energy industry, we must start by building up our young talent – especially women.

CREATING SPACE – ANDRITZ PROGRAMS WITH REAL IMPACT

The future of the industry will be more connected, more diverse, and more demanding – and we aim to actively shape this future by educating the next generation. At ANDRITZ, promoting young talent is not a side show, but a strategic core value.

From hands-on apprenticeships to structured graduate programs, ANDRITZ offers diverse entry points for young talent worldwide. A recent milestone in Austria underscores this commitment: 17 apprentices were successfully recruited – and notably, eight of them are female. A strong sign that targeted outreach, like the Girls' Day event in Weiz or university partnerships in Vienna, is working. More women and girls are discovering that technical careers can be creative, impactful, and welcoming.

In Turkey, the overall female to male employee ratio stands at 11.3%. Nonetheless, in 2024, our Hydropower division in Turkey welcomed 14 female interns out of 24 from various academic backgrounds and departments – an encouraging sign of increasing female participation in technical and engineering roles.

"When you give girls tools, they build futures. That's what we do at ANDRITZ."

– HR Team, Austria, ANDRITZ Hydropower

In Canada, the Young Graduate Program provides university graduates with two years of rotations in different departments – from engineering to procurement and project execution. The program was designed with mentoring, skill-building, and visibility in mind. It attracts more female candidates than traditional entry-level roles – proving that women respond positively to structured, supportive environments with clear growth potential.

REAL STORIES FROM THE FIELD

But what does a career start at ANDRITZ really feel like? What challenges do young women face – and overcome? In the following interviews, two women from Austria and Canada share their personal journeys: how they entered the world of hydropower, what inspired them, and why they now see themselves as part of the industry's future. Their voices are proof that when companies create opportunities, women create progress.

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HANDS-ON, FULL STEAM AHEAD

From barn to workshop, Theresa Peintinger is shaping her career in mechanical engineering. She reflects on challenges, support, and ambition at ANDRITZ Hydropower.

Interview *with* Theresa Elisabeth Peintinger, ANDRITZ Hydropower Austria

Age: 20
Nationality: Austria

Theresa Elisabeth Peintinger is in the final year of her 3.5-year apprenticeship as a mechanical engineering technician at ANDRITZ Hydropower in Weiz, Austria. Theresa combines her hands-on upbringing on a farm with a passion for engineering. Inspired by a friend and former apprentice, she chose a technical path that offers variety, growth, and international opportunities.

Theresa played also a leading role in our latest image video for apprenticeship promotion.

Please introduce yourself briefly. Who are you and what vocational training are you currently doing?

> My name is Theresa Elisabeth Peintinger, I'm 20 years old and from Gasen, a small municipality in Styria, Austria. I'm in the final year of my 3.5-year apprenticeship as a mechanical engineering technician at the ANDRITZ Hydropower workshop in Weiz, near Graz.

Why ANDRITZ Hydropower? What led you here?

> A good friend, knowing my interest in engineering, encouraged me to do a trial internship at ANDRITZ Hydropower. It gave me valuable insights into the company, the profession, and the training opportunities. I really liked what I saw – that's when I decided to pursue this career path.

Why a technical profession? What do you like about a skilled trade?

> I grew up on a farm where hands-on work and self-sufficiency were part of everyday life. From a young age I helped in the barn and with the machines, which sparked my interest in engineering. I really enjoy the fact that there is always a new challenge and something to learn. I am always moving in this job, and the work is different every day.

How does your daily life compare to that of friends your age?

> I feel that I'm building a solid long-term career with exciting opportunities, something many of my friends don't have in their jobs.

Theresa and colleagues working with a 3D printer.

> On a personal level, although the work is very varied, I have set working hours and a regular schedule. Other friends, for example those working in construction, sometimes come home earlier or later.

Who inspired you to work in plant engineering? Any female role models?

> While many female engineers can be role models, it was actually my friend – as mentioned earlier – who also completed her apprenticeship at ANDRITZ Hydropower, who introduced me to this career. She spoke highly of the company and the prospects that a career in engineering could open for me. She still works here as a mechatronics engineer and we're still in close contact.

What are the biggest challenges as a woman in a technical field?

> Sometimes I can't lift as much as my male counterparts, but fortunately I'm part of a supportive team where we help each other to ensure that any job is completed successfully. If I have questions or face difficulties, I can always turn to my trainer or colleagues. That team spirit is one of the great things about working at ANDRITZ Hydropower.

Have you experienced any disadvantages as a woman in this environment?

> Not at all. I've never been treated differently because I'm a woman – nor do I expect special treatment. ANDRITZ actively promotes women in technical careers, and everyone I've worked with has been nice, respectful, and helpful. I also serve as a youth trade union representative, helping other apprentices with questions and concerns. Through this role, I have also made new friends – both men and women – and sometimes we get to hang out outside of work and do things together.

Have you worked on a construction site? What was that like?

> Last year, I had the opportunity to visit the Kühtai pumped storage project in Tyrol for a week. It was fascinating to see how a power plant is built from scratch. If I get the chance again, at Kühtai or another site, I'd definitely like to go.

How do you see your career developing? What are your plans for the future?

> My immediate goal is to pass my final apprenticeship exam next year and become a qualified technician. Beyond that – who knows? I'm excited to see what the future holds for me and my career.

What do you enjoy outside of work? What interests you outside of technology?

> In my free time, I still help out on the family farm – I'm just as passionate about agriculture as I am about technology. I am also a member of the local music society and spend time with friends. To relax, I enjoy hiking and cycling.

Thank you, Theresa, for sharing your inspiring journey and passion for engineering. We wish you all the best for your final exam and every success in your future career.

NEXT-GEN ENERGY, NEXT-GEN LEADERSHIP

Meet Marie Rouillard – engineer, innovator, and advocate for community-driven technology. She shares how mentorship and mindset helped her thrive in a technical field.

Interview with Marie Rouillard

Age: 24
Nationality: Canada

Marie Rouillard is about to complete her bachelor's degree in mechanical engineering and has completed turbine and project management internships at ANDRITZ Hydropower, demonstrating a strong commitment to renewable energy and community-driven innovation. She has assumed leadership roles in technical organizations such as Esteban's solar car team and has been honored with multiple scholarships in recognition of her academic excellence and active engagement.

Please introduce yourself briefly. Who are you and what vocational training are you currently doing?

> My name is Marie Rouillard, I am 24 years old. I will complete my bachelor's degree in mechanical engineering at Polytechnique Montréal in autumn 2025 as an exchange student at the Czech Technical University in Prague.

Why ANDRITZ Hydropower? What led you here?

> I had the opportunity to discover ANDRITZ Hydropower through its role as a major sponsor of Polytechnique Montréal's Esteban technical club, of which I was Co-Director General for two years. I was able to see that ANDRITZ Hydropower shared many of my fundamental values: encouraging the next generation, technological innovation, and sustainable development.

Why a technical profession? What do you like about it?

> I've always been drawn to science and technology but also have a strong interest in community service. I realized that engineering would enable me to reconcile all my interests: contributing to community well-being while taking on stimulating technical challenges.

As Co-Director General, Marie was part of a development team, the Technical club Esteban from Polytechnique Montréal, that aimed to design and build a solar car.

How does your daily life compare to that of friends your age?

> It's difficult to compare the day-to-day experiences, but I can say that my experience at ANDRITZ Hydropower was particularly concrete and focused on practical application. Every single person was available and ready to help me and there's a real sense of pride in contributing to a greener future.

Who inspired you to work in industrial plant engineering, and do you have any female role models?

> I had the chance to chat with Anne-Marie Labrecque and Daniel Carrier. They told me about ANDRITZ and encouraged me to apply to the Young Graduates Program. This discussion had a profound influence on my career path. Several inspiring women have also shaped my worldview and encouraged me to get involved in science but the women who inspire me most on a daily basis are my fellow students and friends. They are brilliant women who combine empathy, gentleness, and excellence.

What are the biggest challenges as a woman in a technical profession?

> I believe that one of the greatest challenges facing women in the technical professions is overcoming imposter syndrome. This feeling can be particularly prevalent at the start of a career. Learning to take one's place with confidence is a process that requires time, support, and sometimes inspiring role models.

Have you experienced any disadvantages as a woman in this environment?

> It can be unsettling to find yourself in a room where you're the only woman but during my internship at ANDRITZ Hydropower, a colleague shared a perspective that stuck: Sometimes you have to change your outlook and see the opportunity. Being the only woman in a room is an opportunity to stand out and leave a lasting impression.

Marie giving a "Lunch & Learn" style presentation at the ANDRITZ Pointe-Claire offices.

How do you envision your future career path? What are your plans for the future?

> I want to pursue a career in the field of renewable energies, and I have a real interest in project management. In the medium term, I'm considering an MBA or equivalent in management, but in-depth understanding of the product, the processes, and the day-to-day reality of your team is, in my opinion, a prerequisite.

What do you do in your free time to relax? What interests you outside of technology?

> In my spare time, I particularly enjoy playing a variety of sports and I really enjoy getting away from my screens to go hiking or camping. I also have two cats, Fred and Fiona, who really help me to relax and slow down on a daily basis.

Thank you, Marie, for sharing your inspiring journey. Your passion for engineering and sustainability is a powerful example for the next generation of hydropower professionals.

PROJECT UPDATES

INDONESIA, ASAHAN 3

Precision, progress, power

The Asahan 3 hydropower plant is a state-of-the-art renewable energy project that harnesses the vast potential of the Asahan River in North Sumatra, Indonesia. With its ability to generate over 174 MW of clean energy, this facility is poised to significantly contribute to meeting growing regional energy demand and reduce Indonesia's reliance on fossil fuels.

ANDRITZ was responsible for providing critical metalwork (2,200 tons), consisting of 12 sets of roller gates, four sets of sliding gates, three sets of stop logs, nine sets of trash racks, one set of trash rack cleaning machine, one lane of steel penstock with internal diameter of 5.30 m and a length of 338 m, one set of Penstock Isolating Valve (PIV) DN 5.30 m-PN 6 bar, and advanced Building Information Modelling (BIM) software. Additionally, ANDRITZ was also instrumental in implementing the telemetry flood warning system for improved safety and monitoring. The contract agreement was officially signed in September 2019 and the project was completed in December 2024, marking a significant milestone in Indonesia's energy landscape.

In a remarkable achievement, the Asahan 3 project was completed in just five years. This was made possible by the innovative use of BIM, marking the first time this advanced technology has been applied to hydroelectric power plant construction in Indonesia, accompanied by the cooperation of all stakeholders. According to Mr. Wiluyo Kusdwiharto, Director of PLN's Mega Project & Renewable Energy Division, the successful and timely completion of Asahan 3 underscores the potential of modern technology to streamline and improve large-scale energy projects.

As part of an initiative encompassing 37 electricity projects in 18 provinces, to increase energy accessibility and advance Indonesia's renewable energy goals, Asahan 3 was officially inaugurated by Indonesian President Prabowo Subianto on January 20, 2025. This milestone not only highlights the efficiency of the power plant but also sets a new benchmark for future hydropower developments in Indonesia and beyond.

TECHNICAL DETAILS

Asahan 3:
Total output: 2 × 87 MW
Scope: Metalwork equipment 2,200 tons

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PAKISTAN, GULPUR

Poonch power for Pakistan

After four years of reliable operation, the 102 MW run-of-river plant receives its Final Acceptance Certificate, underscoring Pakistan's progress toward renewable energy independence.

Pakistan faces major challenges in the energy sector due to rising demand and heavy reliance on imported fossil fuels. Over 50% of the country's electricity is currently generated from fossil sources such as gas, coal, and oil. Hydropower, however, already plays a key role in the energy mix, contributing around 25% of electricity generation with over 10 GW of installed capacity (as of 2024). The northern regions of Azad Jammu, Kashmir, and Khyber Pakhtunkhwa offer considerable untapped hydropower potential, thanks to their mountainous terrain and natural river systems.

With the adoption of the updated 10-year Indicative Generation Capacity Expansion Plan (IGCEP 2024–2034) in May 2025, Pakistan is intensifying its focus on renewable energy. Large-scale hydropower projects are seen as essential for a sustainable, secure, and locally sourced energy supply. The goal is to increase the share of water, wind, and solar power, reduce reliance on imports, and foster a competitive electricity market.

A prime example is the Gulpur hydropower plant on the Poonch River in Azad Kashmir. With an installed capacity of 102 MW, it generates more than 460 GWh annually. In December 2015, ANDRITZ was awarded the contract to supply, install, and commission two 51 MW vertical Kaplan turbines, hydraulic steel structures, penstocks, control systems, and other electromechanical equipment.

A highlight of the project is the innovative ANDRITZ HYDRO SXH™ coating, which protects turbine components from high sand content in river water and significantly extends service life.

Since its commissioning in March 2020, the plant has operated without interruption. The project concluded successfully in September 2024 with the receipt of the Final Acceptance Certificate (FAC). Gulpur stands as a testament to ANDRITZ's expertise and reliability in delivering sustainable hydropower solutions in Pakistan.

TECHNICAL DETAILS

Gulpur:

Total output: 102 MW / 129 MVA
Scope output: 2 × 51 MW / 64.7 MVA
Voltage: 11 kV
Head: 59.90 m
Speed: 214 rpm
Runner diameter: 4,200 mm

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PROJECT UPDATES

NEW ZEALAND, KAITAWA

A modern makeover

In partnership with Genesis Energy, ANDRITZ embarks on a full-scale modernization of the historic Kaitawa Power Station – boosting renewable output and future-proofing for net zero 2050.

In late 2024, ANDRITZ signed a contract for the comprehensive modernization of the 36 MW Kaitawa Power Station, the uppermost plant in the Waikaremoana Hydro Scheme commissioned in 1948. The contract was awarded to ANDRITZ by Genesis Energy, one of New Zealand's largest energy generators and retailers ("gentailers"), supplying electricity, natural gas, and LPG to more than 496,000 customers across New Zealand.

After decades of operation, Kaitawa requires a major upgrade to ensure continued efficiency and reliability. Following an Early Contractor Involvement (ECI) process, Genesis Energy and ANDRITZ collaboratively finalized a detailed refurbishment plan to enhance the station's performance and extend its operational life.

The scope of the contract includes:

- Replacement of the station's generators
- Installation of new turbine runners, guide vanes, and turbine covers
- Modernization of pressure relief valves and hydraulic governors

ANDRITZ will undertake the design, manufacturing, delivery, installation, and commissioning of the new equipment.

"We are excited to collaborate with ANDRITZ on this significant project," said Jane Bydder, Genesis' General Manager of Engineering and Projects. "The power station's upgrade will increase its efficiency, helping meet increasing demand for reliable, renewable electricity as we support New Zealand toward its goal of net zero 2050."

The modernization effort represents a significant investment in renewable infrastructure, reinforcing Genesis Energy's commitment to innovation and environmental stewardship. The project is currently in design and manufacture, with completion expected by late 2027.

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TECHNICAL DETAILS

Kaitawa:
Total output: 42 MW
Scope: 2 × 21 MW / 2 × 23.6 MVA
Speed: 500 rpm
Head: 123.7 m
Voltage: 11 kV
Runner diameter: 1,430 mm
Station average annual generation prior to upgrade: 100 GWh

NEW ZEALAND, MATAHINA

Tailored efficiency: A custom retrofit

A major turbine overhaul by ANDRITZ unlocks higher energy yield and adaptive flow control at Matahina Power Station – customized to match the unique challenges of the Rangitaiki River.

First commissioned in 1967, the Matahina hydropower station, located on the Rangitaiki River in the central North Island, comprises two Francis turbines. The upgrade by ANDRITZ is the first major overhaul of the turbines and involved the installation of new turbine headcover and bottom ring, new guide vanes and a new runner together with various ancillary components in one unit, and installation of a new runner and guide vanes in the other unit, along with refurbishment of the existing components.

The original turbines were destined for another power station when procured in the 1960s and were therefore not designed for the Matahina HPP's river flows. ANDRITZ's solution involved changing the design of the turbines to be a low- and high-flow unit, to optimize the efficiency over the flow range of the two-unit station. Only changes to the runner design were required to accomplish this, which while incurring additional design cost was a very positive development for the project economics. The dissimilar unit capacities result in a significant improvement in energy yield, particularly when running at the minimum environmental flow required for the Rangitaiki River. The use of guide vane end seals on the larger unit also reduces water lost through the station during periods of standstill and low inflows.

Overall, a significant improvement in efficiency could be found in the existing stay vanes at the turbine inlet, so ANDRITZ modified both the inlet and outlet stay vane shape using stay vane extensions and specialist machining equipment.

In mid-2024, commissioning and performance testing of the first unit at Matahina Power Station was completed. In late March 2025, installation and commissioning of the second unit was completed. This project represents a significant improvement in the station's from-water-to-wire efficiency for the customer, Manawa Energy, and demonstrates the benefit of working together with the OEM to develop solutions for major overhaul.

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TECHNICAL DETAILS

Matahina:
Total output: 76 MW
Av. annual generation prior to upgrade: 290 GWh

Unit 1
Turbine power output: 42.5 MW
Speed: 166 rpm
Head: 61.7 m
Runner diameter: 3,058 mm

Unit 2
Turbine power output: 33.9 MW
Speed: 166 rpm
Head: 61.4 m
Runner diameter: 3,077 mm

PROJECT UPDATES

NORWAY, FASLEFOSS

Significant boost through major upgrade

TECHNICAL DETAILS

Faslefoss:

Total output: 21 MW
Scope output: 22 MVA
Head: 38 m
Flow capacity: 68 m^3/s max
Voltage: 7.5 kV
Runner diameter: 2,850 mm
Speed: 250 rpm
Av. annual energy generation: 85 GWh

Nestled in the picturesque landscape near Fagernes in Nord-Aurdal, Norway, the Faslefoss hydropower plant has entered a new chapter. Originally commissioned in 1980, the plant harnesses a 38 m head between Strandefjorden and Fløafjorden operating with an original maximum water flow of 68 m^3/s and has long been a reliable contributor to the Norwegian power grid.

Faslefoss is owned and operated by Hafslund, a Norwegian energy and infrastructure group wholly owned by the City of Oslo. The company is Norway's second largest power producer and the largest supplier of district heating. Operating 81 hydropower plants across Norway, Hafslund produces power equivalent to the consumption of 1.2 million homes.

Thanks to a comprehensive upgrade by ANDRITZ, Faslefoss is now equipped for the future. At the heart of the power station is a Kaplan turbine – originally supplied by Kværner (now part of ANDRITZ) – with a nominal output of 21 MW, connected to a generator from National Industri. The annual production of approximately 85 GWh corresponds to the electricity consumption of around 4,250 households, delivered to the grid via 22 kV lines.

The recent modernization marks a major technological and environmental leap. A new oil-free Kaplan runner made of stainless steel has replaced the original, significantly reducing the environmental impact. The generator has been refurbished with upgraded insulation, and the entire switchgear and control system has been replaced, enhancing operational reliability and enabling advanced monitoring and remote operation.

This upgrade not only extends the plant's lifetime but boosts efficiency and reliability while promoting sustainability, reinforcing Faslefoss's role as a clean and stable contributor to the Norwegian power grid for decades to come.

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SWEDEN, RENGÅRD

New unit powering up Sweden's sustainable future

In May 2025, a new chapter began for the Rengård Hydropower Plant as the newly built G2 unit was officially inaugurated. The ceremony was led by County Governor Helene Hellmark Knutsson and Skellefteå Kraft CEO Joachim Nordin, marking a major milestone in the plant's development and a proud moment for Swedish renewable energy.

The new G2 unit represents a leap forward in both technology and environmental performance. At its core is a cutting-edge, oil-free Kaplan turbine paired with a high-efficiency generator from ANDRITZ, tailored for modern demands on flexibility, efficiency, and sustainability. With a net head of 19.3 meters and a flow capacity of 130 m^3/s, the new unit produces 23.9 MW of clean, reliable hydropower. The generator, rated at 27.2 MVA, is engineered for high performance and low maintenance, ensuring long-term operational reliability.

This development builds on previous modernization work at Rengård. The existing G1 unit was recently upgraded with a new turbine and a more powerful generator, boosting its capacity from 40 to 50 MVA. With both units now fully operational, the plant has more than doubled its total generation capacity, from 35 MW to 71 MW. This increase significantly enhances regional energy security and strengthens the resilience of the Swedish national power grid.

Developed through close collaboration between Skellefteå Kraft, ANDRITZ, NCC, and Norconsult, the project was executed to high environmental and technical standards using advanced Building Information Modeling (BIM) technology throughout the process. Backed by a SEK 1 billion investment, Rengård hydropower plant is now equipped to meet the challenges of tomorrow – efficient, sustainable, and built for the future.

TECHNICAL DETAILS

Rengård:

Total output: 71 MW
Scope output: 1 × 23.9 MW / 27.2 MVA
Head: 19 m
Flow capacity: 130 m^3/s
Voltage: 11 kV
Speed: 136.4 rpm
Av. annual energy generation:
205 GWh (G1 & G2)

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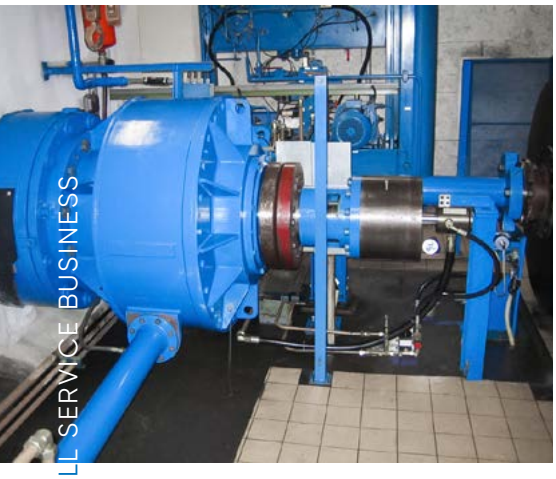
BIG

SMALL SERVICE

Delivering performance with Small Service Business for Hydropower

Although ANDRITZ is a full-service provider covering the entire plant "from water-to-wire", its Small Service Business is dedicated to less complex service and maintenance operations.



Machine hall power plant Allersdorf, Austria

Typical Small Service Business (SSB) projects are broadly limited to single projects which are generally low risk and usually involve a single system. SSB is a solution provider offering spare parts, expert inspection, manufacturing, installation, repair, and overhaul services for individual systems – if possible, all managed from a single team. As unique as every powerplant and its requirements are - as tailor-made are our services and supplies. We support daily power plant operations without the complexity of full system rehab projects.

The global Small Service Business Team combines a wealth of service and maintenance expertise to provide rapid and flexible support for hydropower operators facing unplanned emergencies or planned interventions. Their goal is to ensure continued power plant operations to add value to hydropower assets with a tailored service and manufacturing solution.

For example, considering the generators within hydropower installations, ANDRITZ has in-depth expertise in Nondestructive Testing techniques such as penetrant testing, and magnetic particle and ultrasonic testing to support fault diagnosis. The company also has a long history of manufacturing generator technology and supervision, stacking, windings and installation, as well as site management, refurbishment and modernization, training and much more.

Depending on the customer need, ANDRITZ uses a three-phase approach to addressing power plant issues, starting with assessment and diagnosis during which all project-related parameters are identified and weighed. Any life extension needs are taken into consideration, followed by an evaluation of the results and recommendations for potential next steps. The second phase is a detailed analysis to develop and evaluate suitable service scenarios for the customer. Finally, the execution phase is initiated, and the implementation of the optimum solution is based on a systematic approach from planning to commissioning. All these steps are in close cooperation with the customer.

As an example, the SSB teams repair synchronous and asynchronous generators up to 351 MVA, including elements such as the stator frames, windings, and core, but also comprehensive servicing of generator poles, rotors, and bearings. The SSB teams also serve all aspects of electromechanical service, repair, and refurbishment, including turbines, runners, valves, guide vanes, spiral case, and draft tube as well as governors, instrumentation and control and

ESULT

auxiliaries like, excitation, lubrication, and cooling systems.

The emphasis is always on short delivery times while meeting all relevant standards and tests and is based on experience and comprehensive testing.

Examples of projects where we provided technical support and expert knowledge include the Auhof converter plant and the power plant Allersdorf in Austria, Murray in Australia, Nalubaale in Uganda, Ballisodare in Ireland, Renun in Indonesia, and Kihansi in Tanzania, to name a few.

SSB is committed to exceptional service and our dedication to quality and customer satisfaction ensures the smooth operation of hydropower plants worldwide.

"The global ANDRITZ Small Service Business Team combines service and maintenance expertise to add value for customers."

Iris Egger, Vice President
Small Service Hydropower

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Work on the generator for converter plant Auhof, Austria

HYDROPO

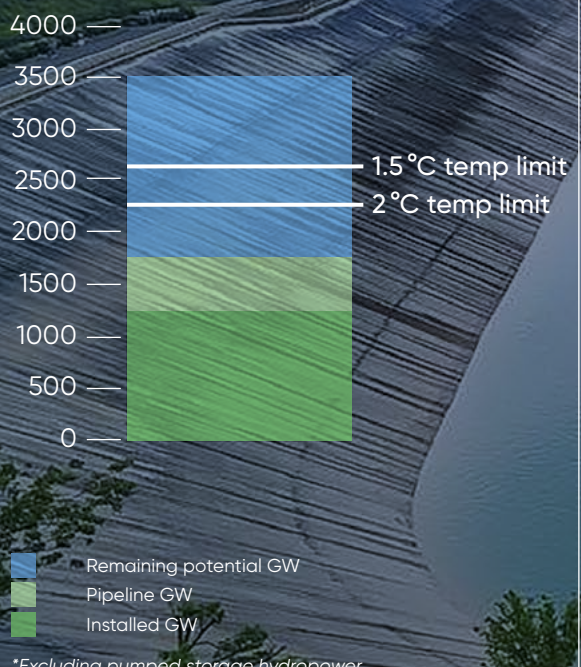
CLEAN. RELIABLE. ESSENTIAL.

Renewable hydropower is a reliable, adaptable, and cost-effective source of clean power generation and responsible water management.

Modern hydropower plants help accelerate the transition to a clean energy supply by providing important services in the areas of power generation, energy storage, flexibility, and climate protection.

Hydropower is also an important resource for building secure, clean power systems and achieving global net-zero targets.

Hydropower 2050 - Towards NetZero



**Excluding pumped storage hydropower*

1,443 GW
installed

4,578 TWh
of generation

14%
of total electricity generation

+ 85%
of installed global energy storage capacity

FLEXIBLE. BALANCING.
Hydropower is an optimal balance to variable renewables like wind and solar thanks to its flexibility and energy storage services.

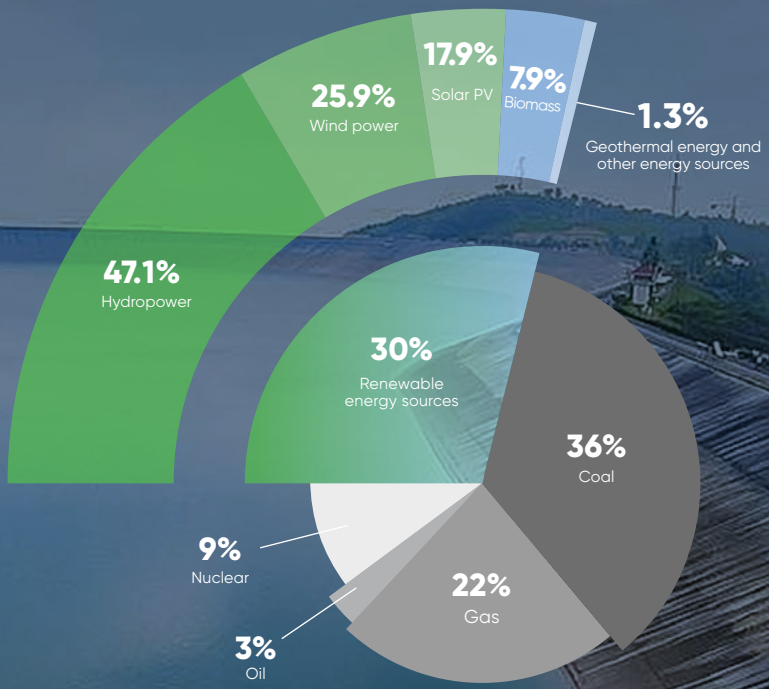
Pumped storage is the world's largest energy storage technology, accounting for over 85% of installed global energy storage capacity, far ahead of lithium-ion and other battery types.

FACTS AND FIGURES HYDROPOWER

OWER

THE WORLD'S #1 RENEWABLE

Around 47% of all renewable electricity is generated from hydropower. The sector produces about 14% of total electricity generation from all sources. No country has come close to achieving 100% renewables without hydropower in the energy mix. Hydropower installed capacity reached 1,443 GW in 2024. Global hydropower generation increased by approximately 10% in 2024, rebounding from 4,180 TWh in 2023 to 4,578 TWh, despite significant drought conditions in Latin America and southern Africa. This growth illustrates the sector's resilience but also highlights increasing climate-driven variability, which is expected to shape year-to-year performance.



Source: IEA World Energy Outlook 2024

AFFORDABLE. ECONOMICAL.

The global weighted average cost of electricity from hydropower projects was US$ 0.057 per kWh in 2023, making it one of the cheapest sources of electricity in many markets.

US$ 0.057 per kWh

JOBS. WATER. SECURITY.

Hydropower does not end with electricity generation. It provides socioeconomic benefits, creates local jobs, supports regional economies, ensures water supply and flood control, and can be used for irrigation and navigation. And hydropower is more necessary than ever as it is key to climate adaptation, offering flexible energy and water storage. Hydropower can deliver greater value from less water.

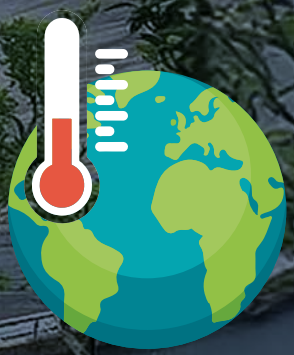
The hydropower industry employs more than 2.3 million people worldwide directly and many more in related supply chains, accounting for 17% of total power generation employment – the second-largest contributor after solar PV.

NO SMOKE. NO CARBON.

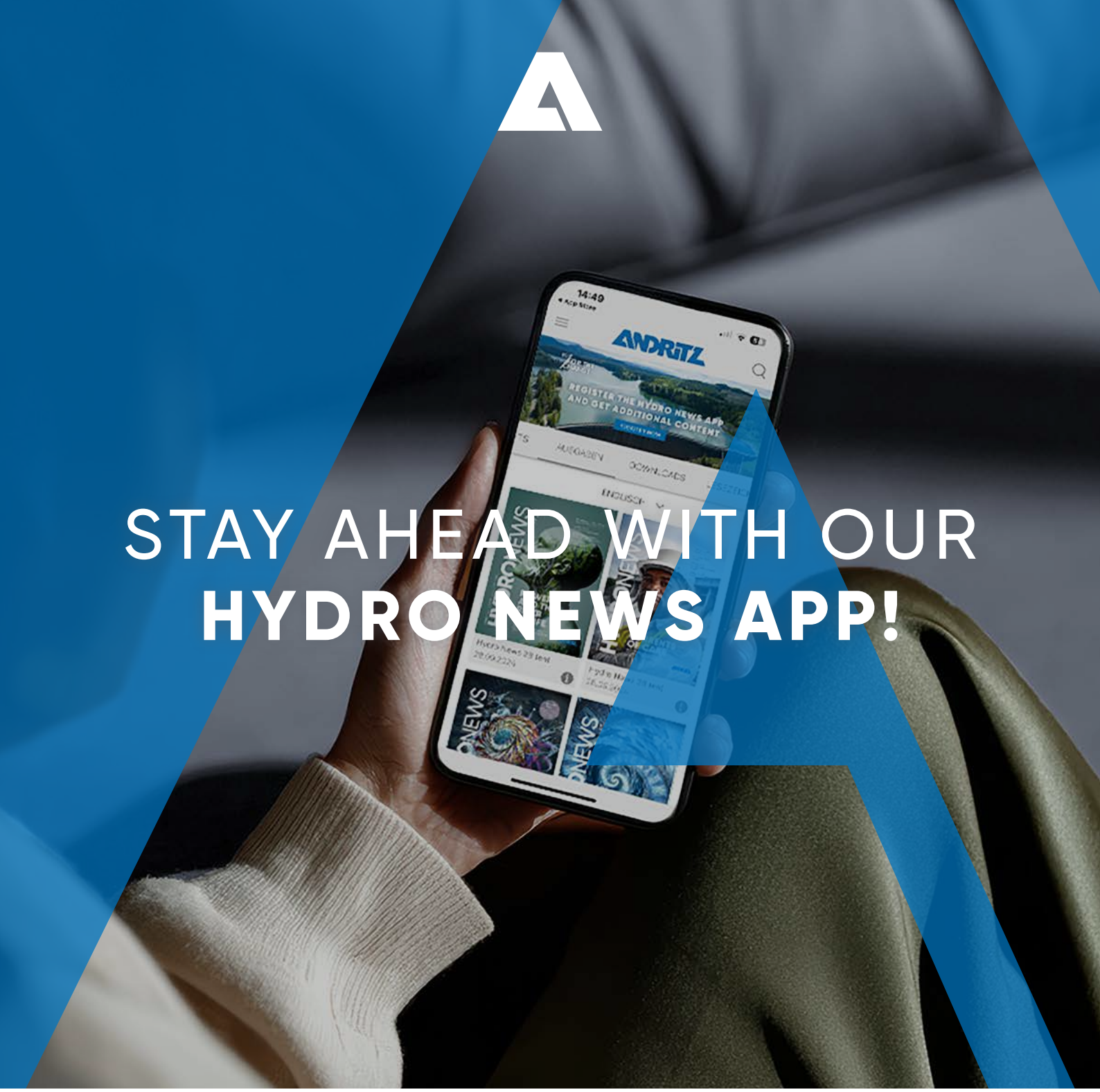
According to independent research, using hydropower instead of fossil fuels to generate electricity has helped avoid more than 100 billion tons of carbon dioxide in the last 50 years alone.

The IEA estimated that 1,300 GW of additional hydropower capacity is needed by 2050 to limit the temperature increase to 1.5 degrees Celsius.

– 100 billion tons CO_2
+ 1,300 GW to keep **< 1.5 °C**



Sources: IEA, IHA and IRENA



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