This giant 'water battery' under the Alps could be a game-changer for renewable energy in Europe

By Rebecca Cairns, CNN

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Switching to renewable energy is key to tackling the climate crisis, but wind and solar e rely heavily on the weather, creating an inconsistent power supply. Nant de Drance is pa new generation of "water batteries" which could accelerate the transition by storing ene stabilizing the electricity grid. Using the latest technology, including variable-speed pum turbines (pictured), Nant de Drance has a storage capacity equivalent to 400,000 elect batteries. **Find out about more storage solutions for renewable energy**

1 of 8

Beginning operations last month, the water battery, called Nant de Drance, is a pumped storage hydropower plant that provides the same energy storage capacity as 400,000 electric car batteries.

Located high in the Swiss Alps in the canton of Valais, the plant is equipped with agile, reversible turbines that offer new levels of flexibility, says Robert Gleitz, a delegate of the board of directors of Nant de Drance: with the flick of a switch, the plant can go from storing energy to providing electricity.

The massive project took 14 years to complete. Around 17 kilometers (10.5 miles) of subterranean tunnels were excavated through the Alps while the six turbines are stored 600 meters (1970 feet) below ground, in a giant cavern the length of two football fields.

The six turbines are powered by water cascading down a steel pipe that's taller than the Eiffel Tower.

Nant de Drance repurposed two existing reservoirs, raising the upper one by 21.5 meters (71 feet) to double its capacity -- it now holds more water than 6,500 Olympic-sized swimming pools.

As one of the largest facilities of its kind, the $2 billion project could play a vital role in stabilizing Europe's electricity grid as the continent transitions to renewable energy, says Gleitz.

Making a splash

supply.

"We can take energy (from the grid) when there is too much, and generate it again when it's needed," says Gleitz.

Unlike many of the plants that preceded it, Nant de Drance uses variable speed pump-turbines, says Pascal Radue, CEO of GE Renewable Energy Hydro which supplied equipment for the facility.

The turbines help to stabilize the electricity grid, says Radue.

"With a fixed speed turbine, you have to wait until the power plant is running at exactly the right speed to be synchronized to the grid," says Radue, adding that this wastes time and energy. Variable speed turbines supply electricity to the grid immediately so there's less risk of blackouts.

A big impact

Historically "open-flow" pumped storage hydropower stations, which are built on river systems and require dam construction, disrupted wildlife and damaged ecosystems. In Switzerland, where the first pumped storage hydropower plant was built in 1890, almost half of total river lengths have been artificially altered, with very few Alpine rivers in a natural state.

Nant de Drance used existing dam and reservoir infrastructure, with the majority of the building work carried out underground -- limiting its impact on the landscape.

That's why modern projects favor closed-loop systems, like Nant de Drance, which don't impact river systems, says Andrew Blakers, a professor of engineering at the Australian National University.

relatively small space given the energy security they provide. He estimates that to power a city with one million inhabitants for 24 hours would require around two square kilometers of flooded land, adding that pumped storage hydropower offers one of the highest efficiency energy storage solutions currently available.

Nant de Drance returns around 80% of the electricity it takes in back to the grid, and stores around 20 hours of backup energy, says Gleitz.

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Transitioning to renewables

Hoping to become the "first climate-neutral continent," Europe has big ambitions for renewable energy: in 2020, just over one-fifth of the continent's total energy came from renewable sources but in May this year, the European Commission increased its 2030 renewables target from 40% to 45%.

To achieve this, new, high-capacity storage facilities are essential, says Blakers. The European Association for Storage of Energy estimates that the continent will need 200 gigawatts of storage by 2030 -- more than four times its current storage capacity. In the decade between 2010 and 2020, just 8 gigawatts of storage was added to the grid.

The turbines are stored in an underground cavern the length of two football fields.

That's why Nant de Drance is so significant. Located at the geographical heart of Europe, Switzerland could offer stability to the grid across the continent, says Rebecca Ellis, energy policy manager at the non-profit International Hydropower Association. Nant de Drance has increased Switzerland's installed energy capacity by 33%, says Ellis, adding that it "shows the leadership of Switzerland" in the transition to renewables.

However, as the nation is not a member of the European Union, regulations are currently a barrier, says Gleitz. "The market rules are not easy," he says. "We still need to have closer agreements with the EU."

Pumped storage hydropower could provide energy security outside of Europe, too: Blakers and his team have identified around 600,000 potential sites for closed loop systems -- although just 1% of these would be needed to meet total global energy storage needs, he adds.

As the climate crisis intensifies, Gleitz hopes that Europe embraces the potential of the "clean energy storage" provided by pumped storage hydropower plants. "If we want to go in the direction of having clean power, Nant de Drance is one of the stepping stones on this path," he says.

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