Alpiq: Keeping Hydroelectric Power Flowing

Case Study: How Alpiq generates more power and profits—with less water

Meet an energy powerhouse

Hydropower is the number one renewable energy source in the world—and the backbone of Swiss electricity. For more than a century, energy producer Alpiq has used hydropower to generate climate-friendly, sustainable electricity across Europe. This includes participating in the construction of the Nant de Drance power plant—one of the most powerful pumped storage plants in Europe, with a capacity of 900 MW.

Alpiq also manages shares in nuclear power plants, thermal plants, wind farms, and photovoltaic systems. They have more than 1,200 employees and are headquartered in Lausanne in Switzerland.

What they needed

To keep energy flowing smoothly between producers and consumers, Alpiq had the ambition to optimize how they manage their pool of hydroelectric plants in the short-term. A benefit of hydropower is that you can throttle it up and down quickly, turning turbines on and off in minutes. Unlike solar and wind, it's highly controllable and more flexible than nuclear power.

Until now, Alpiq had modeled each power plant individually. Their new goal: Figure out a better way to coordinate and run a pool of assets at the right times. That meant balancing many technical constraints, such as:

- Changing market demands of the electrical grid
- Number of turbines and pumps available
- Number of hours each engine can run
- Volume of water in a dam

"Our Quant Analysis team looks to optimize our output in both the short and long term," said Anne Tye, Senior Energy Analyst at Alpiq. "We want to use the least amount of water to generate maximum efficiency and profits."

Finding the right solver

To make this sort of complex modeling easier, analysts at Alpiq compared an array of commercial and open-source solvers. Above all, they needed flexibility, speed, and optimality. After testing several available tools against a representative model of their systems, they soon landed on Gurobi Optimization.

"We were looking for something that was highly customizable, quick, and feasible to execute within the constraints of our equipment and ever-evolving environment," said Tye. "Gurobi stood out over other solutions because it was the most robust in terms of speed, optimality, and price. It matched up exactly with what we needed."

Source: Alpiq

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Harnessing more power

Now, Alpiq is using their new solver as part of a highly customized model to optimize their pool of power plants—notably by capitalizing on their synergies. With Gurobi, they can more easily keep their asset running efficiently today, plus better predict how much energy they need to store and generate tomorrow.

Alpiq was also able to tap into the power of the Gurobi support team. "Working with the Gurobi engineers has helped us move even more quickly," said Tye. "It's an added value that we get a second set of eyes to double-check our configuration and confirm we've set everything up correctly."

Powering other areas

Moving forward, Alpiq plans to use a solver to model many other aspects of their power plants, too. "In our industry, there are many market processes as well as technical challenges which need to be optimized," said Tye. "A stochastic approach—for example of the forecast of market prices or natural inflows—helps us price our production and grasp market opportunities. Modeling helps us predict and respond quickly to market conditions outside of our control."

> *"With Gurobi, we get the precision, flexibility, and speed we need to optimize the efficiency of our hydroelectric power plants. And we can change our constraints at any time, to keep up with evolving demands of the electrical market and characteristics of our complex Alpine power plants."*
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> Anne Tye, Senior Energy Analyst at Alpiq

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