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EPV

Turning Former Oil-Storage Caverns into a 17 GWh Heat Battery at Vaskiluoto

How four engineering projects helped connect cavern-based thermal storage, electric boilers and CHP generation in one integrated energy system



Business challenge

As more weather-dependent renewable electricity enters the grid, flexibility and storage become more important. At Vaskiluoto, Vaasan Voima had already demonstrated that two former oil storage caverns, with a combined volume of 210,000 m^3, could be used to store heat. The site had also shown how electric boilers could convert low-cost electricity into district heat. The next challenge was to increase the amount of energy the same caverns could store.

The project needed to solve four engineering challenges:

- Prevent water from boiling above 100 °C by pressurizing the thermal storage system using the natural pressure created by a water column
- Design a new pumping and heat exchange system for the caverns
- Redesign the plant's district heating pumping system and operating philosophy
- Integrate the upgrade with the existing CHP plant, electric boilers, and energy infrastructure so the full system could work more effectively together

Few systems of this kind had been built at this scale. EPV Energia and Vaasan Voima drove the concept forward through ambitious thinking and innovative reuse of existing infrastructure. Cyient supported the development, building on earlier work at the site and applying proven thermodynamic principles to a largely new design.

Overview

EPV Energia Oy (EPV Energy) is a Finnish energy group with 70 years of experience in energy generation. Its subsidiary Vaasan Voima operates the Vaskiluoto combined heat and power (CHP) plant in Vaasa, which supplies heat to the region's district heating network.

Since 2019, Cyient has provided engineering for four consecutive Vaasan Voima projects at Vaskiluoto. The latest project pressurized the site's cavern-based thermal energy storage so it can operate at up to 130 °C. It inaugurated what EPV describes as one of Europe's most advanced sector coupling systems.

The Cyient solution

Cyient carried out multi-discipline concept to detail engineering for the pressurization of the thermal storages, building on three earlier projects at the site from concept to detail engineering.

- Engineered the pressurization of the thermal storage caverns, which uses a water column to keep water from boiling at up to 130 °C
- Designed a new pumping and heat exchange system for the storages
- Developed a new design for the plant's district heating pumping and operation philosophy
- Regulatory deliverables, e.g. PED documentation for the notified body and the boiler placement plan under Finnish legislation
- Built on earlier Cyient projects at the site: thermal energy storage in the first cavern (2019), a 40 MW electrode boiler (2021), and conversion of a second cavern (previously used as expansion volume) to storage with two 60 MW electrode boilers (2023)

EPV inaugurated the Vaskiluoto energy system in September 2026.
It now integrates thermal energy storage, electric boilers and CHP generation on a single site.

Storage

Thermal energy storage capacity increased to approximately 17 GWh. For scale, EPV compares this with an estimated 3 GWh of battery storage connected to Finland's electricity grid, while noting that thermal and electrical storage serve different purposes.



Engineering continuity

Four engineering projects for Vaasan Voima since 2019

Temperature

Storage raised to 130 °C from below 100 °C previously

Flexibility

Charging and discharging capacity doubled to approximately 220 MW

Electrification

220 MW of electric boiler capacity working alongside CHP generation

Renewable energy utilization

Surplus renewable electricity can be converted into heat, stored over extended periods, and released during peak demand.

Reduced combustion dependency

Stored heat reduces the need for combustion-based production, while CHP generation maintains supply during prolonged cold spells.

> "Our teams at EPV Energia continue to push the boundaries of how existing energy infrastructure can be used in new and innovative ways. Cyient has been a strong engineering partner in supporting that ambition, combining multidisciplinary expertise with an understanding of our Vaskiluoto site to help turn new concepts into practical, integrated energy solutions."

***Simon Björkman**, Development Manager, EPV Energia Oy*

Considering energy storage or ways to benefit from electricity price fluctuations? How would these fit into your existing energy system?

Talk to Cyient's energy engineering experts.

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