

Flow measurement without inlet and outlet runs

The water flow of Porvoon Energia's new district heating battery is measured with Endress+Hauser's Full Bore flowmeters



Porvoon Energia is a pioneer in clean energy production, and wants to produce energy solutions for the people of Porvoo and other Finns that make it possible to reduce emissions.

Porvoon Energia invested in a district heating battery that reduces the use of peak load plants and balances heating distribution during downtime. Endress+Hauser provided the plant with flowmeters that utilize cutting-edge technology.

If you were to walk to the end of Kipinätie in the industrial area of Kevätkumpu in Porvoo, Finland, you would find yourself standing in front of a 40-meter-high and 18-meter-wide tower. Inside this tower, protected by sheets of metal and layers of insulation, are 10,000 cubic meters of hot water. This amount of hot water corresponds to 350–400 MWh of energy, enough to provide heating to approximately 25 single-family houses for a year.

The tower is, in fact, energy company Porvoon Energia's new district heating battery. As the name implies, the tower acts like a battery: it can be used to either store energy in the

form of hot water or discharge it into the district heating network. Near the surface of the tank, the water temperature can be as high as 95°C, while at the bottom the temperature drops to approximately 50°C.

"The Kipinätie district heating battery allows Porvoon Energia to prepare for electricity price fluctuations and controlled power outages and downtime. When power generation is maximized, the battery can be used to store any excess heat generated during production, reducing the loss of energy," explains Automation Manager **Marko Heikkilä** from Porvoon Energia.

"This allows us to influence the average price of the electricity we generate and achieve significant economic benefits," says Heikkilä.

The district heating battery is not a new invention by any means. What is exceptional about Porvoon

Energia's district heating battery, however, is the fact that it is located dozens of kilometers away from the main production plant. Although the distance poses challenges in terms of charging, placing the battery closer to consumers allows for very short response times in exceptional situations.

"The battery can cover the capacity of Porvoon Energia's main power plant in Tolkkinen for up to ten hours," Heikkilä adds.

The process planning for the approximately EUR 3.5 million facility was carried out by Elomatic and the automation solutions were provided by Valmet Automation. All of the components critical to the operation of the facility and the process were supplied by Endress+Hauser.

Making inlet and outlet runs a thing of the past

Heikkilä describes the district heating battery as a technologically fascinating facility, the operation of which involves combining data on weather forecasts and the output of power plants, among other things, in real time. Heikkilä's fascination is shared by Endress+Hauser's Product Manager **Ari Kettunen**, according to whom the facility also utilizes cutting-edge measurement technology.

"One of the aims in the planning stage of the Kipinätie facility was to minimize the inlet and outlet runs required by conventional measurement technologies. Endress+Hauser's 0 x DN Full Bore flowmeters, launched in 2019, use multiple electrodes to provide reliable measurements that are independent of flow profiles – without traditional inlet and outlet runs," Kettunen says.

The discussion about the collaboration between Porvoon Energia and Endress+Hauser began in a customer seminar held just before the start of the COVID-19 pandemic and continued with Endress+Hauser's Sales Manager **Jarmo Partanen**, focusing on how Full Bore could meet the facility's requirements.

"When it comes to new facilities, the general aim is to build as densely as possible. This approach limits the space available for instruments, necessitating new kinds of solutions. Full Bore is Endress+Hauser's solution to these challenges. These types of products are not available from any other supplier," Partanen says.

In addition to the limited space, the measurement position also set its own requirements. The district heating battery's flowmeters are used to measure water flow in both directions – depending on whether the battery is being discharged or charged. Luckily, Full Bore flowmeters provide two-way measurement data, the accuracy of which, according to Heikkilä, has been positively surprising with small water flows as well.

"Since the district heating network is sensitive to variations in differential pressure, the choice of flowmeter was given particular attention. The flowmeter has 0–700 cubic meters of water flowing through it per hour, and even the slightest imbalance in the battery's input and return flows is immediately visible in the district heating pumping of main production plants. The repeatability of the measurement must be top-notch – so far, the Full Bore flowmeter has provided just that," praises Heikkilä.

"Full Bore has been well-received by our customer base. So far, we

have sold around twenty Full Bore flowmeters in Finland, with the Kipinätie district heating battery being the first facility featuring them to be commissioned," Partanen says.

Full Bore flowmeters pay themselves back many times over

The collaboration with Porvoon Energia began in 2010 when Metso Endress+Hauser was chosen as the component supplier for Porvoon Energia's TolBio project, providing most of the measurement instruments for the new plant. Since then, the cooperation has been maintained through smaller projects over the years.

"Going with Endress+Hauser's products was a natural choice for us. The decision was confirmed not only by Partanen's sales pitch but also by our previous experiences of Endress+Hauser's measurement instruments and compatible spare parts," says Heikkilä.

The Kipinätie plant was originally built in 1983 and automated in 2018. The older parts of the facility also feature plenty of Endress+Hauser's pressure, level and flow measurement instruments.

"The ultrasonic flowmeters that have worked flawlessly in the older parts of the plant were actually our number one pick for the district heating battery as well during preliminary planning – although the need for inlet and outlet runs was a concern. In the end, Full Bore became a key component for us and allowed us to save a significant amount of space. A smaller building also translates to lower costs," Heikkilä explains.

Product development bears fruit

The preliminary analysis of the district heating battery project was started back in 2012. Now, ten years later, the facility has entered the test run phase.

“Right now, we are looking for the optimal way to run the process. By our calculations, the battery will have an annual utilization rate of 83%. The most significant benefit will be minimizing the amount of natural gas consumed by peak load plants,” says Heikkilä.

Porvoon Energia produces 90% of its electricity and district heating in an environmentally friendly manner. This year, Porvoon Energia became the first energy company in Finland to be awarded the EKOenergy label for district heating as well.

Heikkilä commends Endress+Hauser for keeping its services running and sticking to its promised delivery times even during COVID. The commissioning of the flowmeters was also carried out without a hitch. Partanen and Kettunen are also particularly proud of the successful collaboration. For them, the newly commissioned facility represents the culmination of long-term development work.

“We have been investing in product development for years, which is reflected in the fact that

Endress+Hauser holds more than 8,600 international patents. It is at places like the new Porvoon Energia facility that these investments become visible!”



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