

Energy-efficient pumping station ensures a clear future for Pien-Saimaa lake region

The southern part of Lake Saimaa was threatened by deteriorating water quality before an innovative pumping solution came to the rescue. Supplied by local Finnish company AXCO-Motors, the energy-efficient motor for the pumping station is already generating annual savings of tens of thousands of euros for the City of Lappeenranta.

In the winter of 2008–2009, something very unusual was observed in the Pien-Saimaa lake system: blooms of blue-green algae beneath the ice lasting throughout the entire winter.

Measurements revealed that the water in the western parts of Pien-Saimaa was completely starved of oxygen in places and smelled of hydrogen sulphide. At the same time, phosphorus was being released from the bottom of the lake, making the lake water even more eutrophic.

The findings were described in the Finnish media as a mystery that confounded even international blue-green algae

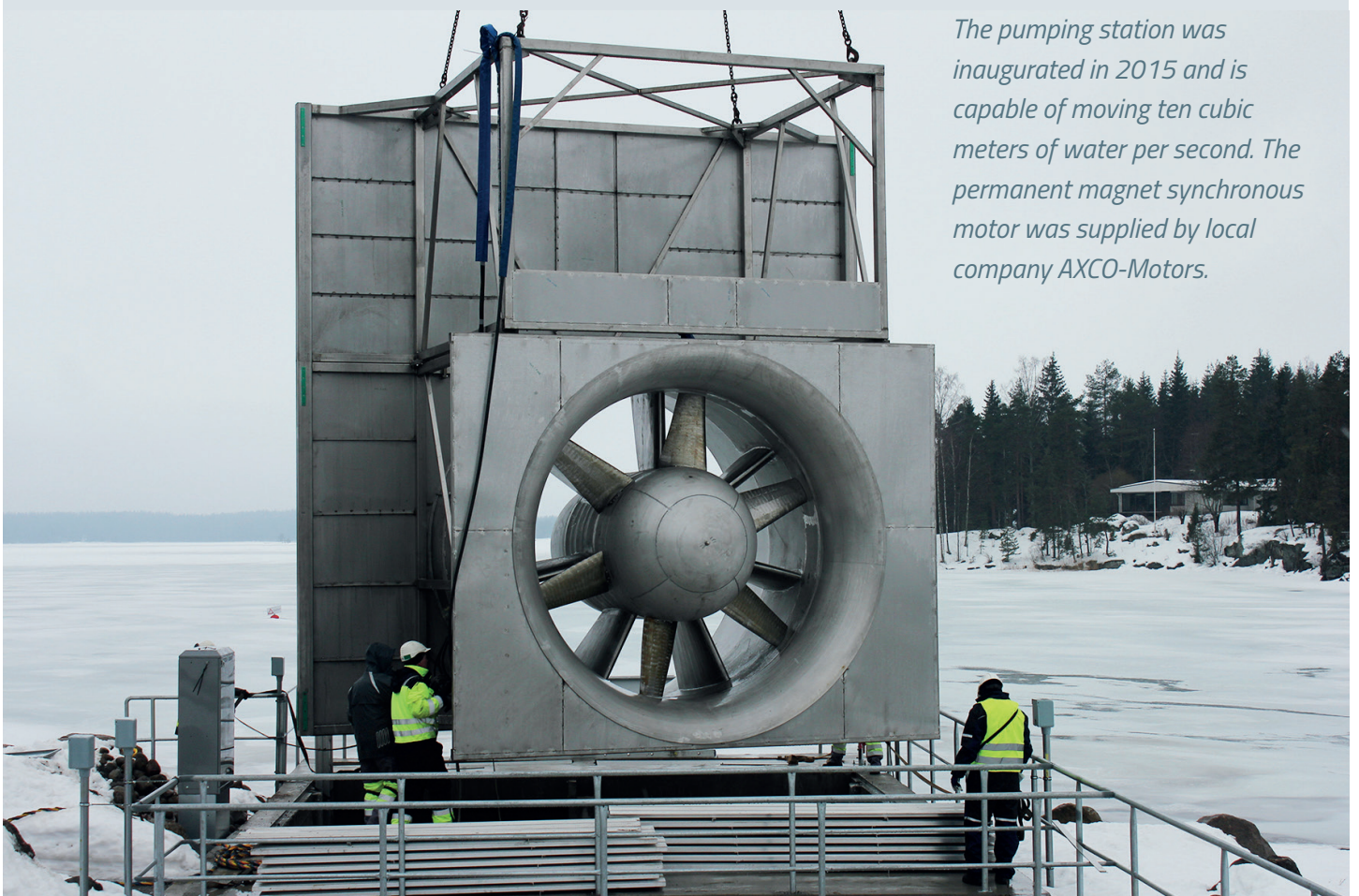
researchers. The fear was that the blue-green algae would spread to the main waterway system of Suur-Saimaa.

The catastrophic condition of the Pien-Saimaa lake system was ultimately revealed to both experts and local residents during that winter.

“Major studies were undertaken immediately to find a solution to the problem,” says **Ilkka Räsänen**, Director of Environmental Services at the City of Lappeenranta.

One of the first solutions that was suggested was to increase the flow of water by means of a pumping station.

The pumping station was inaugurated in 2015 and is capable of moving ten cubic meters of water per second. The permanent magnet synchronous motor was supplied by local company AXCO-Motors.



"Pien-Saimaa is shallow and partially isolated, so stagnant water is one of the main problems. It takes on average five years for the lake water to recycle, making it easy for nutrient levels to get out of control," Räsänen adds.

Lappeenranta selects an innovative solution

Following the completion of a Master's thesis on the subject, an environmental impact assessment was conducted for the potential location of the pumping station and the number of pumps that would be required. Planning could then begin on implementing the project.

The City of Lappeenranta went with a truly innovation solution that had not been tried anywhere else previously. The flow technology of the pumping station was designed at Lappeenranta University of Technology, the pump system was supplied by Waterpumps WP and its mechanics and motor were designed and manufactured by AXCO-Motors.

The pump uses an impeller that measures over three meters in diameter and is powered by a 30-kilowatt permanent magnet synchronous motor designed and manufactured by Lappeenranta-based company AXCO-Motors. The impeller is capable of moving ten cubic meters of water per second, compared to the natural flow in Pien-Saimaa of approximately four cubic meters per second.

According to Ilkka Räsänen, the decision taken by the City of Lappeenranta was unanimous, even though it took a lot of courage from both decision-makers and officials.

"First of all, the idea was completely new, and secondly the pump solution was only a prototype that had never been used before in any other project. It was a bit like buying a car that has never been built and exists only on the drawing board," Räsänen describes.

Annual cost savings of tens of thousands of euros

Construction of the new pumping station began at Kivisalmi in summer 2013, and the motor was started up a year and a half later in spring 2015.

According to Räsänen, the pumping station has lived up to expectations extremely well. The water quality in the area has improved dramatically, and the pump solution has proven to be reliable and extremely energy efficient.

Räsänen points out that the solution was chosen specifically on the basis of total life-cycle costs rather than acquisition costs. The original alternative was to install two industrial pumps adjacent to each other in the area, but their efficiency would have been much lower than the solution that was selected.

Pien-Saimaa refers to the southernmost parts of Lake Saimaa around Lappeenranta and Taipalsaari. This part of the lake system is shallow and partially isolated, making the waterflow slow.

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According to subsequent research, the new pumping station has significantly improved the water quality in Pien-Saimaa, and algae levels are now below the levels they were in the early 2000s.

"We are currently saving around 45,000 euros per year in energy costs," Räsänen estimates.

According to **Asko Parviainen**, Vice President, Sales and Technology, at AXCO-Motors, life-cycle costs are kept reasonable in part by the extremely low maintenance requirements.

"Similar levels of performance and efficiency cannot be achieved in practice with any other solution than a permanent magnet synchronous motor. This solution is also safe for the environment, as the motor is mounted in a pressurised watertight and airtight space. This is also optimal for cooling, as the motor is surrounded by cold water on all sides," he explains.

Parviainen believes that there is clear demand for these kinds of pumps elsewhere in Finland and around the world. The experiences from the demanding and large-scale Kivisalmi project have been extremely positive.

"Despite the number of partners involved in the project, the collaboration was very smooth. For us, coming from Lappeenranta, it was also a great chance to help improve the water quality in this unique region," Parviainen adds.



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