



Solar-powered mixers help reduce aeration runtime and improve mixing.

Solar-Powered Circulation

By Patrick J. Schnaidt

Mixers reduce aeration horsepower, save energy for shared WWTP in Oregon

Along the banks of the Columbia River, northwest of Portland, the city of St. Helens, Ore., and the town's major industry, Boise Paper, share a wastewater treatment plant (WWTP) and even a U.S. Environmental Protection Agency-required National Pollutant Discharge Elimination System permit. The two organizations work together closely to meet the mutual goal of operating the plant as efficiently and cost-effectively as possible.

For this goal, a recent project to reduce the cost of aeration in the 42-acre lagoon led to the installation of solar-powered, long-distance circulation mixers from SolarBee Inc.

The city and mill not only cut their energy costs, but the project also qualified for a rebate from their electric utility, Columbia River PUD, with support from the Bonneville Power Administration's Energy Smart Industrial program. Aeration runtime costs are down more than 50% and payback in two years is anticipated.

An Energy Reduction Project

The current WWTP consists of two ponds: a three-acre primary lagoon that receives loading from the city and smaller industries, and a 40-acre secondary lagoon that receives effluent from the city's primary pond and the mill's primary clarifier.

The secondary lagoon is divided into three zones by baffles. Prior to the energy reduction project, 24 mechanical surface aerators in the first two zones ranged from 50 to 150 hp and operated approximately 2,100 hp per day, effectively making them partial-mix zones.

The aerators were alternated to maintain thorough mixing: Five to six aerators ran constantly in Zone 1 and one aerator in Zone 2. A SCADA control system rotated the aerators automatically depending on the level of dissolved oxygen. Zone 3 is a quiescent area, where the solids are allowed to settle. The secondary effluent is discharged into the Columbia River, past Sauvie Island 650 ft into the channel.

The size of the lagoon was adequate for the needs of the mill and the city when Boise Paper operated as both a pulp and paper mill. But times have changed. Boise shut down its pulp processing operations in January 2010 and today operates solely as a paper mill.

Energy-Saving Solution

When the mill reduced its loading on the WWTP, the focus changed from maintaining the aerators to reducing the electricity required to run them.

"Boise Paper was working on a variety of energy reduction projects, including reducing energy at the wastewater treatment plant," said Boise Paper Environmental Engineer Alison Dean. "We had been able to decrease aeration down to the point where mixing was the limiting factor. The secondary treatment lagoon was still expensive to operate, and we searched for ways to reduce those costs."

Cascade Energy Eng. conducted a study at the request of Columbia River PUD to consider energy-saving solutions at the plant. It studied seven months of operational data from the plant's SCADA system, as well as input from plant personnel.

Engineers considered three options in their study report:

1. Replace a portion of the existing surface aerator propeller blades to a lower pitch, which would reduce aeration power but also reduce mixing;
2. Replace a portion of the existing surface aerators with aspirating aerators, which would provide adequate aeration but would create only localized mixing due to the small impellers used; and
3. Replace a portion of the existing surface aerators with solar-powered mixers, which would reduce the runtime of existing aerators or the number of aerators while also improving mixing.

According to the study, the lower-pitched propeller blades would save 119,553 kW per year; the aspirating aerators would save 91,747 kW per year and the solar-powered mixers would save about 1.4 million kW per year.

Halving Aeration Horsepower

"To me, the choice was obvious," said St. Helens' Wastewater Treatment Plant Superintendent Aaron Kunders. "Due to the energy savings and the resources available through the ESI program, Columbia River PUD was able to provide a 70% rebate for the cost of the mixers. It brought the price so far down that our payback was two years. In two years, we have a payoff and in four years we make that money back. This one cost a lot more up front,



Aaron Kunders, superintendent, St. Helens Wastewater Treatment Plant, said the mixers reduced aeration horsepower by 50%.



The control room offers a view of the lagoons and mill.



In January 2012, the city received the Oregon Leaders Award for Industrial Energy Efficiency.

but it also has the biggest return.”

The solution was to install seven SolarBee SB10000 v18 machines, five of them in Zone 1 and two of them in Zone 2. Each mixer can displace between 30 and 60 hp of aeration.

“Right now we’re saving more than 50% of horsepower,” he said. “We were at 550 hp per day before we added SolarBee mixers, and now we’re at approximately 250 hp. Plus, we’re getting nearly complete mixing at up to 20 ft deep in the 28-ft secondary lagoon. Typical aerators only mix the top 5 to 6 ft.”

Kunders said that taxpayers enjoy the biggest payoff of the project.

“The cost for all these mixers was offset so the cost doesn’t have to go to our taxpayers,” he said. “Instead of paying 100% of it, the city

probably paid 10% of it, between the rebate and the mill’s contribution, which is incredible. The citizens got a great deal on it.”

Because of these significant savings, the city recently received the Oregon Leaders Award for Industrial Energy Efficiency at the 4th Annual Northwest Industrial Energy Efficiency Summit in Portland in January. St. Helens was one of six organizations honored for innovation and improving efficiency. [WWD](#)

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