

Water Quality/Wastewater Treatment

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Help prevent algae growth in wastewater ponds while saving money

Solar powered wastewater pond circulators provide power payback

DICKINSON, N.D. — You don't think of wastewater treatment as a cheerful business, but Skip Rapp, of Dickinson, ND, is all smiles these days. Rapp, the city's Public Works Superintendent, is smiling about the city's solar powered pond circulators.

A three year study completed in May, 2002, shows that all 16,000 residents of Dickinson have good reason to smile.

In 1998, the city was facing some tough issues regarding wastewater treatment. Its 133-acre lagoon system was the town's biggest energy consumer and required constant "hands-on" attention. Even with 500 horsepower of aeration and pumping equipment, it could barely keep up with the city's needs due to strict ammonia limits for discharging water to the Heart River.

Of the city's 1.4 million gallons per day of wastewater, only 12 percent could be cleaned up well enough to be discharged to the river. So most of the water was disposed of by irrigation. Since there was virtually no excess capacity, if an irrigation system went down the city had to scramble quickly to get it going again. And at one point a key irrigation system started to erode a river bank, with the potential to cause serious new environmental problems.

Consequently the city was forced to start looking at options, including construction of a new multi-million dollar mechanical treatment plant. Mechanical plants have much higher ongoing operating costs than lagoons, not only due to energy costs but also for fulltime employees, equipment maintenance, and chemicals. A mechanical plant would have meant large sewer rate increases for their customers.

Fast forward to 2001. In 2001 the city's existing lagoon system met all water quality standards for discharging all of the water it needed to pump into the river. Irrigation was all but eliminated and the system energy requirement had dropped from 500 horsepower to only 130 horsepower, enough energy savings to supply about 240 homes with electricity year-round. In addition, the lagoon system now requires very little management or maintenance effort, and has plenty of capacity to meet the city's needs far into the future.

How was such a dramatic change possible? By capturing more of the sun's energy and putting it to work to clean up the wastewater.

Joel Bleth, President of Pump Systems, Inc. of Dickinson, ND, the manufacturer of the "SolarBee" solar-powered

ered pond circulators installed by the city, commented that "The sun produces about 5,000 horsepower of 'free' energy per surface acre. The SolarBee captures more of that energy to clean up the water than grid-powered aerators do."

According to Bleth, aerobic bacteria

Note: Pump Systems, Inc. (PSI) markets its pond circulators as the "SolarBee" brand. This article refers to machines which PSI developed, manufactured, and installed before it adopted the trade name "SolarBee".

ria in the water need adequate oxygen just like fish and humans, as they consume the sewage and break it down. But while grid-powered aerators produce oxygen, they also produce turbulence as the high horsepower motors force air bubbles into the water and then mix them throughout the lagoon. The turbulence impedes many natural processes such as algae growth, photosynthesis and sludge digestion by anaerobic bacteria at the bottom of the lagoon.

Bleth says the SolarBees are more in synch with nature. In the front-end lagoons, which receive the highest ammonia and other nutrients from the raw sewage, the SolarBees provide gentle but thorough mixing which allows algae to produce high volumes of pure dissolved oxygen for the bacteria to use. The algae production also raises the pH, which allows ammonia to be gassed out of the water and causes other nutrients to be transformed into harmless chemical compounds that settle to the bottom of the lagoon. Therefore low levels of nutrients are passed on to the next lagoon.

When SolarBees are used in several lagoons in series, the result is that the water quality in the final lagoon is high enough to discharge to a river, having very little algae, ammonia, or other nutrients, and a normal pH. This all adds up to a smile of relief for Dickinson's residents and city officials.

The SolarBees used by the City of Dickinson are 16 ft. in diameter by 4 feet tall and are constructed primarily of stainless steel. They float mostly submerged in the lagoon, with concrete mooring blocks and stainless steel anchor chain to accommodate changing water depths.

Each machine has three 55 watt solar modules that convert sunlight to electricity, powering an electric motor that turns a large pump impeller that brings water up from low in the lagoon and spreads it across the surface. The larger SolarBee models produce flow rates up to 10,000 gallons per minute.

According to a May, 2002, report called "Watergy"

by the international organization Alliance to Save Energy (ase.org), co-chaired by ND Senator Byron Dorgan, 7 percent of total world energy and 3 percent of total U.S. energy is used to process water and wastewater. Since demand for both water and energy are expected to grow quickly in the years ahead, large energy savings

are possible in this field. ASE coined the word "watergy" to demonstrate the linkage between these two large problems.

Bleth feels the SolarBee can be an important part of the solution, not only in wastewater but also in freshwater lakes where harmful algae blooms can cause fish kills and, in the case of drinking water reservoirs, problems of taste, odor, and excessive treatment costs. So far, most of the 250 SolarBees manufactured since 1998 have been placed in wastewater systems, but several of them have been placed in freshwater lakes. Thus far, they appear to have eliminated the harmful algae blooms. More tests on fresh water lakes are being conducted in 2002.

Conventional rooftop solar modules often have a long payback time — sometimes 20 years or more. But the SolarBee payback time is much shorter, often only 1-3 years.

The City of Dickinson purchased sixteen SolarBees between 1998 and 2000, and will purchase four more in 2002 to eliminate the need for the last 130 hp of grid energy in their system. The city will have less than \$500,000 total invested in their SolarBees, but the entire investment has already paid for itself in energy costs, labor, and avoided costs.

For more information about SolarBees, contact Pump Systems, Inc. in Dickinson, N.D. at 800-437-8076, fax: 701-225-0320