Smart Tech: Saving (Really) Big on Water Treatment with SolarBees

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Introduction

It's no surprise that local and regional water suppliers are looking for ways to cut costs. Increased demand from population growth and/or growing industrial activity combined with higher water treatment costs from associated pollution are straining budgets and making life harder for water delivery professionals everywhere.

Here's some good news: a somewhat obscure technology, the "SolarBee," is working wonders in Houston, TX (to the tune of $759,000 savings annually) and could be *your* ace in the hole.

The SolarBee is a floating solar-powered reservoir circulator. It creates a 4-6 foot diameter column of rising water below the machine and spreads this water gently across the top of the reservoir in a long distance flow pattern, affecting up to 35 surface acres. Depending on the model, the SolarBee is 10 - 17 feet in diameter with flow rates between 1,250 - 10,000 gallons per minute. The mixing action has numerous positive effects on water quality in lakes, wastewater ponds, and potable water reservoirs.

SolarBee on Lake Houston

Source: City of Houston

Case Study: Lake Houston

In 2005, The City of Houston began receiving many complaints on the taste and odor of municipally-supplied water coming from Lake Houston. Although the lake has generally good water quality, the combination of poor clarity and high nutrient loads was leading to prolific blue-green algae growth. In addition, deficient oxygen at lower depths, thermal stratification, and seasonal turnovers were creating a cycle of taste and odor (T&O) events. The situation was bad for the marine environment and frustrating for the municipally-owned water utility which even had to close its Lake Houston plant doors for a brief period in December 2005 because of the T&O problems.

Before and After SolarBee Mixing

Source: www.solarbee.com

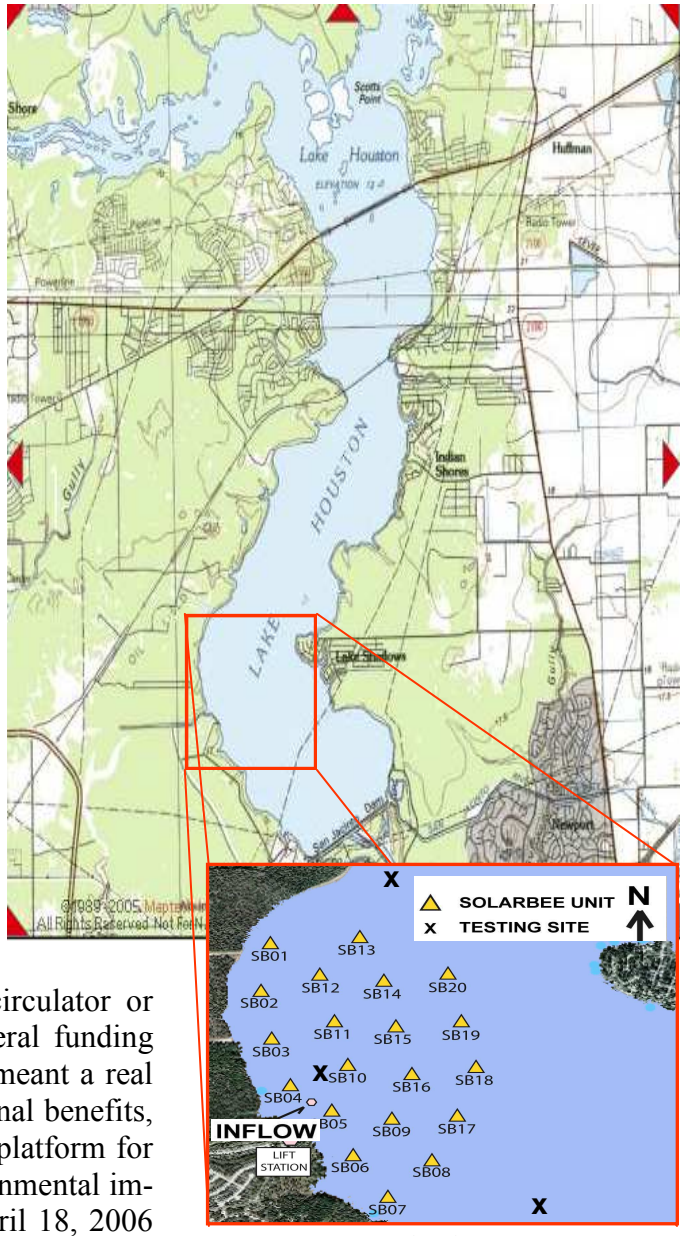
There are several ways to prevent, or reduce the effects of, T&O events:

- *Nutrient Reduction* - can be difficult to achieve for all non-point sources.
- *Chemical Applications* - costly and impermanent solution.

- *Bioshift* - can only occur when favorable conditions exist for "good" lake ecology.
- *Aeration and Circulation* -
  - Disrupts blue-green algae favored environmental conditions.
  - Disrupts blue-green algae ability to regulate buoyancy.
  - Allows "good," edible algae (ie. greens, diatoms, etc.) to out-compete for soluble P and N, enhancing the lake's food web.
  - Increases DO levels and destratifies the water column.

Through a unique collaboration between the utility, the Federal Science and Research Agency, and equipment vendor stakeholders, Houston decided to pursue an aeration and circulation strategy as part of a new focus on source water protection. Since Lake Houston has a typical area of 11,000 acres, project planners settled on a partial treatment plan that placed 20 laminar flow hypolimnetic circulators (SolarBees) around the plant intake on a lease basis as well as construction and deployment of 3 USGS WQM stations. The monitoring stations were placed upstream, in-stream, and downstream of lake circulators.

Lake Houston SolarBee Project Area



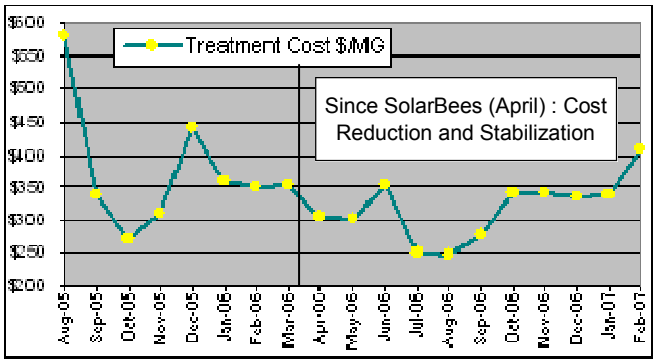
Source: City of Houston

The low capital and operating costs ($40,000 per circulator or $1,100 per month lease option) and the use of federal funding through the first-in-kind floating monitoring stations meant a real opportunity for Houston to harness long term operational benefits, study the effects of partial treatment, and establish a platform for other, further-reaching source water quality and environmental improvements. The 20 circulators were installed on April 18, 2006 and the monitoring stations went online in August 2006.

Results

Almost immediately, researchers observed notable improvements in water clarity (Secchi Depth) as well as diversification and proliferation of aquatic species in the project area. Researchers also observed a dampening effect on the overall variation of water quality indicators such as pH, total organic carbon (TOC), and turbidity in waters entering the treatment plant. Improvements in water quality led to an avoidance of seasonal algal blooms and T&O events associated with lake turnovers. After installation of the SolarBees, a major T&O event did not occur for more than 12 months. This led to significant treatment cost reductions as well as dramatic decreases in customer complaints. The plant lowered its average Powdered Activated Carbon Dosage (chemical treatment) from 93 lbs per million gallons (MG) to 62 lbs/MG with no loss in treated

water quality. Overall treatment costs were reduced from $375/MG to $318/MG resulting in $500,000 in chemical treatment savings within the first 11 months. After three years of building operational knowledge and efficiency gains within the system, the utility is realizing yearly average savings of 2,190,000 kWh in energy avoidance and 67% reductions in chemical treatment use. This represents yearly savings worth $769,000.



Source: City of Houston

Applying Houston's Successes

The Lake Houston project, while unique in some aspects, is applicable to a myriad of geographic regions and water sources. The take home message is that circulation of stagnant, anoxic water bodies can be immediately beneficial to the local ecosystem and, in turn, the human populations that rely on those systems. Additionally, these types of projects can be extremely cost-effective with either short payback periods or instant and continual savings through loan programs. Also, circulators, such as the SolarBee model used in the study, can be modified for other specific purposes and to a wide range of local conditions and reservoirs including:

- *Estuaries and Other Saltwater Bodies*
- *Wastewater Facilities*
- *Stormwater Retention Ponds*
- *Freezing or Intermittent Water Bodies*
- *Potable Water Storage Tanks*
- *Recreational Ponds and Lakes*
- *Industrial Reservoirs*

Source: Harold Davis

It is also worth noting that vertical mixing and increased flow is not a complete solution for preventing harmful algal blooms or poor water quality in general. While circulation technology is an excellent near term strategy, reduction of point source pollution in the intermediate term as well as non-point source reduction in the long term will limit the causative factors and provide the greatest environmental benefits. Information on these and other water-related topics can be found at the ICLEI Global Water Program Website. Here one can find links to trainings, tools, and publications as well as advocacy and other example programs.

Resources

SolarBee Website

Houston Mayor's Office of Environmental Programming

ICLEI USA—Local Governments for Sustainability

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