

THIS GREENHOUSE EFFECT JUST MIGHT BE GOOD FOR US

Solar-powered aquatic gardens can transform raw sewage into clean drinking water

Clad in L. L. Bean blue jeans and a white T-shirt, John H. Todd smiles into the sunlight flooding his new greenhouse. Rows of clear plastic water-filled tanks, each brimming with a deep green mixture of plants, algae, and bacteria, fill the air with the sweet smell of fresh flowers. But the plants in Todd's aquatic garden are not for sale. They are helping produce 20,000 gallons of clean water a day from Providence's raw sewage.

"It's a space-age approach to the purification of water," says Todd, pointing out the contrast to a pungent municipal treatment plant a few hundred feet upwind. Trailing his fingers in the murky water, he rattles off a rapid-fire description of his system. Waste, flowing from one tank to another, is broken down in stages by bacteria and algae into nutrients that are digested by aquatic plants. The tanks are home to 200 plant species, some two dozen kinds of fish, and myriad microorganisms.

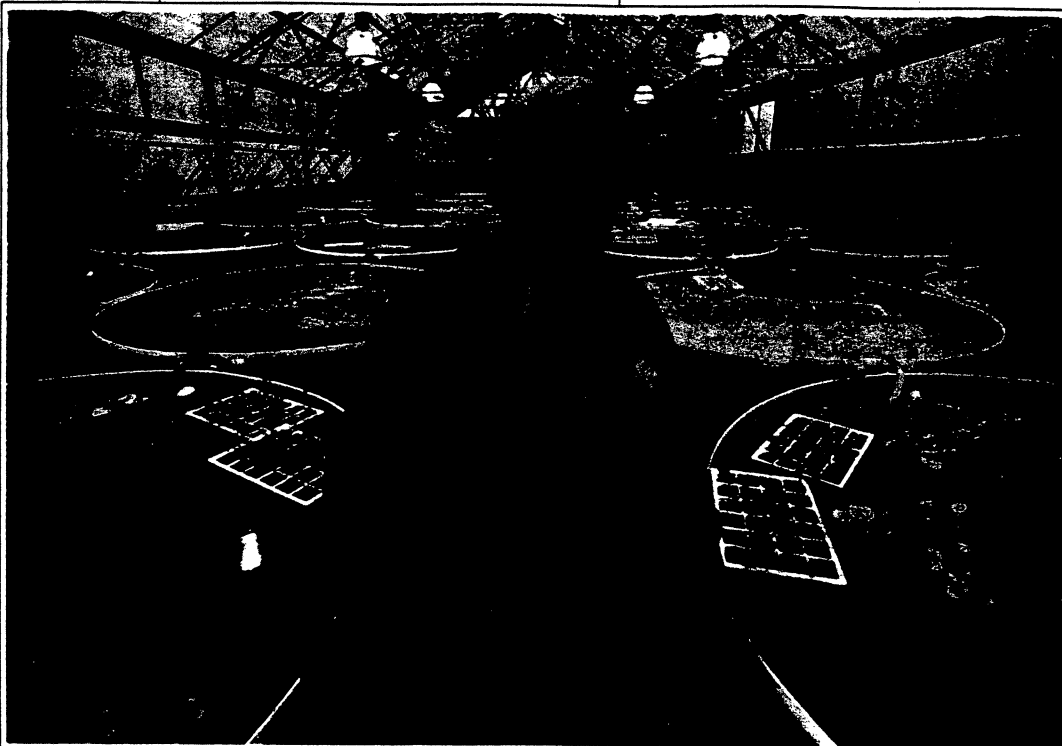
By the time the waste water reaches the final tanks, it's crystal clear. The sun powers the system—hence the name: solar aquatic waste-water treatment.

COPYING NATURE. For Todd, the July opening of the Providence greenhouse was the payoff for years spent studying the way nature cleanses itself. In 1969, he and several other scientists working at Woods Hole Oceanographic Institute in Massachusetts founded the New Alchemy Institute, a nonprofit center to study water purification. Recently, Todd's search was spurred by an alarming rise of cancer rates in Falmouth, Mass., where he lives with his wife and children. "Treating sewage with chlorine and aluminum salts makes the water unacceptable for drinking and poisons the earth when you put the solid wastes in a

landfill," he says, echoing a growing environmentalist opinion. "That was a problem I couldn't get out of my mind."

Now, Todd's natural approach is starting to draw wider interest. For one thing, there are no more government funds for expensive conventional treat-

ceptive to such technologies as solar aquatics that might provide a cheaper, cleaner alternative. Todd's first test facility, a small greenhouse built in 1987 to treat sewage from a Sugarbush (Vt.) ski resort, ran for two years, gathering enough evidence to convince state au-



TODD'S GREENHOUSE IN PROVIDENCE: "IT'S A SPACE-AGE APPROACH TO THE PURIFICATION OF WATER"

ment facilities. By next year, the Environmental Protection Agency (EPA) will have made its last outright grant, a combination of federal and state funds that once covered as much as 97% of a facility's cost. That means communities themselves will have to raise the money for construction—as much as \$200,000 per household.

In addition, amendments to the Clean Water Act have tightened standards for water quality, forcing expensive and sometimes impractical alterations to conventional treatment plants. In Western states, there's even a shortage of water itself. San Diego, for instance, imports 90% of its water—and not surprisingly is a pioneer in alternative waste-water technologies that yield potable water.

Many communities have become re-

thorities that the technology worked.

Citizens of Harwich, Mass., where Todd built his second demo site last summer, were so impressed that they approved a plan for a one-acre greenhouse that will eventually treat 5,000 gallons of raw septic-tank waste per day. The greenhouse, which is scheduled to begin operating next spring, will cost \$3 million to build—about one-fourth the cost of a new conventional facility nearby—and only \$250,000 a year to operate.

CAUTIOUS KUDOS. With Harwich signed on, Todd decided it was time to take his research commercial. Last fall, he and a Woods Hole colleague, Susan B. Peterson, founded Ecological Engineering Associates. So far, three investors have put in about \$3 million to fund the construction of more pilot sites. On the agenda: a

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facility to treat boat waste for Marion, Mass., and perhaps a small greenhouse for the 50-person Illinois headquarters of cartoonist Jim Davis.

So far, Todd's efforts have drawn a mixed response. In June, the new technology won him a medal from the New England regional office of the EPA. "It's precisely the kind of approach we need to encourage," says Michael R. Deland, chairman-designate of the President's Council on Environmental Quality.

Other regulators are a bit more reserved. Todd has already fended off a suit in Massachusetts, where he built a pilot plant without obtaining a permit. In each state, he'll have to start from scratch to win regulatory approval of his technology.

Nor have the precise costs of solar aquatic treatment been worked out to the satisfaction of many engineers. In San Diego, which has been experimenting since 1981 with a solar aquatic system that uses ponds instead of a greenhouse, the latest phase is expected to cost \$15 million—for a project to treat only 0.5% of the city's water. "There are no hard numbers," says Thomas Chadwick, a consulting engineer with Nolte & Associates in San Diego. He estimates that solar aquatics costs about 10% less than conventional systems.

SNAGS LURK. But Chadwick sees other problems with using complex ecosystems to treat waste water. For one, the toxic material concentrates in the plants, which have to be weeded out and disposed of in landfills. Also the solar aquatic system can get backed up: "There are elements in the waste, like plastics and metals, that take a long time to be broken down," says Chadwick. Even Todd admits that the systems are delicate. Twice, the Sugarbush installation was inundated with wastes it couldn't handle, distorting the system so much that Todd lost two months of data.

But he wasn't deterred. At the Providence greenhouse, a team of 14 scientists is gathering data and refining the mix of plants in the tanks. For example, they have added bulrushes to absorb toxic heavy metals, such as cadmium. For the Marion marina facility, the group is experimenting with plants that grow in salt water to replace the water hyacinths used in freshwater systems.

Alternative treatment facilities had better come quickly. There are many communities without sewage systems, where waste poured into septic systems and landfills is seeping into the water table. "I want a world that's safe for me and my children," Todd says. If he can do that and make a little money on the side, so much the better.

By Laura Jereski in Providence

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CAMBRIDGE MA.

George Mokray
218 Franklin St #3
Cambridge, MA 02139
(617)661-2676

Tuesday, November 28

To the Cambridge City Council:

Enclosed is an article from Business Week about a biological method of waste treatment that promises to be lower in costs, both fiscal and environmental, than traditional methods. I bring it to your attention because I believe it has merit and such alternatives are not being seriously considered by the MWRA for the upcoming Boston Harbor project.

For the past year, I have been documenting these experiments and have roughly 8 to 10 hours of videotape on the initial treatment plants in Warren, VT, which processed sewage, Harwich, MA, which processed septage, and Providence, RI, which is presently processing sewage and sludge. If you wish to see those videotapes please let me know. In the course of that work, I have talked to people in the environmental community and in the MWRA. I have seen, heard and felt how everyone seems to be defeated by the court order mandating the way the Harbor clean-up is to proceed, even though the data may be wrong, as Donald Harleman of MIT asserts, and other alternatives of less cost, like this one, may be available. I am wondering what the citizenry will say and do in five or ten years when the Harbor Project is completed and water and sewerage rates have gone through the roof and they can compare costs and environmental effectiveness with towns such as Providence which may have proceeded with the cheaper and more benign methods of biological filtration or solar aquatics.

I also know that John Todd, the originator of this process, has proposed his system for use in the purification of water supply as well. In conversation with David Del Porto, a member of the Citizen's Advisory Board for Water Supply, I have learned that the Cambridge Reservoir was specifically mentioned as a possible site for a trial project. Perhaps this is an option that should be investigated further.

This town, this state, this country has to clean up the way we handle our wastes, by law and by necessity. I would like to see us do it once and do it right. I believe a system that can handle raw sewage, septage, which can be 100 times more toxic than sewage, and sludge while producing ornamental plants and fish that test cleaner than control specimens is a logical alternative to consider seriously. So far, I don't believe it has.

Presently, Providence, RI has a plant which treats 20,000 gallons or more per day. The next scale up would be within the 100,000 gallon per day area. Surely, there are commercial or industrial plants which could be sites for a trial of this waste treatment method within the MWRA service area or Cambridge. Please consider this possibility.

The major problems of these United States today seem to be bad management (try talking to the phone company, the government at any level, or the utilities) and the supreme lack of imagination. Please don't be a party to these.

Yours in Green and Blues,
With a Hint of Red at the Edges,

George Mokray
George Mokray

7. S-814

Comm. from George Mokray, 218 Franklin
St., regarding a biological method of
waste treatment.

In City Council,

Dec. 4, 1989

Placed on file