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How Solar-Powered, Mobile Water Purifiers Can Help Cities Cope With Bad Water

Quench Water & Solar is selling its solar-powered water purifiers to private owners as U.S. cities wrestle with clean drinking water issues

By **Maria Gallucci**

Photo: WorldWater and Solar Technologies

A solar-powered MaxPure system turns pond water into clean drinking water.

When WorldWater and Solar Technologies deploys its mobile water purifiers—arrays of solar panels, batteries, and high-pressure pumps—the machines usually wind up in natural disaster zones, off-grid villages, or military operations around the world.

Now the company is expanding within the United States, where cities are grappling with contaminated water supplies and dwindling freshwater reserves. Quench Water & Solar lets entrepreneurs sell clean—and ideally cheap—drinking water to their neighbors, local businesses, and at large events like festivals, where plastic water bottles pour down like rain.

“The water infrastructure throughout most of the U.S., and certainly way beyond, is very old...and municipalities don’t have the wherewithal or the resources to be able to address these things,” says David Hammes, president of Quench and vice president of international development at WorldWater. “We see this as an opportunity to take our technology and really benefit people that are subject to contaminated water.”

The mobile systems range from the size of golf carts to food trucks, depending on their desired output. Solar panels lay on top, generating electricity that charges the GEL-sealed, lead-acid batteries, which in turn run the motor that pumps water through filters. Clean water pours out a hose and, depending on the filtration process, contaminants flow out a discharge stream or remain in mechanical membranes. Internet-connected monitors remotely display the systems’ water quality, output, and equipment performance.

"We can deploy it anywhere and literally take contaminated, poisoned water and turn it into drinking water in minutes," Hammes says.

If water comes from ponds, lakes, or municipal taps, it passes through four filters to remove microbes, sediment, and other contaminants. An ultraviolet light then sterilizes the filtered water. Brackish or seawater undergo reverse osmosis, in which water is forced through a thick membrane that blocks sodium and chloride ions and lets freshwater pass. The process uses a substantial amount of energy, so those units require more solar panels and batteries and cost thousands of dollars more.

Lead-tainted water also requires reverse osmosis, because of the metal's low molecular weight, says Ben Switzer, Quench's director of business development. When we spoke in early October, he was manning a promotional booth at a conference in Flint, Michigan—a city still reeling from a public water crisis.

After Michigan officials switched Flint's water supply in 2014, foul-smelling water laden with lead and harmful bacteria coursed through kitchen faucets and shower heads for two years. State authorities say Flint's water is now safe to drink, but many residents say they no longer trust the government's word, and they continue buying bottled water or installing home filtration systems for drinking, cooking and bathing. Nationwide, some 18 million people were served by water systems with federal lead violations in 2015, according to an analysis of federal data.

Quench's water purifiers aren't designed to rival a municipal water supply. Its largest solar-powered units produce an average of 113,500 liters per day for freshwater filtration, and about 11,400 liters per day with reverse osmosis filtration. By contrast, more than 45 million liters of water per day flow through the pipes in Flint, a city of nearly 97,000 people.

But the mobile systems could provide communities an affordable alternative to the bounty of bottled water and home filters. With the Quench units, licensees could provide a gallon of drinking water "at the cost of a fraction of a cent," Switzer says.

WorldWater, Quench's parent company, has already delivered its technology to about 30 countries in the last three decades. The Mobile MaxClear systems feature a 900-watt solar array and 5.4 kWh of battery storage, while the Mobile MaxPure system has a 4-kW folding solar array and up to 31 kWh of battery storage. Systems can range from $30,000 to $150,000, depending on the water source and capacity expectations.

A handful of other companies provide mobile, solar-powered water purifiers and pumps worldwide. Tata Group, the Indian conglomerate, is building village-scale desalination systems and solar-driven water pumps in India. PV Pure, a startup founded by MIT researchers, has delivered its small units across Latin America, the Caribbean islands, and the Middle East.

Amy Bilton, who helped develop PV Pure's technology as an MIT doctoral student, says a key challenge with solar-powered water purifiers is the intermittent nature of solar energy. If a system operates with any fluctuations, it can quickly degrade the equipment. To address this, operators can either use small batteries to maintain steady power flows, or turn the system on and off to match the sunlight.

“In the course of our work, we’ve done a little bit of both,” says Bilton, now director of the Center for Global Engineering and the Water and Energy Research Lab at the University of Toronto. “Even if you include batteries, you’re still going to have to operate the system intermittently. To be able to run a system 24 hours a day, like a traditional desalination plant, is something you can’t cost-effectively do.” Larger batteries can bank power and extend operating times, but they add considerable costs to the overall system.

Purifiers with reverse osmosis face an additional challenge, she says. Intermittent operations can lead to membrane “fouling” if not properly managed. Salts, microbes, and heavy metals can attach to and grow on the membrane, which means it takes even more energy to force water through the filters. To avoid this, operators can run a rinse cycle when shutting down to make sure there’s no stagnant water adjacent to the membrane. Certain chemicals can be added to untreated water to ensure deposits don’t build up.

Bilton noted a growing interest in these types of solar-driven water technologies, not only overseas but also across North America, including in the parched southwestern U.S. and in remote Canadian villages, where water treatment is difficult. “It’s something that’s becoming more common,” she says. “There are certain markets where it makes a lot of sense.”

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