

Their mission: Water where water isn't

6 where the shall not defeat AIDS, tuberculosis, malaria or any other infectious diseases that plague the developing world until we win the battle for safe drinking water, sanitation and basic health care," said Kofi Anan, United Nations secretary general at a U.N. gathering in New York in 2001.

Now, eight years later, Mr. Anan's words are a prediction borne out. There's little debate any more that access to safe drinking water has become a global concern, more so than access to any other natural resource. We can live without oil, coal, steel and copper. Water is essential to life.

Water Missions International (WMI) is a nonprofit, Christian engineering organization serving the water and sanitation needs of impoverished people in developing countries and disaster areas. WMI uses alternative energy and low-maintenance water technologies for drinking water treatment and distribution, wastewater management and storm water control.

WMI's mission is to provide sustainable access to safe water and an opportunity to hear the "living water" message in developing countries and disaster areas. The organization's vision is that no person should perish for want of safe drinking water and, in this mission, WMI has brought relief and hope to more than a million people across the globe.

"Worldwide, more than a billion people lack access to clean water," explained Brad Reed, WMI president and CEO. "More than two billion do not have adequate sanitation. Every day, an estimated 25,000 people die from the lack of safe water and sanitation.

"The lack of safe water affects one-sixth of the world's population. It prevents children from attending school. It forces women and girls to spend many exhausting hours each day fetching and carrying heavy buckets of [usually dirty] water. A lack of water contributes to the poverty cycle that prevents people in poor countries from attaining a better standard of living."

Living water treatment system

In 1998, South Carolina-based General Engineering Laboratories, an environmental engineering firm and one of the top ten environmental testing laboratories in the U.S., responded to the devastation in Honduras caused by Hurricane Mitch. The firm, led by owners George and Molly Greene, built and delivered six 10gpm drinking water treatment units. A few weeks after the storm's landfall, 16 volunteers from the company were setting up these water treatment units — now referred to as the "Living Water Treatment System"

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(LWTS) — in remote locations of Honduras.

Over the next three years, the design of the LWTS was modified to eliminate replaceable components, to make it more reliable to operate over extended periods of time and to reduce operating costs. Additional systems were placed in rural communities in Eastern Europe, Africa and Central America, some in response to natural disasters and some in support of ongoing development projects.

During this time, the Greenes developed a growing awareness of the overwhelming need for safe drinking water throughout the developing countries of the world. They sold their firm in 2001 and used a substantial portion of the proceeds of that sale to found Water Missions International.

Solar powered submersible pumps

According to Reed, in 2007 WMI began to use



A viable option to labor- and supply-intensive generators, WMI began to use solar-powered submersible pumps.

Grundfos SQ Flex solar-powered submersible pumps to bring water into off-grid, third-world communities. "We now have six of them in use: two in Uganda, two in Honduras and two in Sierra Leone. They're proving to be a good, viable alternative to labor- and supplyintensive generators.

"The key factor driving the use of solar powered submersible pump technology is the need for consistent, sustainable power to operate the pumps for the water treatment systems," added Reed. "No power, no pump and no safe water. Generators are at a higher risk of failure, either mechanically, due to plugged injectors with poor quality fuel, or simply due to the fact that developing countries may not apply their limited funds to purchase fuel to keep the generators operating."

When WMI teams require the assistance of drilling rigs, they partner with other, in-country organizations to drill water wells, with holes that vary in depth from 100 to 1,000 feet.

"We began to use the SQ Flex pumps after a successful pilot installation in Charleston, S.C.," continued Reed. "The system ran flawlessly for nine months, so we felt confident enough to send them out into the field." According to Reed, the SQFlex solar pumps can provide clean water for tens of thousands of people if a well taps a deep, high capacity aquifer or if there is sufficient surface water to treat.

Surface water and improperly placed wells are commonly contaminated with bacteria, viruses, parasites and protozoan cysts, which are suspended solids. "These contaminants represent easily 95-plus percent of the known health hazards leading to waterborne illnesses in developing countries and are handled by mixed media filtration followed by chlorination. Our current systems are not designed to handle dissolved solid contaminants, such as salts, fertilizer, toxic metals and arsenic," said Greene.

The SQFlex sophisticated electronics enable the pump to shift between various power sources and operate optimally, regardless of where that power comes from. Equally cost-effective and easy to install, the SQFlex Wind is particularly suitable for open fields, valleys and landscapes where the wind blows consistently. And of great value in areas where there's a constant need for water supply, the company's "combo" system permits the use of either solar or wind power: solar for when the sun is shining and a wind turbine for when the wind provides sufficient speeds.

WMI's first solar-powered water system in Sierra Leone (See sidebar.) required twelve 70-watt solar panels. The system supplied water for a 200-foot pipeline feeding a 12-foot fiberglass stock tank. This system now serves 3,000 people.

A typical Living Water Treatment System consists of several solar panels, an SQFlex pump to lift water from a well or pond and filtration equipment. "Our filtration units are very similar to what's used for pools," explained George Greene IV, P.E., VP of international



The difference is pretty clear — clear water, that is. A typical Living Water Treatment System consists of several solar panels, an SQFlex pump to lift water from a well or pond and filtration equipment.

programs. "We have two multimedia depth filters that use anthracite and three different grades of garnet to achieve effective filtration. As the filters remove dirt from the raw water, they clog over time and are regenerated through backwashing. The final step in the treatment process is chlorination.

"The primary option for power in off-grid applications is a diesel generator," added Greene. "Even with a generator, the cost to produce safe water is low about \$3.00 for 1,000 gallons. But by using renewable sources and eliminating the need for diesel fuel, oil and fuel filter replacements, operating cost drops to \$.23 for 1,000 gallons of clean water. The more we can remove from the operating cost, the higher the likelihood of sustainability."

The SQFlex pump has the ability to operate from any power source providing 30 - 300 VDC or 90 - 240 VAC, allowing the use of solar panels, wind turbines, AC generators or batteries for power. The integrated electronics automatically sense the incoming voltage and adjust accordingly, allowing for simple installation, without the need for matching voltages or complicated wiring. AC and DC capabilities permit a generator to be used as a backup power supply when solar or wind is inadequate. So, if conditions are really poor, a farmer

WMI in Sierra Leone

One of WMI's most recent water treatment installations is in the remote village of Kenema, Sierra Leone, located on the west coast of Africa. "The people there are desperately poor, and the need for clean water was urgent," explained George Greene IV, P.E., VP of international programs for the organization.

Just before the delivery of the water pump and treatment equipment, Johon Neitsch, WMI's Uganda country director and Felix Masasa, WMI technician, traveled from their base in Uganda to supervise digging of a well for the water. Nietsch recalls great skepticism. On a Friday, the people of the village dug 30 feet straight down. It was a long and arduous day. The locals said, despondently, "This is a waste of time."

The next day, as the digging got more difficult and dangerous, Nietsch and Masasa encouraged the workers to go further. They dug the well another 10 feet, digging entirely by hand — but still, no water.

Though there was much resistance, the people of the village dug the hole just a few feet further the following day, finally hitting water at 45 feet. "They had to dig another eight feet down to create a pool at the end," said Greene." This is where the digging became too dangerous to continue."

This is the first time that the people of Kenema have had a ready source of fresh water. Once the water and treatment systems are running, WMI works with the locals to establish a "safe water committee" that sets affordable pricing for the water so that the service is self-sustaining. For the very poor, water is free.

Typically, water availability at, say, five gallons a day, may be priced at \$.050 per month. It is always stipulated, however, that no one can be denied access to safe water from the system because they can't afford it.

can plug the system into a portable generator to make water all night long. The motor also features built-in protection against over-temperature, overload, overand under-voltage, and dry running.

The system can accommodate a wide variety of applications, with 10 different pump models offered. The deepest setting model is able to generate heads as high as 650 feet, and the highest flowing model can produce up to 60 gpm. All models are designed for optimum efficiency in their specified range, so total system costs are competitive with comparable remote water supply options, such as windmills and generator systems.

In addition to pumps and motors, the entire system, including solar panels and wind turbines with all necessary equipment such as tower kits, wiring, etc., can be provided. Pre-matched components ensure simple and quick installation as well as minimal maintenance requirements.

"Our key goal is to empower the people," concluded Greene. "We want them to take responsibility for the water. The solar-powered systems simplify the technology so much that this goal has become achievable in even the most impoverished communities. Yet the need remains for so many more of these systems to be in place. And that's what we're here to do."