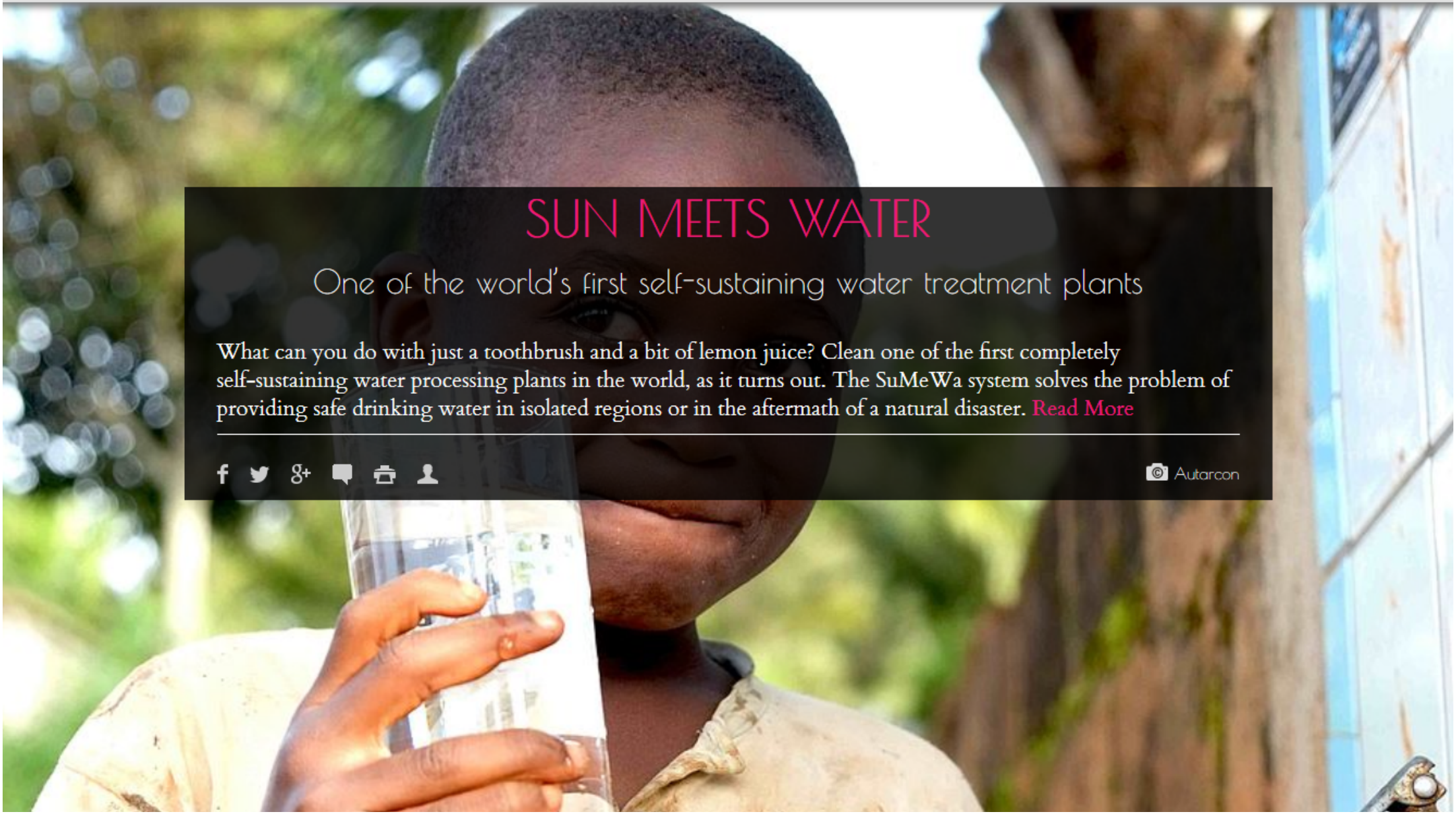

SUN MEETS WATER

One of the world's first self-sustaining water treatment plants

What can you do with just a toothbrush and a bit of lemon juice? Clean one of the first completely self-sustaining water processing plants in the world, as it turns out. The SuMeWa system solves the problem of providing safe drinking water in isolated regions or in the aftermath of a natural disaster. Read More

In what would later be known as the flood of the century, days of heavy monsoon rains resulted in severe flooding in North-western Pakistan in 2010. The ravaging water destroyed millions of homes, bridges collapsed and millions of people suddenly found themselves dependent on humanitarian aid.

In this situation of destruction, the first water processing plant developed by the German Autarcon company was installed. It was developed for a hospital in Punjab where the heavy rains had flooded and polluted the well. Set up went smoothly and quickly, and soon the treatment plant was supplying the entire hospital with purified drinking water until the disaster had passed.

Autarcon has developed a technology that offers a hands-on solution in such emergencies: a water processing plant that pumps fresh water out of wells or lakes from up to 70 meters below ground, purifies it to drinking-water quality, and then stores it germ-free – all completely self-sufficiently.

The systems are designed to work in isolated regions with no reliable source of electricity or central water supply. Most Autarcon systems are in operation in Egypt today, where they supply fresh drinking water at 14 desert locations and the neighbouring villages. Some are also in use in Latin America and Asia. The systems relieve people from the daily chore of pumping water from a well, lower the incidence of disease caused by contaminated water, and have even created new income streams for the local population.

As hard as it may be to believe, completely self-sufficient water processing plants of this kind are still relatively rare.

Living without clean drinking water

There is sufficient fresh water on the planet for everyone, but not everyone has access to purified drinking water: The World Health Organisation estimates that almost 900 million people worldwide live without clean drinking water. This negatively impacts food security, livelihood choices, and educational opportunities for poor families across the world.

Together unclean water and poor sanitation are the world's second biggest killer of children: Every day, nearly 1,000 children die due to preventable water and sanitation-related diarrhoeal diseases, and close to half of all people in developing countries suffer from health problems caused by poor water and sanitation. It has been estimated that 443 million school days are lost to water-related illnesses each year.

In many places in the world, people employ simple filters like clay to process their water. While these do remove some contaminants, they do not offer any protection from dangerous pathogens that spread diseases like diarrhoea.

GENERATING CHLORINE FROM WATER

As hard as it may be to believe, completely self-sufficient water processing plants of this kind that comply with WHO drinking water standards are still relatively rare. The reasons are two-fold. First, pump and filtering processes require power as a rule, leaving people with no access to electricity with no way to process their drinking water. Second, to safely store drinking water, a disinfectant has to be added to prevent the growth of bacteria and other contaminants. Chlorine is the most common disinfectant in use, but it is not always available and it can be difficult to get the proportions just right.

Autarcon has solved both these problems. Their "SuMeWa" system, short for "Sun Meets Water", is completely powered by the sun via an integrated solar panel and needs no external power source. But the real trick is that the system generates its own chlorine.

"Every kind of water contains some level of dissolved salts, except rain water," Philipp Otter, project coordinator of Autarcon, explains. "Our systems use anodic oxidation to transform these salts into chlorine gas that then dissolves in the water." A sensor constantly monitors water quality and adjusts chlorine production accordingly. This kills all the microbes in the water so it can be stored and transported safely. In the unlikely event that there is not enough salt in the water, table salt is added automatically to make up the difference. "Table salt is available almost everywhere and easier to deal with than chlorine itself."

Autarcon develops an individual filter system for every water processing station it builds. "There are no one-size-fits-all solutions, since water quality is different at every location. We always ask for one or two water samples to analyze before we start work on a system." This allows the company to generate safe drinking water from almost any source of germ-infested fresh water.

The filter station that worked so well for so long in the hospital in Pakistan, for example, was no longer effective once the flood had ended and the water in the well changed back from rainwater to groundwater, which contains a higher concentration of iron. The system had not been built to deal with the excess iron. The SuMeWa systems in use in Egypt today have benefited from research based on the problems experienced in Pakistan. They can even filter water with high concentrations of iron and manganese.

The "SuMeWa" system is completely powered by the sun and generates its own chlorine. ©Autarcon

WATER IN THE DESERT

One individual SuMeWa station can process up to 20,000 litres of water a day, enough for around 500 people. Although the systems are relatively inexpensive, they still cost between 11,000 and 22,000 euros, depending on the local source and water conditions. So Autarcon's customers are generally institutions or NGOs.

Since the beginning of 2014, the Research Institute for a Sustainable Environment (RISE) of the American University in Cairo (AUC) has worked with Autarcon, for example. Over the course of two years, they have built 14 systems at desert locations around the oases of Farafra and El Heiz in Egypt's Western Desert as well as on the far southern Red Sea coast. Tina Jaskolski was the driving force behind the project:

"Each plant we build provides an entire village with a source of clean water – and the whole village benefits. The well water in the Western Desert is orange because of its high iron content. People used to filter the water through unglazed clay pots before drinking it, which did remove the iron, but still allowed bacteria to grow when the water was stored in unclean containers." According to Jaskolski, locals had tried other types of filtration systems, none of which had worked. "They broke very quickly, couldn't be fixed or maintained, or didn't generate enough chlorine to ensure that the water was pathogen-free."

The SuMeWa system has changed all that. The water filter looks like a simple box that hooks up to a pump, easy for locals to install themselves. "People can learn how to maintain the system in just about one hour," Philipp says. Just a toothbrush and some vinegar or lemon juice are enough to clean the pump and the electrolyte cells. The filters itself are automatically backwashed.

Every system has an integrated data card that stores important information like solar radiation, amount of water, and pressure on the filter, and transmits the data to Autarcon's central offices in Kassel. Employees assess the data and share tips and information with local operators. "We currently have three research units up and running in India and our off-site diagnostics are working really well," Philipp says. "I look at the data and tell local operators that the solar panels need cleaning, for example, or that the filter needs to be rinsed." The company plans to release an app soon that will allow operators to check the data themselves. "The smartphone revolution has been a great opportunity for us. We are in constant contact with customers all over the globe via WhatsApp and they send us live images any time."

The well water in Egypt's Western Desert is orange because of its high iron content. ©Autarcon


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Drinking water taps in Egypt. ©Autarcon

CLEAN DRINKING WATER AS A SOURCE OF INCOME

The systems in Egypt are also financially self-sufficient. The water stations are equipped with a modern metering system that uses pre-paid customer cards. Users pay a small fee for every litre of water they withdraw. Villagers can top up their cards with the person who maintains the system, and the money goes towards maintenance and paying the operator a small salary. The rest is saved to cover the cost of any repairs needed further down the road.

The villagers set the water prices independently. "We explain how much the components cost and how much money is needed to cover the cost of maintenance every year, replace the battery, and perhaps renew the station in around 10 years," Philipp explains. "The villagers then decide how much water should cost so everyone can afford it." Now every litre of water costs around 1 piastre, around 0,2 eurocents, in most villages, an unbeatable price considering that most stores charge the equivalent of 20 cents for a litre of bottled water.

Additionally, the water stations in most villages can produce more than is needed locally. The additional water is a source of income for the village as people from the surrounding area come to purchase their drinking water every day. They pay twice as much for water as the villagers themselves. "I once met a man who had travelled 45 kilometres," Tina recalls. "He said the quality and taste were so good, it was worth the journey." Furthermore, the water treatment plants have also created new jobs. Enterprising young people have set up small delivery services and take the clean water through the villages on tricycles, selling it to local households.

Users pay a small fee using pre-paid customer cards. ©Autarcon

After payment, the tap is unlocked and the water starts running. ©Autarcon

In Nepal, Autarcon cooperates with Tibetan monks. ©Autarcon

Philipp has learned that they need different business models for different places though: "This model works very well in Tanzania and Egypt, but people in India just turn their backs. Most people are unwilling to pay for clean water there." Other problems have arisen in Egypt, where the government controls all the cellular phone networks and could at least theoretically monitor any cellular communication, including the maintenance data sent to Kassel for off-site diagnosis. So the systems used in Egypt do not include an integrated SIM card. Instead RISE employees travel to the stations frequently to check them over in person.

"Because local conditions can be very different, we feel it is really important to work with established local partners who have experience working on water issues in rural areas," Philipp says. Along with RISE in Egypt, Autarcon also works with Tibetan monks in Nepal or with the Swiss Water Kiosk Foundation, for example.

A UNIVERSITY PROJECT GOES GLOBAL

Autarcon has users all over the world, from Brazil and Ghana to Laos and India. Though this might sounds like the reach of a large global corporation, the company is actually just seven employees, and was born of a university project six years ago. Autarcon still gets most of its funding from research grants and the few employees fly in to oversee each individual project personally. "In the beginning it was like learning to walk, but now things are running smoothly. We delivered and installed 12 systems in just the first few months of this year," Philipp says. This has increased income from sales, but the rapid rise in demand has brought real challenges. "Our team was really stretched to the limit by building so many systems in such a short time. Management is still involved at every stage, right down to the small details, like soldering the control panel. This is manufacturing, not production."

But hiring more people to handle production takes money. "We have a lot of interested investors if we can provide empirical proof that our systems are financially self-sustaining over time." This is the root of a dilemma: to offer the proof the investors want to see, the small team would have to evaluate a wide range of locations worldwide, collect the data and present empirical findings. This involves a significant up-front investment in time and money. The experience the company is gathering in Egypt could be a first step in the right direction.

Martina Jaskolski

Researcher

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