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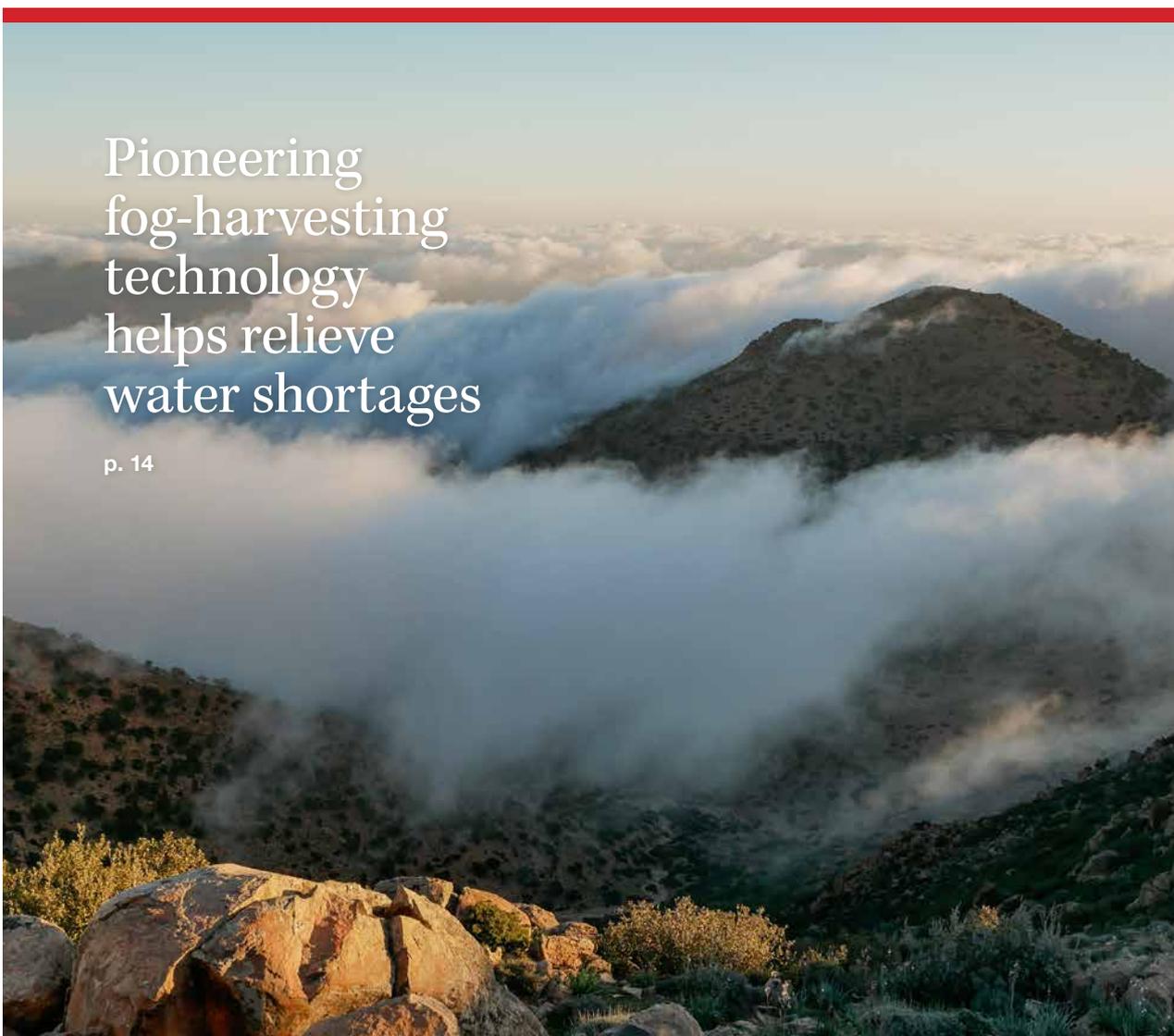


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Editor: **Catherine Jewell**  
Layout: **Ewa Przybyłowicz**

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# Pioneering fog-harvesting technology helps relieve water shortages in arid regions

By Catherine Jewell,  
Communications Division, WIPO

CloudFisher® is a pioneering new water technology that offers communities facing severe water shortages in arid and foggy coastal or mountainous regions an affordable and sustainable source of clean water.



Photo: Courtesy of Aqualonis, GmbH

When we think about sources of water, fog is not the first thing that springs to mind. But a pioneering new water technology called the CloudFisher® offers communities facing severe water shortages in arid and foggy coastal or mountainous regions an affordable and sustainable source of clean water.

Developed by the German Water Foundation (WasserStiftung®), the technology is commercialized and implemented through Aqualonis, a Munich-based for-profit company headed by industrial designer Peter Trautwein, who is also responsible for the Water Foundation's fog water extraction sector. The CloudFisher's pioneering design, which takes fog-harvesting technology to a new level, is the brainchild of Mr. Trautwein with input from researchers at the Technical University in Munich.

In 2013, recognizing the shortcomings of existing fog-harvesting technologies, in particular their inability to withstand high winds, the German Water Foundation began working with Mr. Trautwein and a team of researchers to come up with a more efficient and sustainable fog-harvesting system.

"When I first saw fog collectors in Eritrea, I was disappointed with the bad construction," says Mr. Trautwein. "All over the world, this idea fails because of its construction, not because of the principle. On the day of my visit, I was determined to design a maintenance-free and effective system," he explains, noting that when such equipment suffers damage, the people that use it typically lack the means or the know-how and technical understanding to maintain it.

#### **OPTIMIZING FOG COLLECTION IN MOROCCO**

Over a two-year period between 2013 and 2016, the team piloted fog-harvesting technology on the slopes of Mount Boutmezguida in Morocco to optimize the design and assembly of fog collectors and demonstrate their ability to serve as a reliable source of clean water. During the pilot phase 10 different types of mesh fabric were tested.

The team found that woven mesh and fabrics made of stainless steel produce a lower water yield than three-dimensional spacer fabrics, which Aqualonis has been using ever since. The larger surface area of three-dimensional spacer fabrics can capture many more tiny water droplets than other materials, and the distance between the monofilaments is very important – it must not be too small or too big. "The specially produced monofilaments used in the CloudFisher were developed for use in food safety and for extreme UV radiation," Mr. Trautwein explains. These materials are proving very resilient, with little visible sign of deterioration even after three years of continuous use.

Mount Boutmezguida proved an ideal location for the pilot. It is one of the driest regions of Morocco and, located in the Anti-Atlas Mountains not far from the coastal town of Sidi Ifni, for most of the year it is shrouded in fog and clouds that roll in from the Atlantic. For many years the villages in the area have lived with the threat of drought, suffering severe water shortages and stress resulting from low annual rainfall and depleting ground water sources. But with CloudFisher technology they are now able to tap into the plentiful water supply that literally hangs in the fog and the clouds that envelope Mount Boutmezguida.



Photos: Courtesy of Aqualonis GmbH

### ABOUT CLOUDFISHER TECHNOLOGY

The CloudFisher consists of a fine-mesh net suspended within a steel frame. The net is held in place by a series of rubber expanders that also attach it to the collector at its base. The expanders “create tension on all four sides of the whole geo-grid or mesh,” Mr. Trautwein notes. “A normal approach is to try to stabilize the seam at the edges of the nets because that is where the wind impact is concentrated, but it makes better sense to distribute the wind energy across the whole surface,” he explains.

The nets are positioned to allow the wind to blow the fog through the nets for maximum water collection. The water vapor in the air is trapped in the fine mesh of the net, condenses and drips down the mesh into a collector at the base.

The technology is quick and easy to set up – requiring just two simple tools – and is low-maintenance. “The only parts of the CloudFisher that are likely to tear in a storm are the rubber expanders, and these are cheap and easy to replace,” explains Mr. Trautwein.

Easy assembly and maintenance are particularly important in resource-poor locations, where funds and spare parts are limited at best. “It is important to use parts that the people actually doing the assembly in whatever country can easily understand. That way you don’t have to spend too much time explaining the system to them,



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Photos: Courtesy of Aqualonis, GmbH



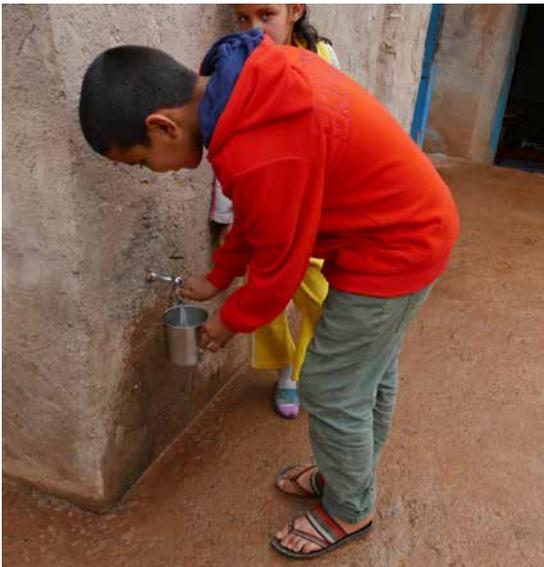
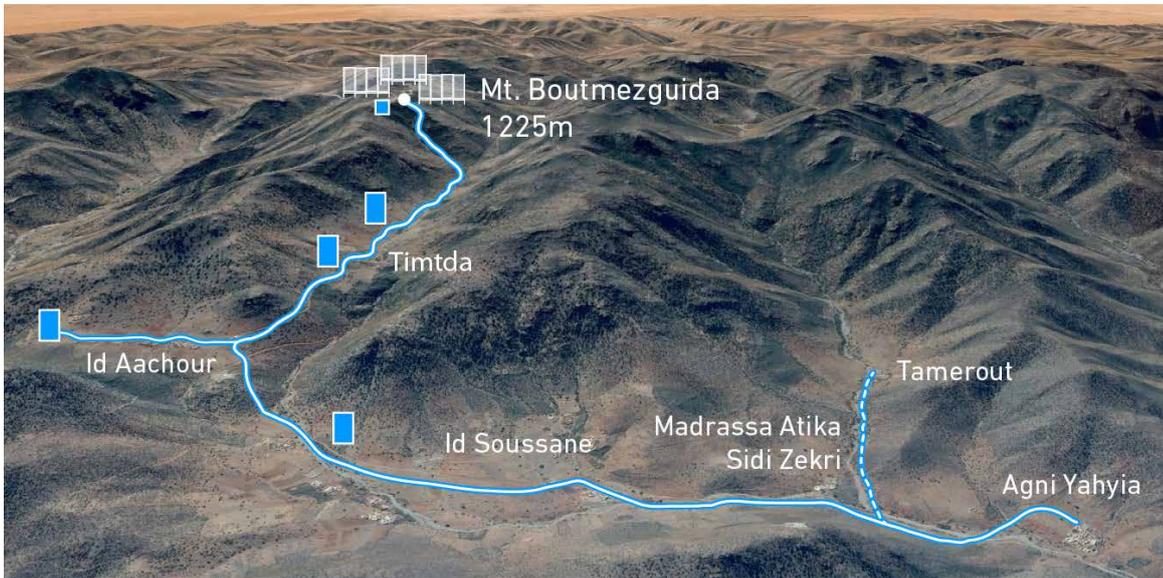
and maintenance is trouble free. You have to make sure that people get the message immediately. That was crucial for me right from the start," he says.

The company produces two types of CloudFisher, the CloudFisher Pro, consisting of four nets measuring 13.5 square meters with a total surface area of 55 square meters, and the CloudFisher Mini, which consists of three nets measuring 5.5 square meters covering a surface area of 16.5 square meters.

#### **A MORE EFFICIENT FOG-HARVESTING SOLUTION**

The CloudFisher stands out from other fog-harvesting system in a number of ways. It is the only fog-collecting system, to date, that can withstand winds of up to 120 kilometers per hour; its fine food-safe 3D mesh makes it possible to trap more water vapor from the air than other models; and its robust plastic grid helps prevent tearing and also stops the mesh from bulging and draining outside the collector at its base. The rubber expanders used to secure the net and the collector to the steel frame serve as a buffer against strong winds and also ensure that the collector follows the movement of the net in the wind. Samples of the water harvested from the CloudFisher in Eritrea, Morocco and the United Republic of Tanzania comply with World Health Organization standards but can vary from region to region.

So how much water can be harvested from fog? According to Aqualonis, CloudFisher technology makes it possible to harvest between 10 and 22 liters of water per square meter of net, depending on the region and time of year, though they also note that the CloudFisher once produced nearly 66 liters of water on the slopes of Mount Boutmezguida.



Thanks to CloudFisher® technology, communities on the slopes of Mount Boutmezguida, one of the driest regions in Morocco, now have access to a plentiful water supply that literally hangs in the fog and clouds that roll in from the Atlantic.

### THE WORLD'S LARGEST FOG-HARVESTING PARK EMERGES

In January 2017 the pilot moved into full implementation with 15 CloudFisher collectors installed in collaboration with the Dar Si Hmad Foundation, a Moroccan woman's charity, and local building companies. An additional 15 collectors will be installed in 2018, making it the world's largest fog-harvesting park with 1,682 square meters of fog-harvesting mesh in place. "That means that on a foggy day, the park will be able to produce up to 37,000 liters of water a day for the surrounding villages," notes Mr. Trautwein.

Aqualonis has been commissioned by the Water Foundation to roll out the project. So far, every house in 14 surrounding villages and a school have been connected to the CloudFisher collectors via a delivery system where water is collected into five storage cisterns and piped down the mountain into villagers' homes. The water cisterns will help to ensure that water is readily available throughout the year, including during most of the dry season.

### IMPACT

The technology is already having a marked impact on the households of surrounding villages. Women and girls, traditionally responsible for fetching and carrying

water, no longer have to spend hours trekking to remote locations to collect water for their families' daily needs. With fresh, clean drinking water now piped into their homes, they can devote more time to learning to read and write and other activities. The ready supply of water also means villagers can grow more fruit and vegetables, with health improvements associated with a better diet and opportunities to trade and generate income.

When the project is completed, around 1,150 villagers will have access to up to 18 liters of water per day, compared to just 8 liters in years past. In the interests of sustainability, however, villagers are required to pay a modest sum for the water to cover operating and maintenance costs. "The communities have participated and welcomed what originally seemed to them an unconventional idea," notes the Dar Si Hmad Foundation, which has been working with the team and liaising with the communities in rolling out the project.

### NEW LOCATION, NEW LEARNING

Now that the Mount Boutmezguida fog-harvesting park is well underway, Aqualonis is beginning a new project working with a German non-profit organization, p(ed)d world, in Qameyu in the United Republic of Tanzania to upgrade the fog-harvesting infrastructure at the Qameyu secondary school. The school has been fog-harvesting for many years, but the collectors they have been using have been prone to tearing and other wind damage. The installation of the more robust, efficient and high-yielding CloudFisher technology will provide the school's 300 students with a more abundant supply of clean water that will also enable them to cultivate the school garden. "The students will benefit from the fact that CloudFisher technology produces much higher water yields than the old nets and requires minimal maintenance," notes Mr. Trautwein. Well construction is not possible in this area because Qameyu is located on a highland plateau.

"We improved and tested our CloudFisher technology over a three-year period in Morocco, where we were working at 1,225 meters above sea level, and our work in Tanzania is a great opportunity to test it under very different conditions. In Qameyu we will be working very close to the equator and at an altitude of 2,500 meters," he says. "This is a win-win for everyone involved. On the one hand, we see innovation and technology transfer working in practice, and on the other, the local people have more clean drinking water at their disposal."

### THE ROLE OF INTELLECTUAL PROPERTY

CloudFisher® is a registered trademark held by the German Water Foundation, and the technology itself is protected using both utility models and patents. "We protected the system to prevent others from copying it and to ensure we have freedom to operate with no fear of infringing anyone else's rights because the technology can also be used for commercial purposes, for example by breweries," Mr. Trautwein explains. "We used the Patent Cooperation Treaty to protect our technology (WO/2016/062877) because it offers a very cost-effective and straightforward way of applying for patent protection in many different countries. I transferred the rights to the German Water Foundation, which is a strictly non-profit entity. Aqualonis markets and sells CloudFisher products under license from the Foundation." This arrangement means that profits from the implementation of projects can be used to support the Water Foundation's social projects. "This is important, because in the future we will need a source of income to supply people with water," he says.

CloudFisher technology makes it possible to deliver clean drinking water to communities facing severe water shortages in arid coastal and highland regions where fog is a regular occurrence. Low rainfall and depleting ground water resources put communities under huge pressure, making them prone to a range of challenges ranging from land degradation and rural migration to poor literacy, and low levels of nutrition and health. CloudFisher technology offers these communities a user-friendly, low-maintenance and sustainable alternative. And despite the significant progress made in improving the technology, Peter Trautwein remains committed to finding ways to further perfect it and to supporting its installation in as many places as possible, "to give more people, especially women and girls, more time for education."

This is clearly a business where every drop counts and which has the potential to improve the well-being of hundreds of thousands of people around the world living under the threat of drought in resource-poor environments.



34, chemin des Colombettes  
P.O. Box 18  
CH-1211 Geneva 20  
Switzerland

Tel: +41 22 338 91 11  
Fax: +41 22 733 54 28

For contact details of WIPO's External Offices  
visit: [www.wipo.int/about-wipo/en/offices/](http://www.wipo.int/about-wipo/en/offices/)

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