Aquair Optimizer® Technology
Atmospheric Water Harvesting

The technology origin

Our technological origins began in 1999, after five years of an in-depth study and experimentation with mist and fog collectors for water harvesting, Carlos Angel Sánchez Recio designed a series of new optimized devices in Tenerife.

In the following year 2000, these devices were registered with the Spanish Patent and Trademark Office as Models to be used under registration numbers 1041062 (flat-surface models) and 1043648 (polyhedral and circular models), both under the commercial trademark Aquair Optimizer®.

In 2001, a number of Water Collection Sites were set up for the Local Canary Islands Administration. With the aim of controlling the development of the technique, the team continued carrying out Collection Site performance verification of the installations, and at the same time setting up "Natural Aqua Canarias S.L"., company that in 2010 has signed the exclusive agreement for complete global rights to our company OpenMS.

In 2004, the company carried out its first international installation, in collaboration with the University of East Colombia, in Cerro Ipuana (La Guajira), Colombia. This provided a test bed for the first comparison between the Canadian SFC system and the Atmospheric Water Harvesting (AWH) designed by Natural Aqua.

From then until 2005, this new company focused on studying and perfecting the technique, at the same time carrying out installations targeted specifically to verify the practical advantages offered by this new renewable source of clean water. During this period, the company operated as a technical engineering firm, reinvesting all spare income in researching and perfecting the technique.

During the period 2005-2006, the analysis of the technique indicated that it was now mature and ready for deployments. This meant that the company could start making contacts with a view to carrying out fully operational installations, at the same time as expanding existing Research Centres.

Thanks to an agreement with the Foundation 2001 Global Nature, operating in mainland Spain the Atmospheric Water Harvesting Technique was defined as a specific area of activity for the new Canary Island office.

At the end of 2005, it gained E.U. approval for the DYSDERA project (Design and Monitoring of Water Harvesting Sites), within the framework of the INTERREG III B MAC Programme.

The principal aim of this project is to initiate the construction of an AWH Site Network that, in the future, will enable a world-wide study of the behaviour of Atmospheric Water existing in the atmosphere in gaseous state that has yet precipitated to earth).

During 2006, Phase 1 was carried out, consisting of the installation of four AWH Sites in Fuerteventura, El Hierro, La Gomera and Madeira Islands. These points, all of which are equipped with climate and water production control systems, are connected in real time to the Data Processing Centre located on the company own premises.

On the 14th of July that same year, the first AWH Site (El Hierro) began operating, thus marking the start of a new era in the study of these atmospheric phenomena by providing data regarding climate and water production 24 hours a day. The rest of the Sites began operating throughout the second half of the year.

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Due to the success of the project, in 2007 the E.U. decided that it should continue, and granted funding for Phase 2, scheduled for the period up to June 2008 and consisting of the installation of two new Sites in Fuerteventura (focusing specifically on the fight against desertification) and one in Tenerife at the Ongoing Research Centre that the company was planning to build in Las Rosas (El Rosario).

At the same time, during 2006, the company designed a training program for the manufacture and installation of AWH devices, targeted at developing countries which urgently need the clean water provided by the technique.

Thanks to the Foundation, funding was received from the ICO (Official Credit Institute), Foundation for running the first training course in the program in the Dominican Republic (San José de Ocoa).

The course was therefore organised and resulted in the manufacturing and installation of an AWH Site for a Rural School. The project was carried out entirely by local people, under the supervision of our technicians.

The interest awaken by this initiative prompted the Dominican Republic Government to mark down funds from its own budget to supplying the material required for erecting a fence around the site and for equipping it with new tanks or cisterns for storing the water obtained.

2007: Tenerife Inter-Island Council Award: ‘Good European Ideas, I.R&D (Internal Research & Development 2007’.

The Tenerife Inter-Island Council awarded the company the ‘Good European Ideas, IR&D 2007’ prize, thus enabling it to join the CIDE Network (the Canary Island Network of Innovation and Business Development Centres).

In addition to the contacts provided by this Network, the Ministry for the Environment also decided to include us in its anti-desertification network in Fuerteventura, requesting the installation of three new AWH Sites. We were also requested by the Spanish Agency for International Cooperation to expand the existing site in the Dominican Republic and to export the 'Training program for manufacturing and installation to Colombia (La Makuira) and Morocco (Agadir).

These latter sites were set up in direct collaboration with the French OPUR Foundation (International Organization for Dew Utilization), which specializes in the forced condensation of morning and night dew.

The latest award received by the company coincided with the launch of the ANAGUA Project, which aims to set up three AWH Sites in Anaga Massif to ensure a decentralised supply of drinking water, sanitation and irrigation, thus avoiding costly pumping activities and transport by tankers.

This project will be carried out in collaboration with EMMASA (Mixed Water Company of Santa Cruz de Tenerife) and the Management of the Anaga Country Park.

The company Price Cooper Waterhouse is currently selecting the most appropriate funding formula based on regional and European funds available.

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Fog & Mist as a water resource

Due to their geographical location, the Canary Islands lie in the path of a cold ocean current (the cold Canary Current) which, along with the north-eastern trade winds from the Azores anticyclone, provide the islands with a mass of cold, water-laden air. This situation gives rise to the formation of two clearly differentiated layers: a lower layer which is cold and wet, and a higher one which is dry and warm. Thus, a heat inversion occurs which prevents the vertical development of cloud masses, fostering instead a horizontal spread. When this occurs in the Atlantic anticyclone, it generally takes the form of concentric rolls which, as they move and are retained by the islands' mountainous relief, form a blanket of cloud. As they are pushed up, condensation also increases. In the Canary Islands, this phenomenon is known as a 'sea of clouds', and generally tends to develop between 500 and 1,500 metres above sea level, on those mountain slopes most exposed to the wind.

This heat inversion is located lower down during the summer months, at an altitude of around 1,200 meters (the subsistence heat inversion is sharper, since there is an almost absolute predominance of the trade winds), and higher up in winter, at around 1,600 meters (the cold, wet lower layer is reinforced by interruptions of maritime polar air masses). As a result, it is during the winter months that the blanket of stratocumulus cloud is thicker.

The presence of this type of fog increases the atmospheric humidity levels and deposits a large quantity of minuscule droplets (measuring between 0.001 and 0.04 mm) on the leaves of the forest vegetation and other obstacles. As these drops join together and increase in size and weight, they fall to the ground in the form of fog precipitation. This type of precipitation is responsible for the differences in landscape between the windward and leeward slopes.

Fog precipitation increases with wind speed, the density of the fog and the abundance and a circular and laurel-shaped form of the leaves of the vegetation with which it comes into contact. As a result of this phenomenon, the amount of water that reaches the soil is much greater than that generally recorded by normal rain gauges, which only record conventional rainfall that falls directly from clouds. Fog precipitation is especially important in summer, when direct rainfall is practically non-existent. On leeward slopes, however, since a large proportion of the water vapour has already been lost, the humidity rate drops and temperatures rise, resulting in totally clear skies (the Fohn effect).

Fog or mist is defined as a mass of droplets of condensed water vapour suspended in the air over dry land.

The technique for harvesting water from fog, or 'hidden precipitation' as it is sometimes known, basically consists of making use of the fact that the droplets contained in the fog turn to precipitation upon contact with solid objects.

Thus, mist and fog may provide a viable natural alternative water source in dry regions, with said water being harvested by means of simple low-cost low-maintenance collection systems called Atmospheric Water Collectors.

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Use of atmospheric water

Agriculture

The installation of standard water harvesting devices can turn dry fields into irrigated ones, improve water quality, help recover soil contaminated with salt and supply isolated areas. Troughs and watering holes: Collection sites can be used to fill tanks and deposits that in turn provide an automatic, programmed water supply to natural areas in which animals have serious trouble finding water during the dry season. Drinking fountains for walkers and recreational areas: The need for an adequate water supply to recreational areas in forest regions has been satisfied, until now, by means of enormously expensive tankers. Harvesting water directly from the atmosphere in these highland regions cuts supply costs and provides the population (both tourists and local inhabitants) with high-quality water without harming the environment.

Improving water quality

Another socially beneficial use is the harvesting of atmospheric water in rural areas that, due to the over-use or pollution of local aquifers, are obliged to consume (for either domestic use or irrigation) water containing concentrations of undesirable elements that are above the values permitted by the European Union. In many cases, mixing this water with the one obtained by harvesting devices provides a viable solution in return for a much lower investment than those required by other treatment or supply methods (distillation, etc.).

Ensuring a supply to isolated areas

Due to the low level of maintenance required, this method is the cheapest one available for providing an adequate water supply to isolated populations living in foggy regions, mountain shelters, weather stations and observatories, etc. In these cases, providing they have a good storage and mineralization system, basic installations can guarantee an adequate supply, thus reducing or eliminating the need for costly transportation of water from lower-lying regions.

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Reforestation

Recovery of plant cover through programmed irrigation until the new plants is large enough to be self-sustaining, thus helping to control surface runoff. This technique also minimises the impact of both isolation (which makes other methods of irrigation impossible) and low rainfall.

Fire fighting and prevention

Atmospheric water collection installations can be used to provide a continuous supply to either existing or new tanks and deposits located in areas close to regions with a high fire risk (forest fire lines or recreational zones with bonfires, etc.), thus enabling those to supply remotely activated aspersion irrigation systems. This acts as a preventative measure, moistening high risk or inaccessible zones, and can also help control a fire until specialist fire fighting teams arrive. Furthermore, it also enables tankers to be filled in situ directly from the tanks, thus enabling them to arrive at the site of the fire more quickly, since they do not have to carry a full load all the way.

Industry

The fact that certain industrial processes require distilled water is yet another argument in favour of water harvesting installations, since having access to a supply of almost pure water considerably cuts the costs of the purification processes required for obtaining top-quality water.

Decentralised Water Supply Systems (DWSS)

The availability of water in highland areas offered by fog, mist, rain and dew harvesting systems, is a factor which may help make many isolated rural areas inhabitable and ensure the profitability of agricultural and livestock farms located in mid-level regions. This new resource enables the design of new storage and distribution systems that operate separately from the centralized supply system, thus providing a secondary network of high-quality water that uses gravity as its distribution motor, is totally renewable and which contributes to defining a new framework for sustainable development.

Technical considerations

'AQUAIR OPTIMIZER' Atmospheric Water Collection devices enable the harvesting of the water present in fog, mist and low-lying clouds. They can also collect drizzle and rainfall, channelling everything to a tank or deposit where it is stored for later use. The water obtained is almost completely pure, generally having conductivity and hardness levels of around 200 µS/cm and 3.2 mg/l $CaCO^3$ respectively.

Depending on the zone, rainfall generally occurs at more or less the same time every year, although this period hardly ever coincides with the seasons in which local crops require most water. In many cases, this results in the total or partial loss of the harvest.

The use of 'AQUAIR OPTIMIZER' devices offers a solution to this problem, creating a water reserve that can be used when rainfall is insufficient to cover local needs.

Fog contains a huge amount of water which, until now, only trees have been able to take advantage of. 'AQUAIR OPTIMIZER' devices imitate the action of the trees and retain and store this valuable natural resource which would otherwise pass over our fields without leaving a single drop of water behind.
Under optimum conditions (i.e. in the presence of intense mist and a moderate wind), our devices are capable of harvesting up to 32 litters per square meter of vertical mesh.

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Therefore, a standard 10 m^2 devices is capable of harvesting up to 320 litters per day, and a standard installation of 10 devices can provide up to 3,200 litters per day under the optimum conditions outlined above. "AQUAIR OPTIMIZER" devices are completely environmentally-friendly, require no power supply of any kind and are as silent as the trees themselves.

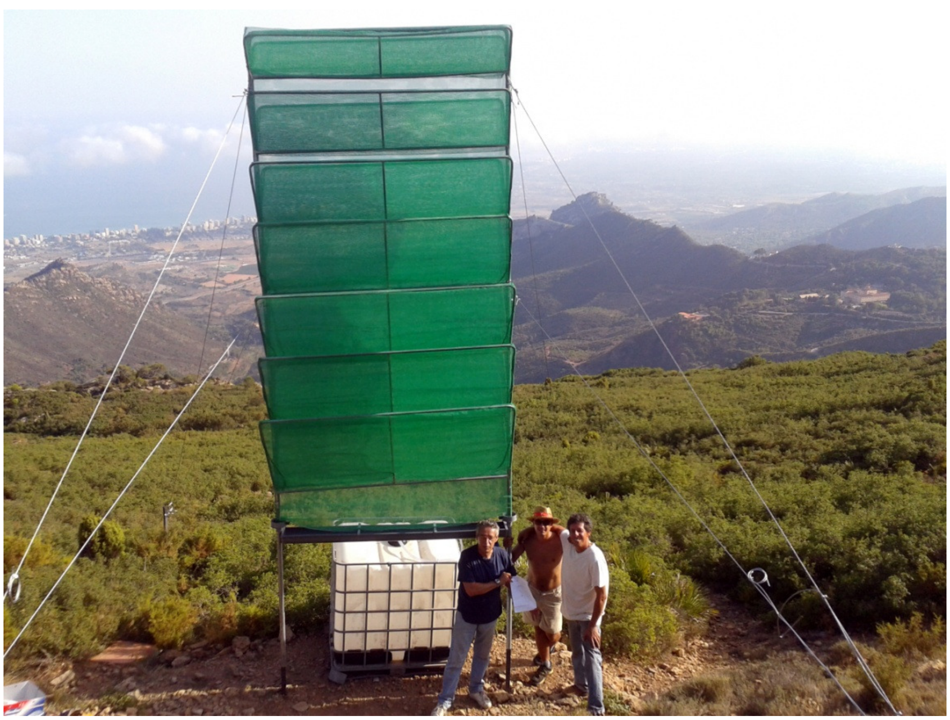
All the water harvested is channelled to a tank as part of a process that generates no waste and does not alter the water cycle, since even if large quantities of water are harvested, the fog or mist is still allowed to pass freely and continue along its natural course.

The devices consist of a vertical frame measuring 5 by 2 meters, and seven 30 cm-wide trays. They are made from galvanized iron, 304 stainless steel and 316 L. stainless steel, and can support both: plastic and metal meshes, or pre-perforated plates. The incorporation of collection trays multiplies the harvesting capacity of the devices.

Furthermore, unlike previous devices, 'AQUAIR OPTIMIZER' is also able to collect rainfall. Their estimated working life is 10 years for metal components and 5 years for plastic meshes. The devices are very simple to maintain, and require only sporadic cleaning once or twice a year, depending on the atmospheric conditions. We also recommend that you periodically check the guide lines which fix it to the ground.

There are various 'AQUAIR OPTIMIZER' device models, specifically designed to ensure optimum harvests and duration under different climatic conditions.

The high quality of the water obtained prevents corrosion and/or obstructions in the irrigation devices, thus minimizing their maintenance also and prolonging their working life. In the event of having other reserve-based water supplies (galleries, wells, sources, etc.), the water obtained from the devices may be used to improve the general quality of the supply or to reduce the amount extracted or the frequency of said extractions, thus contributing indirectly to the regeneration of traditional reserves.



Atmospheric Water Harvesting Models

Model Base

A highly wind-resistant device with a good harvesting level, ideal for exposed sites or regions which experience strong winds at some point in the year.

Measurements and maximum collection values

3 x 2 meters: 192 litters per day per collector.
3,9 x 2 meters: 250 litters per day per collector.
5 x 2 meters: 320 litters per Day per collector.

Model Duplo

It is identical to the BASE model, but with collection trays on both sides of the vertical frame. It offers very good harvesting capacity. Wind resistant but designed more for those regions with less intense winds.

Measurements and maximum collection values

3 x 2 meters: 240 litters per day per collector.
3,9 x 2 meters: 312 litters per day per collector.
5 x 2 meters: 420 litres per Day per collector.

Model Abeto

The device that most resembles to a tree. it has staggered, decreasing collecting trays on both sides of the vertical frame, with the largest located at the bottom with a width of 1 metre, and the smallest at the top with a width of 40 centimetres. It has excellent harvesting capacity. It is suitable for regions with gentle winds or areas protected by trees or hills, etc.

Measurements and maximum collection values

3 x 2 meters: 288 litres per day per collector.
3,9 x 2 meters: 374 litres per day per collector.
5 x 2 meters: 480 litres per day per collector.

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Atmospheric water collection sites

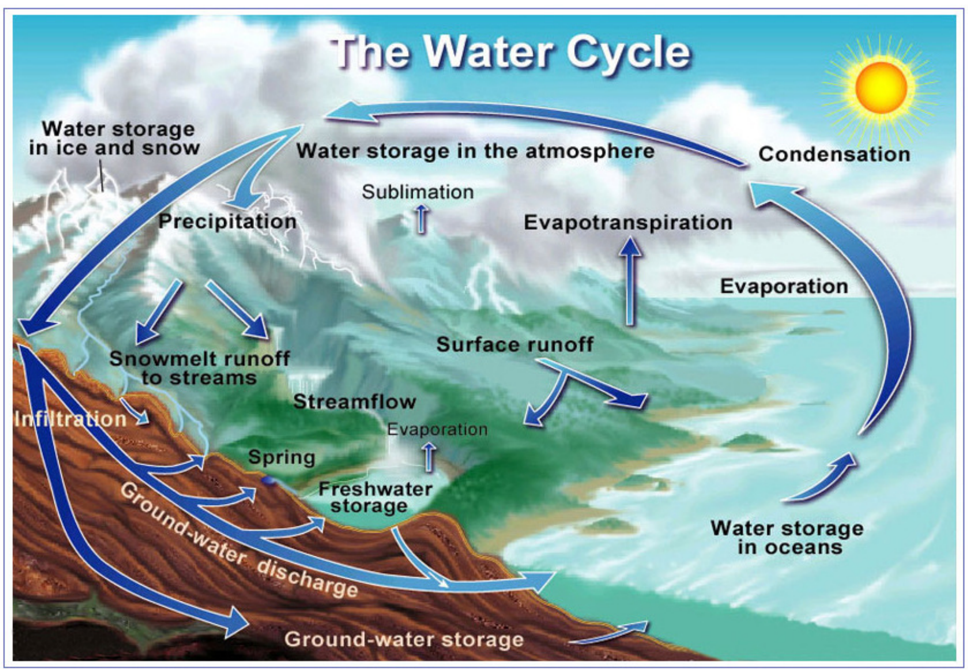
The sites are made up by a given number of water collection devices (10 normally in standard or basic sites) of one or various models, depending on the geo-climatic conditions of the region.
The devices are positioned independently in order to ensure optimum harvesting depending on the direction of the zone's prevailing winds. The purposes of these sites may be either scientific or productive. Normally, they also include a weather station to enable the dynamic analysis of the climatic elements that influence the harvesting of atmospheric water (fog, temperature, precipitation, relative humidity, speed and wind direction, etc.).

AQUAIR OPTIMIZER, A new water source

The technique and devices designed by Natural Aqua Canarias S.L. have been acknowledged at an international level, winning the Gold Medal and congratulations of the International Jury at the 28th Swiss Exhibition in Geneva, and the Swiss Society Special Award for Environmental Protection. They also enjoy the support and backing of various environmental foundations, such as the Global Nature Foundation, official bodies (FEDERTE, Inter-island Councils and Local Councils) and national and international universities.

The Natural Aqua Atmospheric Water Harvesting Technique can be described as: Clean, Environmentally-friendly, Inexpensive and Innovative.

OPEN MS has exclusive worldwide rights for the manufacturing, distribution and commercialization of these atmospheric water harvesting systems and can lease licensing agreements for the in-situ production of local deployments including training and knowledge technology transfer to minimize costs and reach the points which most urgently need our solutions.



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