

Water from Air

By Gunter Pauli

This article introduces a creative approach to producing water as one of the 100 innovations that shape "The Blue Economy". This article is part of a broad effort to stimulate entrepreneurship, competitiveness and employment.

The Market

The world market for the production of drinking water was estimated in 2007 at \$400 billion, expected to increase to \$533 billion in 2013. The prognosis of growth for world market for ultra-violet and ozone disinfection of drinking water points to an expansion from \$4.6 to \$10 billion over the same period. However the cost for society is not limited to the production and the treatment of potable water, it also requires the infrastructure for capturing and distributing water. The United States has laid over 700,000 miles of water pipes, which is four times more than the length of all national highways. The cost of expansion and improvement has been estimated at \$250 billion over the next decade. The US is not alone, the Chinese government has announced a \$128 billion budget to distribute water, especially in urban settings.

The global consumption of potable water has increased six fold over the past century. Production of water has barely been able to keep up with the trend, leading to disturbing data that 1.2 billion citizens in this world do not have access to drinking water and 2.4 billion people have no adequate sanitation. The supply of water is further compounded by the fact that water and soil is increasing contaminated. Our production systems, especially in agriculture are high consumers of water. One hamburger requires 2,400 liters of water (one kilogram of beef requires 15m³ of water); one pair of shoes requires 8,000 liters of water and a cotton T-shirt (also the organic ones) guzzle 4,000 liters of water.

Whereas 70 percent of the earth is water, only 2.5% is fresh water and the majority is captured in ice caps. One of the least tapped resources are the 12,900 cubic kilometers of water suspended as vapor in the atmosphere. One cubic kilometer of clouds could hold as much as 3,000 m³ of water. This highly distributed source of water, readily available over 70 percent of land represents one of the unique opportunities for responding to the dramatic increase in demand.

The Innovation

The cycle of evaporation, condensation and precipitation is known as the water cycle. It is a natural system that has been widely described and studied. Several inventors have focused on capturing vapor through the control of the dew point. Actually, the water-from air devices use refrigeration techniques to condense vapor from the air. This system operates in ambient temperatures between 21-32 degrees with a water humidity in the air ranging between 40 and 100 percent. The Atmospheric Water Technologies (USA) licensed this technology to the Katgara Group in India which installed the first ever system that guarantees a permanent supply of drinking water to 350 villagers at Jalimundi, a small village near Rajahmundry (East Godavari). However, the biggest challenge is the cost of energy for refrigeration. Most places that lack water, also lack electricity and the huge demand for electricity makes it unsuitable for any practical application of solar power.

Curt Hallberg, the navy marine turned water engineer, who went on to establish WATRECO in Malmö, Sweden, with his colleagues recognized that one of the main potential applications of the vortex technology (see Case 1) is the production of clean water. Whereas he already worked on filtration systems, pressing the impurities out of water, that subsequently exit through a nozzle, while the clean water is ready for consumption, he was aware the main challenge is not only purifying, but rather to produce water in the first place. The air-to-water systems rely on the decrease of temperature as a means to control the dew point. He saw an opportunity to use the other key physical parameter: increasing pressure. As air is sucked into a tube, forming a vortex, pressure increases. Thanks to the swirling movement, water is "pressed" out of the air. The energy required to suck moist air through the vortex generator is a fraction of the energy required to reduce the temperature of the cooling agents.

The First Cash Flow

Curt has already demonstrated successfully that he can extract air from water, and that he can press air into water reaching critical saturation using the swirling forces of the vortex. His insights already created a portfolio of dozen potential business applications, of which three have already reached the phase of commercialization. This includes ice making, descaling and irrigation improvement. Now he is ready to use the same logic, but instead of changing the air content of water, he is changing the water content of air. After all the same principles apply and instead of pushing for water through high energy costs, he looks at water production with very low energy requirements. It has been estimated that the engine of a vacuum cleaner would be sufficient to power the water capturing device that could be powered by small solar units, a feat that would not work for refrigeration.

The Opportunity

The logic applied by Curt is not much different from the breakthrough ideas James Dyson applied in turning vacuum cleaners more efficient. Dyson achieved 45 percent better suction by adding smaller cyclones through smaller diameter tubes generating greater centrifugal forces. The multiplier fan increases the air flow with a factor 16. The combination of the established technologies from Sweden and the UK could provide a cheap and lasting solution for the production of water from the air, at a fraction of the energy that the standard on the market requires at present.

This innovation would permit a distributed generation of water, much along the lines of decentralized energy generation. And, since scarcity of water is nearly always accompanied by a scarcity in electricity, the solving of one can lead to the solving of the other, cascading solutions that can be clustered into innovations that use available resources. Humidity in the air as a source for drinking water has been overlooked as a local resource. Therefore these technologies qualify as examples of The Blue Economy.

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The Blue Economy

... Further information on the 100 innovations at www.theblueeconomy.org.

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