



Case 1

The Vortex

saves energy, eliminates chemicals and generates 250,000 jobs
within a decade

This article introduces the vortex, 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 water treatment and the production of potable water represents one of the safest investments ever. The commodity of water is indispensable for society and industry. The availability of clean water is increasingly under pressure as population increases and consumption per capita rises incessantly. Water used to be free of charge, a commons. The last few decades has turned water into a profitable business with a secure cash flow and rising costs to the consumer.

The world market for water and waste water treatment surpassed the \$200 billion mark in 2009. China leads this market with an estimated annual growth of 17 percent. Treating water sewage is valued at \$40 billion with over 13,000 companies worldwide, driven by long term service contracts. The model of water treatment so far has involved sedimentation and oxidation, which means settling solids out and pumping air in, and a subsequent chemical treatment. The annual volume of chemicals used to treat water in the US exceeds 10 million tons. As world demand for water increases, so does demand for chemicals.

The consumption of bottled water increased by an average of 12 percent per year each year over the past decade with an estimated \$22 billion in sales. One of the fastest growing niches in this quest to expand drinking water supply is the conversion of salt and grey water into drinking water through reverse osmosis. The capital expenditure for this technology exceeds \$2.2 billion annually but is expected to grow another 50% over the next four years. Aguas de Barcelona (Spain), part of the GDF Suez Group (France), is planning the biggest installation of this type, investing over \$1 billion, thus liberating Barcelona from a chronic water shortage.

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The Innovation

It is within the context of the world market for water that we have to assess the arrival of an extraordinary simple innovation: the vortex. The vortex has the capacity to dramatically increase efficiency in water treatment, cutting costs while generating local jobs. This natural phenomenon could one day replace chemicals and membranes, and upset the existing cash flows of traditional suppliers that have looked safe. The technology platform of the vortex is inspired by the observation that dirty water cleanses itself as a river moves downstream. The continuous swirling movement forces air in and out of the water, discouraging and stimulating beneficial micro-organisms.

Two Swedish inventors, the development engineer Curt Hallberg and his colleague Morten Oveson, translated their observations into a mathematical model and then created a simple device that emulates the movement of water in a vortex with predictable results. They continued their venture to create Watreco AB based in Malmö. Watreco AB was elected the Swedish GreenTech company of the year in 2009. This company is more than green - it changes the business model of water.

The power of the vortex rests in the predictability of the laws of physics, where air particles are dragged to the center, from where air is sucked out. The energy source for this process may be simply gravity, which is guaranteed to power the device 24 hours per day! Gone are chemicals, gone are membranes, and energy consumption is minute.

The First Cash Flow

The inventors realized the broad spectrum of applications for their vortex device and searched for the first obvious market entry close to home, which was soon identified as ice making. The hand-made vortex generator achieved beneficial results: energy savings and crystal clear ice. Water includes air, dissolved in micron-size bubbles. The vortex removes this air, and since air acts as an insulator, the resulting air-free water freezes faster. Air-free ice is crystal clear and cracks much less readily. When applied to ice hockey rinks, advertising signs beneath the ice remain visible all season, thus increasing publicity revenues. Since there is no air in the ice, aerobic bacteria that typically grow in ice like E.coli and Salmonella cannot survive. Most of the prominent Scandinavian ice rinks have since adopted the technology, resulting in a financial payback within months, not years.

The second niche market that has generated cash flow for Watreco AB is the golf course. A golf course may need up to one million gallons of water a day. To save water, surfactants are added to the water so that it penetrates faster into the greens and less evaporates. If the water has been pre-treated by the vortex machine, no chemicals are needed, reducing water requirement by 20 to 30 percent. This is a case where the vortex actually makes chemicals redundant. A third niche market is the removal of algae from stable water bodies including swimming pools, which are typically treated with chemicals like chlorine.

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The Opportunity

While hockey rinks and golf courses are niche markets, the experience gained in these sectors prepared Curt Hallberg and his team for growth markets including industrial water treatment and desalination. The trial units of the vortex machine in the Canary Islands demonstrated that its treatment of salt water again permits the elimination of air, which subsequently eliminates the problem of biofilms. Biofilms grow on membranes, reducing the membrane's efficiency. This forces the closure of the desalination plant's reverse osmosis installation every fortnight to chemically remove biofilms. This increases maintenance costs (via an additional chemical requirement) and reduces the plant's efficiency (since shutdown periods require back up) as well as requiring further capital for replacement membranes (since the life of a membrane is reduced). If there is no air in the water, then the aerobic bacteria are excluded. If a vortex but no chemical is used, then the life expectancy of the membrane increases. In fact the energy cost of one cubic meter of drinking water could drop from 2.4 to 1.0 kiloWatt per hour.

These are only a few of the applications of the vortex that have been realized, but it is expected that more will be revealed soon. However what we know today confirms that the vortex machine results in reduced running costs, energy saved, chemicals eliminated and existing investments generating higher return. The challenge for mainstream industries is that the successful integration of the vortex into existing facilities requires a new core competence: fluid dynamics. It will now be up to General Electric, Siemens and Nitto Denko to take us out of the box. In the mean time, entrepreneurs around the world can create a new competitive model that generates jobs locally anywhere in the world..

GUNTER PAULI

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Further information on the 100 innovations at www.blueeconomy.de and www.zeri.org.

Order Gunter Paulis book at www.blueeconomy.de:

The Blue Economy: 100 Innovations – 10 Years – 100 Million Jobs.

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