Water vortices: A new source of renewable energy

SWITZERLAND has emerged as a world leader in renewable energies. As innovative ideas are hatched, researchers seek out technologies and techniques to put them into practice. In 2009, the only gravitation water vortex plant in Switzerland to date was commissioned in the village of Schöftland (canton of Aargau). The future is looking bright for this new form of hydroelectric power generation.

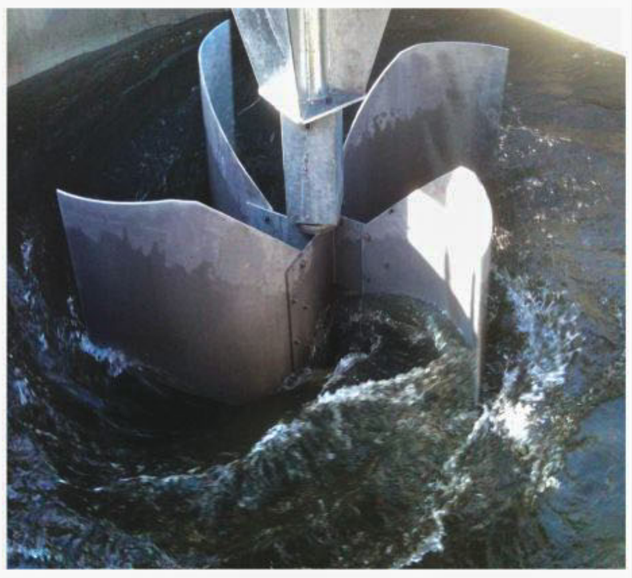
A new type of power plant

Gravitation water vortex plants are built directly on top of the river bed. They require a minimum water level of only 0.7m and a minimum quantity of approx. 1,000 litres per second. Thanks to simple, easy-maintenance and innovative technology, these plants are small, robust and built to last, with a maximum shelf-life of 50 to 100 years.

A gravitation water vortex plant functions differently from traditional hydroelectric facilities. It has a rotation tank equipped with a central outlet above which a stable, symmetrical vortex forms. It then drives the turbine thanks to the gravitational force between the turbine and the outlet. With 20 rotations per minute, the turbine powers the generator, which transfers the resulting electricity to the power grid. The turbine therefore generates neither high levels of pressure nor backflow water. Gravitation water vortex plants meet "clean tech" specifications due to the fact that 97% of electricity production is CO2-free.

Advantages of water vortex plants

The advantages of this type of power plant are many. Not only are they driven by a simple and reliable technology, they are also easy to maintain, compact, and inexpensive. Water vortex plants are also good news for the environment. Their construction will restore the body of water (e.g. a river) on which they are built, benefiting nature and the local community alike. The innovative technology behind these facilities means that they pose no threat to the fish population, as they are able to bypass the rotor downstream and upstream. A further advantage is the improved cleaning efficiency of natural micro-organisms thanks to the higher oxygen levels resulting from the regular aeration of the water.



Water vortex plants have little impact on the local environment as most of the construction work is below ground. With correct planting, the basin itself can be hidden, rendering the entire facility virtually invisible.

Pilot gravitation water vortex plant in Switzerland

The village of Schöftland in the canton of Aargau is home to the first gravitation water vortex power plant in Switzerland. Opened in 2009, the plant, which measures 6.5 metres in diameter and has a height of fall of 1.5 metres, can generate between 10 and 15 kW, depending on the volume of water. This is equivalent to an annual output of 80,000 to 130,000 kWh, enough to cover the yearly electricity needs of around 20 to 25 Swiss households (50-60 people).

Clean drinking water thanks to nanotechnology

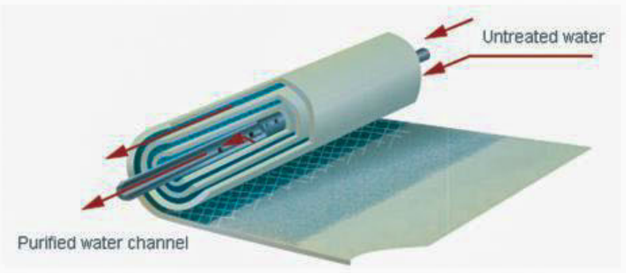
THE Valais mountain village of Zermatt in Switzerland consumes more than 6000 cubic metres of drinking water a day in the peak holiday period of Christmas and New Year – twice as much as in off-peak periods. Given that this huge demand for water overstretches the village's existing sources, additional solutions, in the shape of the nearby Gand Springs and nanotechnology, had to be found.

Membrane technology lowers calcium and sulphate levels

Water from the Gand Springs, which are near the Findel Glacier, 2280 metres above sea level, is perfectly hygienic, but it contains too much sulphate, giving it an unpleasant taste, and the high calcium content clogs up boilers, washing machines and dishwashers. Nevertheless, thanks to nanotechnology, these springs have been providing clean drinking water since 2006. The Wichje filtration plant uses the principle of reverse osmosis to ensure that the treated water meets current regulations on drinking water quality. In the process of reverse osmosis, water is passed through a membrane and can thus filter out the calcium and sulphate ions. This nanofiltration process also removes all chemical compounds, as well as viruses and bacteria present in the water.

Nanotechnology and the Swiss water industry

Nanotechnology has long been used by the water industry. The most modern, but by no means the only, ultrafiltration facility for water treatment in Switzerland is located in Männedorf (canton of Zurich). Since 2005 it has been supplying the 26,000 inhabitants of three lakeside towns with clean drinking water from the lake. The filter removes all particles and germs, even those as small as 2-60 nm in diameter.



Membrane technology opportunities for Switzerland

One-fifth of the public drinking water used in Switzerland is extracted from lakes. Compared with conventional purification processes, membrane technology permits low-cost water treatment with fewer chemicals, less energy consumption and smaller space requirements. The water from karst sources, which is also not entirely free from micro-organisms, can be processed into drinking water with the aid of membrane technology.

Membrane technology opportunities for developing countries

The potential for the use of membrane technology is especially high in developing countries, where around 1.5 billion people do not have access to clean water today. In many places, polluted water flows into bodies of water that are used as a drinking water supply downstream. For such cases, Eawag, the Swiss Federal Institute of Technology's aquatic research institute, is currently developing and testing low-cost membrane filtering processes that are simple to use. A household appliance called "LifeStraw Family" developed by a Swiss company is already available, and contains an integrated ultrafiltration membrane that eliminates all pathogenic germs.

Using nanotechnology to treat water – a broad spectrum of possibilities

The options for treating water using nanotechnologies are as widely varied as the demands placed on them: everything that is undesirable in drinking water – dirt, bacteria, viruses, organic compounds, pesticides, heavy metals, radionuclides, nitrate, phosphate, calcium, sulphate, etc. – can be removed using certain processes.