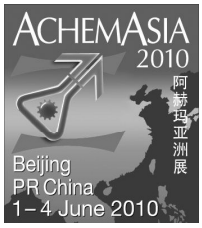

Presse-Information

Press release ● Information de presse

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Trend Report: Elixir of life from the ocean: seawater desalination boosts China's water supply

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- Water demand in China has increased dramatically
- Water treatment and desalination are expected to play a major role in securing sufficient water supply
- Several research centers in China are focussing on seawater desalination

Many people regard water as our number one food. There is no doubt that we cannot live without it. However our dependency on the water supply goes beyond the needs of the human population to include nearly every branch of industry. The availability of water in sufficient quantity and quality is essential for stable development and sustainable economic growth. During the 2008 Olympic Games, the effect which rapid growth in China is having on the country's water resources was brought to the attention of people worldwide for the first time. Demand for water continues to rise in the wake of industrial expansion, increasing urbanization and the rise in the general standard of living, and natural sources of water (rivers and groundwater) are no longer sufficient. During the 2010 Beijing Water Working Conference, the Director of the Beijing Municipal Water Authority, Cheng Jing, pointed out that the situation remains tense. Experts predict that despite new incentives to save water in China, consumption will remain high, possibly reaching 2.8 million m^3 per day. Estimates indicate that there is an annual shortfall of 400 million m^3, and the groundwater level has been decreasing steadily for the past nine years.

China is becoming a major new center of the desalination industry

China has a long coastline, giving it easy access to seawater. The country is ramping up its efforts to improve water management and expand the supply of fresh water. Desalination of water from the sea and coastal rivers and treatment of waste water are two key strategies that are currently being pursued. Along with the Mediterranean countries and the Arabian Peninsula, China is becoming a major new center of the desalination industry.

According to information provided by the International Desalination Association (IDA), the capacity of the installed desalination base worldwide is currently 59.9 million m^3 per day. In

2009 alone, 6.6 million m³/d of new capacity was installed at 700 plants around the world. Contractual agreements have been signed or work has already started to build another 224 plants. Seawater desalination is currently the most dynamic sector in the industry. Capacity increased by 29.6 % to 35.9 million m³/d between November 2007 and November 2009.

In China alone, around 50 seawater desalination plants with a capacity of roughly 300,000 m³ per day have been built and have gone into operation over the past ten years. China has ambitious plans to expand its seawater desalination program over the next ten years, especially in the special economic zones near the coast. A number of small and medium-size islands off of China's northeast coast already rely on seawater desalination for their municipal water supply. The German company ProMinent, for example, has built seawater desalination plants on the islands of Dachangshan and Zhangzhi. One plant has a capacity of 1,500 m³/d to supply water for a population of 89,000, and the other can supply 1,200 m³/d to meet the needs of 70,000 people. Both are reverse osmosis plants.

The long-term strategy is to install capacity to supply up to 8 million m³/d of water to regions which are more distant from the coastline. Officials are currently studying the feasibility of supplying desalinated seawater to meet Beijing's municipal water needs. Drinking water from seawater desalination plants currently costs at least 3 yuan per m³. By way of comparison, private customers in Beijing currently pay 4 yuan per m³ for their drinking water. However this rate also includes sewage treatment charges.

Energy demand has to be taken into account

Initially, fossil fuel fired power stations will provide heat and electricity for the seawater desalination plants. However plans are in place to build nuclear power stations to cut CO_2 emissions and reduce the country's dependency on fossil energy sources. Combined desalination and power generation is another option. Four desalination units will be connected to a state-of-the-art coal-fired power station 200 km northeast of Beijing during the next four years. Using the waste heat, each of the multi-effect distillation units will deliver 25,000 m³ of water per day to generate steam in the power station and to supply municipal water to the local population. The technology will be supplied by the Israeli firm IDE Technologies.

However it is not the case that China imports all of the technology it needs. In recent years, the country has intensified R&D efforts which are aimed at development of its own technology and expertise. The priorities have been set, and the work is concentrated at a number of universities and research organizations, partly with high-level coordination, and the government has also been involved. Work to clarify detailed issues and develop plant components is broadly diversified.

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Different focus in different research locations

Tianjin University, the Institute of Seawater Desalination and Multipurpose Use in Tianjin and Dalian University of Technology are working intensively on the continued development of thermal technologies such as Multi Stage Flash Evaporation (MSF) and Multiple Effect Distillation (MED). Besides investigating ways of increasing efficiency and reducing energy consumption, the researchers are also looking at materials issues. They are trying to understand why corrosion occurs and how it can be prevented in thermal desalination plants.

Scientists at the Development Center of Desalination and Water Treatment in Hangzhou and Ocean University of China in Qingdao are focusing their attention on membrane technology such as reverse osmosis (RO) and nanofiltration (NF). The list of goals includes the development of new and more effective membranes and more cost-effective module production. They are also working on improved plant design and maximum utilization of different technologies in hybrid systems.

Membranes made of cellulose acetate and new, improved thin film composite (TFC) membranes are being developed for reverse osmosis. Spiral wrap TFC membrane modules up to 18 inches in diameter are already available. Researchers are also working on the conceptual design of single-stage systems operating at 55 – 80 bar, and they are looking at 2 -stage membrane configurations which will hopefully deliver high efficiency and yields at lower pressures. More efficient high-pressure pumps with energy recovery features are already available. In addition to turbines with an efficiency rating of 80%, mechanical piston systems which are reported to have a 90% efficient rating are also being used.

A number of government agencies and organizations are subsidizing and coordinating the activities:

- The Science Foundation and Commission is responsible for basic research. A number of projects are underway, and they are not limited to the institutions listed above.
- The Ministry of Sciences and Technology is providing subsidies for pilot and demonstration plants, and a number of projects are currently in progress.
- Support for industrial applications and at least part of the funding is being provided through special programs which have been launched by the National Development and Reforming Commission and several provinces.

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Effects on the environment are studied

In addition to work on continued engineering development of the various technologies, researchers are looking at the impact which deployment of the technologies is likely to have on the environment at the different sites. There is a wide range of aspects to consider. Studies are underway to determine the effects of emissions from power generation facilities and how they will be distributed. The use of alternative energy sources at the sites including solar, wind, geothermal and tidal is also under investigation. In some of the coastal regions, researchers are looking at the effects that concentrated brine effluent (which also contains elevated levels of heavy metals due to corrosion in the plants) is likely to have on the local eco system and the flora and fauna such as algae, seaweed, microorganisms and fish.

Re-use of concentrated brine to produce by-products such as bromine, caustic soda and potassium salts is being given special attention. A pilot plant with a capacity of 10,000 metric tons per annum was constructed in 2006.

The activities are being coordinated to ensure that research is not compartmentalized. Special emphasis is being placed on the development of combined systems that span the entire desalination value-add process including pre-treatment of raw water. Besides conventional sand filters, ultra and nano filtration systems are also being deployed. Membrane systems partially soften the raw water and remove boron compounds to make it suitable for reverse osmosis and also to pre-treat the water prior to thermal evaporation. Ideally, the researchers would like to develop hybrid plants which combine membrane filtration, reverse osmosis and thermal desalination using MSF or MED systems. Reverse osmosis can take place upstream or downstream from the evaporation stage. If the concentration of the brine in the downstream evaporation stage is high enough, minerals such as sodium, potassium and bromine can be extracted.

Opportunities for suppliers and engineering service providers

In recent years, China has invested significant resources in R&D activities, and the domestic industry now has the capability to build large hybrid seawater desalination plants. However foreign companies will continue to have opportunities to collaborate with local companies, supply special components and provide engineering services in the Chinese market. A series of talks at AchemAsia 2010 will be dedicated to industrial water treatment, and there will be items on display which will extend and reinforce the information that will be shared during those sessions.
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(The trend reports are compiled by international trade journalists. DECHEMA does not accept any responsibility for incomplete or incorrect information.)

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