Desalinisation

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Western Australia Water Corporation 2006, 'Desalinisation' paper prepared for the 2006 Australian State of the Environment Committee, Department of the Environment and Heritage, Canberra, <http://www.deh.gov.au/soe/2006/emerging/desal/index.html>.

Desalination of seawater or brackish groundwater or river water for a public potable water supply is increasingly being considered or adopted around the world in areas where demand has been increasing beyond sustainable supply, where water sources are fragile or overdrawn and climate change is making previously reliable sources unreliable.

Rapidly increasing populations are also placing pressure on existing water sources, forcing governments to turn to *inter alia* desalination to provide additional water supplies when existing sources are fully extended. There is also potential for desalination to process already treated wastewater, normally returned to the environment, to a higher quality level for use in industry or mining processing, thus taking industrial demand away from public water supplies. An additional benefit of this would be reducing the volume of treated wastewater disposed to the environment. This option can produce water at a lower cost of treating sea water in many cases.

Desalination for major public supply is already employed fairly extensively in areas such as the Middle East and North Africa, the Caribbean, Southern Europe and now in China, Singapore and the USA.

What is desalination?

A desalination plant essentially separates saline water into two streams: one with a low concentration of dissolved salts (the fresh water stream) and the other containing the remaining dissolved salts (the concentrate or brine stream). The plant requires energy to operate and can use a number of different technologies for the separation of the saline water. The amount of the feed water discharged to waste in the brine stream varies from 20 to 70 percent of the feed flow, depending on the technology employed and the salt content of the feed water.

Desalination is becoming more economically viable as the technology improves. Desalination plants can be provided in a wide range of outputs to cater for small isolated communities or to contribute substantially to water supplies for large cities and even for irrigation (Spain, United Arab Emirates).

One of the processes for desalination is reverse osmosis (RO). It is a membrane separation process in which the water from a pressurized saline solution is separated from the dissolved material by flowing through a membrane. No heating is necessary for this separation. The major energy required for desalination is for pressurizing the feed water, typically up to 62 atmospheres for seawater. In principle, the saline feed water is pumped into a closed vessel where it is pressurized to overcome the osmotic pressure of the solution before diffusing through the membrane. As a portion of the water passes through the membrane, the remaining feed water increases in salt content. This portion of this feed water is then discharged without passing through the membrane.

Cities considering desalination

Australia's first large-scale desalination plant will come into production in Perth to desalinate seawater and become the city's biggest single water source. The plant will produce up to 45 gigalitres per year and is on track to begin production in November 2006. The Gold Coast City Council is developing plans for a 125 ML/day facility at Tugan on the Gold Coast. The plant would potentially feed into a "water grid" the concept that the Queensland Government is developing together with South-East Queensland Water and local government. A larger plant was being planned for Sydney to be operational by mid 2008, however, plans are currently on hold. The costs of desalination are a major consideration and need to be evaluated in the context of other options.

A distinct advantage of desalination of seawater is that it is climate proof and can continue to produce at full capacity even if declining rainfall means dam storages and rivers are dwindling and groundwater aquifers shrinking. However, seawater desalination demands stringent marine environment management. Catchment protection measures need to be in place to maintain the quality of seawater being processed.

Environmental impacts of desalination

The Pacific Institute in California has recently produced a report " Desalination. With a Grain of Salt"(Pacific Institute 2006) which is available on their website www.pacinst.org. The report cites energy costs, environmental concerns with greenhouse gas production and discharge of concentrated brine in the marine environment and a number of other issues. Approximately 16 plants are in "in development" in California.

Discharge of the concentrated saline solution

Monitoring and managing the discharge into the ocean of saline concentrate resulting from the process is required. Satisfactory dilution of the concentrate should be achieved to avoid increasing local levels of ocean salinity and stratification to unacceptable levels, especially in sheltered waters. This is generally not a difficult issue.

Energy use and greenhouse gas emissions

High energy use and consequent high greenhouse gas emissions are the major issue with desalination that need to be addressed. A plant similar to Perth's, even with energy recovery capability, will consume about 24 megawatts of electricity to produce about 45 gigalitres of water per year. This represents about 185,000 megawatt hours of energy per year.

This offers an opportunity to use renewable energy, as will happen in Perth whose plant will take power from a new wind farm to be constructed north of the city. This will make the plant the largest facility of its kind in the world to be powered by renewable energy, and will take the Corporation into a new era of renewable energy growth. It does however add extra cost to the water produced and may not be appropriate in all cases.

Reference

Pacific Institute 2006, "Desalination, With a Grain of Salt", Pacific Institute, Oakland, California, <www.pacinst.org/reports/desalination>, accessed August 2006.