What is desalination?

Desalination is a water supply option that is used widely around the world and involves taking the salt out of water to make it drinkable. Many countries use desalination as a way of creating a more reliable water supply that is not dependant on rain.

Is desalinated water safe?

Drinking water produced by desalination plants is monitored and tested in the same way as water from a filtration plant and must meet the standards of the Australian Drinking Water Guidelines (2006).

How does it work?

There are two main methods that are used to produce desalinated water distillation and membrane processes.

**Distillation**

This occurs naturally through evaporation or through very simple methods such as boiling salty water and condensing the steam. Commercial desalination plants using this process have been in operation for decades.

**Membrane Processes**

A more recent and now more widely used method relies on a semi-permeable membrane with pores so tiny that they separate the salt from water, this is reverse osmosis and it relies on natural processes and membranes.

Figure 1: The process of desalination through reverse osmosis at Sydney Water

Desalination in Australia

Table 1: Summary of Australian desalination plant

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Desalination Plant/s</th>
<th>Initial investment $m</th>
<th>Capacity GL/year</th>
<th>Completion date</th>
<th>Further Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Australia</td>
<td>Southern Seawater Desalination Plant (Binningup)</td>
<td>1400</td>
<td>100</td>
<td>2012</td>
<td><a href="http://www.watercorporation.com.au/water-supply-and-services/solutions-to-perths-water-supply/desalination/southern-seawater-desalination-plant">Link</a></td>
</tr>
<tr>
<td>Queensland</td>
<td>Gold Coast Desalination Plant (Tugun)</td>
<td>1200</td>
<td>49</td>
<td>2009</td>
<td>The plant’s intake and outlet structure are located approximately 1.5 kilometres out to sea and have become artificial reefs, which are home to a variety of local sea creatures. More information on this desalination process can be found <a href="http://www.watercorporation.com.au/water-supply-and-services/solutions-to-perths-water-supply/desalination/gold-coast-desalination-plant">here</a>.</td>
</tr>
<tr>
<td>Victoria</td>
<td>Victorian Desalination Plant (Wonthaggi)</td>
<td>3500</td>
<td>150</td>
<td>2012</td>
<td>The plant was built for the Victorian Government by AquaSure through a Public Private Partnership managed by the Department of Environment and Primary Industries. The plant has been mothballed since December 2012. More information can be found <a href="http://www.sawater.com.au/sawater/whatsnew/majorprojects/wp.htm">here</a>.</td>
</tr>
<tr>
<td>New South Wales</td>
<td>Sydney’s Desalination Plant (Kurnell)</td>
<td>1890</td>
<td>90</td>
<td>2010</td>
<td>Sydney’s Desalination Plant can supply up to 250 million litres a day, which is up to 15% of its water needs. The plant is 100% powered by renewable energy. More information can be found <a href="http://www.sawater.com.au/sawater/whatsnew/majorprojects/sdp.htm">here</a>.</td>
</tr>
</tbody>
</table>

Below is a summary of the surface water storage, desalination capacity, desalinated water supplied and recycled water supplied by region.

Table 2: Surface water storage, desalination capacity, desalinated water supplied and recycled water supplied by region.

<table>
<thead>
<tr>
<th>Region</th>
<th>Surface water storage/urban water supply in 2012-13 (years of supply)</th>
<th>Desalination capacity (% of 2012-13 urban water supply)</th>
<th>Desalinated water (ML) supplied to urban water system in 2012-13</th>
<th>Recycled water (ML) supplied to urban water system in 2012-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adelaide</td>
<td>0.5</td>
<td>62</td>
<td>36 470 (22%)</td>
<td>4 865 (3%)</td>
</tr>
<tr>
<td>Canberra</td>
<td>3.8</td>
<td>N/A</td>
<td>N/A</td>
<td>195 (&lt;1%)</td>
</tr>
<tr>
<td>Melbourne</td>
<td>1.4*</td>
<td>37</td>
<td>0</td>
<td>19 915 (5%)</td>
</tr>
<tr>
<td>Perth</td>
<td>0.6</td>
<td>46</td>
<td>95 770 (29%)</td>
<td>7 505 (2%)</td>
</tr>
<tr>
<td>SEQ</td>
<td>10.1</td>
<td>18</td>
<td>2 805 (1%)</td>
<td>17 550 (7%)</td>
</tr>
<tr>
<td>Sydney</td>
<td>5.2</td>
<td>17</td>
<td>0</td>
<td>22 590 (4%)</td>
</tr>
</tbody>
</table>

Figure 2 compares the capacity of large-scale desalination and recycled water plants for major Australian capital cities with overall use of water in those cities from desalination and recycled water. In 2012-13 all plants were running on average at around one-third capacity because there was abundant surface water. In Perth the desalination and recycled water plants were running at near full capacity.

**Figure 2: Supply capacity of large-scale desalination and recycled water plants for major capital cities versus total urban water use, 2006-07 to 2012-13 (GL/yr)**

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**Benefits of desalination**

Desalination provides a climate-independent source of water for critical human needs and economic development (industry and agriculture in particular). It is an effective way to secure water supplies against the effects of climate change, a growing population and drought.

**The cost of desalination**

The cost of producing and reticulating desalinated water is a function of a number of factors, including plant capacity, process power use efficiency, energy source, proximity to source water and end users and project financing model. As a result, costs ($/KL to end user) are highly variable. For large-scale municipal seawater desalination projects in Australia, the approximate range is $1-$4 per kilolitre.

**Desalination and energy use**

- Desalination requires significantly more energy than existing conventional water treatment processes. This makes it expensive and contributes to greenhouse gas emissions.
- For seawater desalination, energy use can represent 50-70% of total operating costs.
- Desalination plants are complex systems, with pre-treatment filters, high pressure pumps, energy recovery devices and chemical cleaning systems. With appropriate material selection, equipment lifespan is comparable with that for conventional water treatment.
- Desalination requires sophisticated plants that have high capital costs, significant maintenance requirements and shorter operating life than traditional water treatment plants.
- The saltier the water the more expensive it is to desalinate, so it may be cheaper to desalinate brackish (slightly salty) water or wastewater rather than seawater.
- Many Australian desalination plants use accredited ‘Green Power’ by using wind energy to power desalination plants. This can result in a significant increase in operating costs, due to the premium attached to the use of renewable energy. The benefit is reduced GHG emissions, with corresponding environmental benefits.
Social, environmental and economic issues

In general, desalination is often the last resort to address water supply security and/or quality. This is due to the higher cost of production, compared with traditional water resources, except when the latter is scarce due to drought and/or political situation. Key barriers to increasing adoption of desalination technology for municipal water supplies include:

- Capital and operating costs
- Public perception (energy use, environmental impact)
- Environmental impact (energy consumption, management of waste saline concentrates, disposal of large quantities of membrane modules)
- Lack of transparent assessment of desalination plant versus treatment of natural catchment supplies with respect to water security
- Lack of centralised repository of information pertaining to the use, performance and lessons learnt from existing desalination plants in Australia

Criticism of Australia’s desalination plants

In its review of Australia’s urban water sector, the Productivity Commission found that while some of the investment in desalination plants (Table 1), ‘might have been appropriate in the circumstances to maintain security of supply, there is sufficient evidence available to conclude that many projects could have been:

- Deferred for a number of years
- Smaller in scale
- Replaced with investment in lower cost sources of water’

Where lower cost sources of water supply can include rural-urban trade and aquifers.

Support for desalination

In the AWA/Deloitte 2014 State of the Water Sector Report 2014 an overwhelming number of respondents (96%) believed that desalinated seawater can be treated and managed to a level that is sufficient for safe and reliable potable supply (Figure 3). However views on whether it is an environmentally sustainable and cost effective source of potable water varies across jurisdictions.

Figure 3: The Australian water sector’s views on desalination


Ensuring secure water supplies

In the face of growing challenges of climate and population growth the whole portfolio of supply augmentation and demand management options should be assessed for a system. Good, robust collaborative planning between the industry, regulators and communities is also required.
For more information about desalination in Australia

National Centre of Excellence in Desalination
http://desalination.edu.au/

International Desalination Association
http://idadesal.org/

Water Corporation (WA)

Water Secure (Qld)

Water for Good (SA)

Melbourne Water (Vic)

Sydney Water (NSW)