



Research Office
Legislative Council Secretariat

Fact Sheet

Seawater desalination in Australia

FS10/14-15

1. Introduction

1.1 Australia is one of the driest continents on earth. Rainfall is variable and droughts are common in the country. To cope with rainfall variability and secure a stable long-term supply of water for the urban population¹, many state governments in Australia have diversified their sources of water supply by adopting seawater desalination in the past years. This fact sheet aims to provide the Panel on Development with information on water supply management in Australia, with special reference to Western Australia and South Australia where seawater desalination has been adopted as an alternative source of water supply for domestic use.

2. Water supply management in Australia

2.1 In Australia, the Commonwealth government works through the Department of the Environment to manage a wide variety of environmental policies, programmes and operational matters. These include the delivery and reform of water resources and infrastructure policy at the national level. The state and territory governments are responsible for the planning and management of water resources in accordance with the national policy framework, and delivering water services at the state/territory level.

2.2 In addition, the Commonwealth government has implemented the National Urban Water and Desalination Plan to assist major towns and cities to secure water supply and reduce reliance on rainfall dependent sources. The plan features the provision of funding support for undertaking infrastructure projects and research in desalination, water recycling, and storm water harvesting and reuse.

¹ In Australia, most people live in large cities along the coast. According to the World Bank (2015), urban population accounted for about 89% of the total population in Australia.

2.3 In Australia, desalination plants were initially built for mines and power stations to produce boiler feed water or process effluent prior to discharge. The high cost of producing desalinated water had been a barrier for adopting desalination as an alternative source of domestic water supply.

2.4 During the roughly 10-year period between 2000 and 2010, south-eastern and south-western Australia experienced a prolonged period of severe droughts. The resulting shortage of rainwater had enticed the state governments in these two regions to build seawater desalination plants to secure long-term fresh water supply for the urban population. The lower cost of producing desalinated water as a result of technological advancement also contributed.

2.5 A decade or so of severe droughts came to an end in recent years, and the ensuing sufficient supply of lower-cost rainwater has resulted in subdued demand for desalinated water. As a result, the desalination plants in New South Wales, Victoria and Queensland, which were built during the drought years of 2000-2010, have remained idle after a short period of operation.² At present, only the desalination plants in the states of Western Australia and South Australia are still in operation.

3. Seawater desalination plants in Western Australia

3.1 Western Australia is the largest state in Australia with a total land area of 2.5 million sq km. As at end-June 2014, there were 2.57 million people living in Western Australia, of which about 79% lived in Perth. There are two large-scale desalination plants in Western Australia, the Perth Seawater Desalination Plant and the Southern Seawater Desalination Plant, which were built during the drought period of 2000-2010. They are both owned by the Water Corporation of Western Australia ("the Water Corporation"), which is a business enterprise established by the state government and accountable to the Minister for Water (its sole shareholder).³

² These idle plants, which are considered providing an "insurance policy against drought", have attracted criticisms due to their high construction and maintenance costs. See Alfred Deakin Research Institute of Deakin University (2013), Sunshine Coast Daily (2014) and The St George & Sutherland Shire Leader (2015).

³ The Water Corporation is responsible for (a) providing water supply, and wastewater and drainage services, (b) managing and operating the dams and reservoirs, and (c) planning and managing the water supply infrastructure, including desalination plants.

3.2 In 2013-2014, about 289 million cubic metres ("cu m") of water was supplied to Perth, the Goldfields and Agricultural region and some parts of the south western region in Western Australia.⁴ Within the total, 39% was sourced from desalinated water and the rest from groundwater (43%) and surface water (18%).

Perth Seawater Desalination Plant

3.3 The Perth Seawater Desalination Plant, located 25 km south of Perth, commenced operation in 2006. It has an annual capacity of 45 million cu m, accounting for about 17% of total water supply in Perth. The plant adopts reverse osmosis technology⁵, and is powered by electricity generated by a wind farm north of Perth to minimize greenhouse gas emissions. It was reported that the production cost⁶ of desalinated water supplied by the plant amounted to about AUS\$1.2 (HK\$6.8) per cu m in 2013⁷, which was the lowest among the major desalination plants in Australia.⁸

3.4 The Water Corporation has partnered a consortium of private corporations⁹ in the development of the Perth Seawater Desalination Plant. It funded the development cost of AUS\$387 million (HK\$2.2 billion), whereas the consortium was responsible for the design and construction of the plant. The Water Corporation also awarded the contract to one of the consortium corporations to operate the plant for 25 years.

Southern Seawater Desalination Plant

3.5 The Southern Seawater Desalination Plant is located approximately 150 km south of Perth. It adopts reverse osmosis technology, and is powered by renewable energy supplied by a solar farm and a wind farm located north of

⁴ Water supplied to other regions of Western Australia amounted to about 82 million cu m, which was mostly from natural sources.

⁵ See FS07/14-15 for details of the reverse osmosis technology.

⁶ The per cu m production cost of the Perth Seawater Desalination Plant is not directly comparable with that of the proposed Tsueng Kwan O desalination plant (HK\$12-13 per cu m) as their cost components are not the same.

⁷ See National Centre of Excellence in Desalination Australia (2013).

⁸ According to the National Centre of Excellence in Desalination Australia (2013), the production cost of other major desalination plants in Australia was about AUS\$2.7 (HK\$15.5) to AUS\$4.1 (HK\$23.2) per cu m in 2013.

⁹ The consortium, Multiplex-Degremont, was formed by a French water treatment company and an Australian civil engineering company.

Perth.¹⁰ The Southern Seawater Desalination Plant commenced operation in 2011 with an annual production capacity of 50 million cu m. It subsequently underwent an expansion plan that increased its annual production capacity to 100 million cu m in 2013.

3.6 Similar to the case of the Perth Seawater Desalination Plant, the Water Corporation has partnered a consortium of private corporations in the development of the Southern Seawater Desalination Plant.¹¹ It funded the development cost of AUS\$1,400 million (HK\$7.9 billion), while the consortium was awarded the contracts to design, construct, and operate the plant for 25 years.

4. Seawater desalination plant in South Australia

4.1 South Australia is the fourth largest state in Australia with a total land area of 978 810 sq km. As at end-June 2014, there were 1.69 million people living in South Australia, of which about 77% lived in Adelaide. In 2013-2014, total water consumption in South Australia amounted to 214 million cu m, of which 66% was sourced from surface water, 28% from desalinated water and 6% from groundwater.

4.2 Faced with the severe drought during 2000-2010 and growing water consumption from the socio-economic development, the state government of South Australia decided to build a desalination plant in 2007 in an effort to ensure the security and sustainability of long-term water supply. The South Australian Water Corporation ("SA Water"¹²), a government-owned business enterprise, was responsible for the project, and it developed the Adelaide Desalination Plant using a design-build-operate-maintain ("DBOM") delivery model.

¹⁰ The energy requirements of the Southern Seawater Desalination Plant are not directly drawn from the renewable energy farms. Instead, the power requirements are drawn from the Western Power grid which draws energy from the renewable energy farms.

¹¹ The consortium, Southern Seawater Joint Venture, was formed by two Spanish companies and two Australian companies.

¹² SA Water is accountable to the Minister for Water and is responsible for providing water supply, and wastewater and sewage services in South Australia.

4.3 Under the DBOM contract, a consortium of private corporations was responsible for the design and construction of the Adelaide Desalination Plant. The construction cost, at AUS\$1.83 billion (HK\$10.4 billion), was funded by the Commonwealth government and the state government of South Australia. After the completion of the construction project, SA Water awarded another consortium the contract to operate and manage the Adelaide Desalination Plant for 20 years¹³ while retaining the ownership of the plant.

4.4 The Adelaide Desalination Plant, located about 30 km south of the central business district of Adelaide, is a reverse osmosis plant powered by renewable energy. It was constructed in two phases each with a designed capacity of 50 million cu m per annum. The plant started delivering desalinated water in 2011 upon completion of the first phase and the entire facility was fully operational in early 2013. In 2015, the production cost of desalinated water supplied by the Adelaide Desalination Plant was reportedly at about AUS\$2.41 (HK\$13.6) per cu m.¹⁴

4.5 During the initial two years of operation, the Adelaide Desalination Plant was operated on a trial basis, running at an average of 50% capacity. At present, it seems to play a backup role and runs at only 10% of its full capacity. The under-capacity operation of the Adelaide Desalination Plant reflects the sufficient supply of lower-cost water supply from natural sources after the end of the severe droughts in recent years.

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¹³ The consortium is named AdelaideAqua Pty Ltd, comprising an Australian water treatment company and a Spanish water treatment company.

¹⁴ See The Advertiser (2015).

References

1. Alfred Deakin Research Institute of Deakin University. (2013) *A Tale of Two Cities: Desalination and Drought in Perth and Melbourne*. Available from: <http://www.deakin.edu.au/alfred-deakin-research-institute/documents/michael-porter-tale-of-two-cities.pdf> [Accessed September 2015].
2. Australian Broadcasting Corporation. (2014) *Adelaide desalination plant to keep running despite ample water reserves*. Available from: <http://www.abc.net.au/news/2014-12-29/adelaide-desal-plant-to-keep-running/5991256> [Accessed September 2015].
3. *Australian Bureau of Statistics*. (2015) Available from: <http://www.abs.gov.au/> [Accessed September 2015].
4. Australian Government Department of Infrastructure and Transport. (2010) *Infrastructure Planning and Delivery: Best Practice Case Studies*. Available from: https://infrastructure.gov.au/infrastructure/publications/files/best_practice_guide.pdf [Accessed September 2015].
5. Bloomberg Business. (2013) *Drought Prompts Australia to Turn to Desalination Despite Cost*. Available from: <http://www.bloomberg.com/news/2013-03-06/drought-prompts-australia-to-turn-to-desalination-despite-cost.html> [Accessed September 2015].
6. Commonwealth Scientific and Industrial Research Organisation. (2009) *Desalination in Australia*.
7. National Centre of Excellence in Desalination Australia. (2013) *Cheaper seawater desalination*. Available from: <http://desalination.edu.au/2013/07/cheaper-seawater-desalination/#.Ve5GMdKqqko> [Accessed September 2015].
8. News.com.au. (2013) *It's time to go with the flow as \$1.8b Adelaide Desalination Plant opens*. Available from: <http://www.news.com.au/national/its-time-to-go-with-the-flow-as-18b-adelaide-desalination-plant-opens/story-e6frfkp9-1226607197417> [Accessed September 2015].
9. Saliby, I. E. et al. (2009) Desalination plants in Australia, review and facts. *Desalination*, vol. 247, pp. 1-14.

10. South Australian Water Corporation. (2012) *Adelaide Desalination Project - Final Project Report for 100GL/a Plant*. Available from: <http://www.environment.gov.au/system/files/pages/077dd73b-8850-4d2f-b1f4-883b82955229/files/final-report-adelaide-desalination-project.pdf> [Accessed September 2015].
11. South Australian Water Corporation. (2015) Available from: <https://www.sawater.com.au/> [Accessed September 2015].
12. Sunshine Coast Daily. (2014) *Qld to decide what to do with botched \$4b water 'assets'*. Available from: <http://www.sunshinecoastdaily.com.au/news/qld-decide-what-do-botched-4b-water-assets/2218887/> [Accessed September 2015].
13. The Advertiser. (2015) *Adelaide desalination plant too expensive to run*. Available from: <http://www.adelaidenow.com.au/news/south-australia/adelaide-desalination-plant-too-expensive-to-run/story-fni6uo1m-1227322111948> [Accessed September 2015].
14. The Government of South Australia. (2010) *Water for Good: A plan to ensure our water future to 2050*. Available from: [http://www.environment.sa.gov.au/Home/Search_Results?dlv_Site%20Wide%20Search%20Results=\(keyword=Water%20for%20Good:%20A%20plan%20to%20ensure%20our%20water%20future%20to%202050\)](http://www.environment.sa.gov.au/Home/Search_Results?dlv_Site%20Wide%20Search%20Results=(keyword=Water%20for%20Good:%20A%20plan%20to%20ensure%20our%20water%20future%20to%202050)) [Accessed September 2015].
15. The St George & Sutherland Shire Leader. (2015) *Call to close Kurnell desalination plant*. Available from: <http://www.theleader.com.au/story/3045382/call-to-close-kurnell-desalination-plant/> [Accessed September 2015].
16. Water Corporation. (2015) Available from: <https://www.watercorporation.com.au/> [Accessed September 2015].
17. Water Technology Net. (2015) *Projects by Region: Australasia*. Available from: <http://www.water-technology.net/projects/region/australasia/> [Accessed September 2015].
18. World Bank. (2015) *Indicator Metadata*. Available from: http://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?order=wbapi_data_value_2014+wbapi_data_value+wbapi_data_value-last&sort=asc [Accessed September 2015].