



Research Office
Legislative Council Secretariat

Fact Sheet

NEWater in Singapore

FSC22/15-16

1. Introduction

1.1 Singapore opened its first plant to produce NEWater (high-purity reclaimed water) from treated used water in 2003 to diversify its sources of water supply. Over the past decade or so, NEWater has been developed to the extent of becoming Singapore's "third National Tap", accounting for about 30% of its country's current water demand.¹ In order to attain self-sufficiency in water supply in the long run, the Singapore government has planned to further expand the capacity of producing NEWater so that it can meet up to 55% of Singapore's future water demand by 2060. This fact sheet aims to provide information on the development of NEWater plants in Singapore, including the production process of NEWater and its usage in the country.

2. NEWater plants in Singapore

2.1 The Public Utilities Board ("PUB"), Singapore's national water agency,² started as early as in the 1970s exploring the feasibility of producing drinking water from treated used water to supplement Singapore's water supply. However, PUB only decided to adopt NEWater as an alternative water source in the early 2000s, when the necessary water treatment technologies had matured and the production cost of producing reclaimed water came down significantly. There are currently four NEWater plants operating in Singapore³ with a combined capacity of producing over 500 000 cubic metres ("cu m") of NEWater per day.⁴

¹ The other three National Taps are: (a) rainwater collected from local catchment areas; (b) imported water from Malaysia; and (c) desalinated water.

² PUB is a statutory board established under the Ministry of the Environment and Water Resources, tasked with managing Singapore's water supply, water catchment and sewerage in an integrated way.

³ There were five NEWater plants in 2010. In 2011, PUB closed down the third NEWater plant at Seletar as it implemented its plan to centralize the treatment of used water under the Deep Tunnel Sewerage System which was more efficient and cost-effective. See The Public Utilities Board (2011).

⁴ According to PUB, Singapore consumes about 1.8 million cu m of water per day.

2.2 The NEWater plants at Bedok and Kranji were the first two coming on stream, and they were opened in February 2003.⁵ These two plants, each with a designed capacity of producing about 80 000 cu m of NEWater per day, are operated by PUB. Adjacent to the Bedok NEWater plant, PUB built the NEWater Visitor Centre which aimed at building public awareness of and confidence in NEWater through its education programmes.⁶

2.3 The other two NEWater plants, located at Ulu Pandan and Changi respectively (as detailed below), were opened after the mid-2000s. Unlike the earlier facilities, PUB adopted a public-private partnership approach for developing these two plants. That means, the private sector was awarded the contracts to design, build, own and operate the plants, as well as arranging the project financing and supply NEWater to PUB.

Ulu Pandan NEWater Plant

2.4 The Ulu Pandan NEWater Plant, having a designed capacity of 148 000 cu m per day, was opened in 2007. PUB appointed Keppel Seghers NEWater Development Co Pte Ltd ("Keppel Seghers")⁷ to design, build, own and operate the plant. Keppel Seghers is obliged to deliver NEWater to PUB over a 20-year period from 2007 to 2027 with the first-year price set at S\$0.3 (HK\$1.55) per cu m.^{8,9}

Changi NEWater Plant

2.5 The Changi NEWater plant was opened in 2010. It is the largest NEWater Plant in Singapore with a designed capacity of 228 000 cu m per day. PUB awarded the contract to design, build, own and operate the plant to Sembcorp NEWater Pte Ltd ("Sembcorp").¹⁰ Under the agreement signed

⁵ The NEWater plants in Singapore are located close to existing water reclamation plants operated by PUB from which treated used water is obtained for processing.

⁶ The NEWater Visitor Centre employs advanced technology, together with a carefully crafted public education strategy, to educate the public about reclaimed water. For example, the Centre uses digital technology, computer games, visual images and videos to explain water use and reuse in a fun, stimulating, and interactive manner.

⁷ Keppel Seghers is a wholly-owned subsidiary of the Keppel Infrastructure Group of the Keppel Corporation Limited which is in the offshore and marine, infrastructure and property businesses.

⁸ See Keppel Corporation (2004).

⁹ The price does not include the water distribution to end-users and customer service costs incurred by PUB.

¹⁰ Sembcorp is a Singapore-based subsidiary of Sembcorp Utilities Pte Ltd which is wholly-owned by Sembcorp Industries. Being a leading energy, water and marine group in Singapore, Sembcorp Industries provides energy and water solutions to customers in countries including Singapore, China and the United Kingdom.

with PUB, Sembcorp supplies NEWater to PUB over a 25-year period between 2010 and 2035 with the price set at S\$0.3 (HK\$1.71) per cu m¹¹ in the first year of delivery.

3. Production process of NEWater

3.1 NEWater is produced from treated used water transferred from PUB-owned water reclamation plants by using advanced membrane and ultraviolet technologies to make the water clean and safe to drink. The production of NEWater involves the following three processes:

- (a) microfiltration – filtering out fine solids and particles from treated used water;
- (b) reverse osmosis¹² – using semi-permeable membranes to filter out other undesirable contaminants such as bacteria, viruses and heavy metals, and most dissolved salts; and
- (c) ultraviolet disinfection – ensuring the safety and purity of NEWater by inactivating all organisms.

3.2 In order to optimize the performance of the NEWater operations and reduce production costs, PUB has been working with industry partners to develop new technologies such as membrane technology that can increase operation efficiency and reduce energy consumption during the production process of NEWater.

4. Usage of NEWater

4.1 In Singapore, NEWater has been used mainly for industrial purposes by the wafer fabrication, electronics and power generation industries,

¹¹ The price does not include the water distribution to end-users and customer service costs incurred by PUB.

¹² The reverse osmosis technology is the same as the one adopted for producing desalinated water by desalination plants in Singapore.

as well as for air conditioning cooling purposes by commercial buildings. During dry months, a small amount of NEWater (up to about 2.5% of total daily water consumption) is pumped into reservoirs for indirect potable use by blending it with reservoir water. The raw water from the reservoirs will then go through regular treatment at the waterworks before it is supplied to consumers as tap water.

4.2 PUB implemented a public communication programme in the early 2000s to build up the public's confidence in and acceptance of NEWater. The programme featured: (a) top government officials (including the then Prime Minister of Singapore) becoming NEWater ambassadors and champions drinking NEWater publicly to show their endorsement; (b) conducting briefings and exhibitions to engage the stakeholders; (c) NEWater bottled in attractive packaging for public sampling; and (d) setting up the NEWater Visitor Centre for continuous public education on NEWater.

5. Recent developments

5.1 In 2014, PUB awarded the BESIN-UEN Consortium¹³ the contract to design, build, own and operate a new NEWater plant at Changi.¹⁴ The consortium is responsible for arranging the project financing as well. The new plant, reportedly to commence operation in late 2016,¹⁵ will be built with a designed capacity of 228 000 cu m per day. Under the agreement signed with PUB, the BESIN-UEN Consortium will supply NEWater to PUB over a 25-year period from 2016 to 2041. The cost of supplying NEWater in the first year is set at a competitive price of S\$0.276 (HK\$1.50) per cu m.¹⁶

¹³ The BESIN-UEN Consortium is led by BEWG International Pte Ltd and UE NEWater Pte Ltd. The former is a wholly-owned subsidiary of Beijing Enterprises Water Group Limited and the latter a wholly-owned subsidiary of Singapore's UES Holdings Pte Ltd.

¹⁴ The new NEWater plant is the second located at Changi.

¹⁵ According to Asahi Kasei (2015), the second Changi NEWater Plant would come on stream in October 2016. Asahi Kasei is one of the contractors of the new NEWater Plant.

¹⁶ The price does not include the water distribution to end-users and customer service costs incurred by PUB.

References

1. Asahi Kasei. (2015) *Microza™ hollow-fiber membrane selected for Singapore's largest wastewater reclamation plant*. Available from: <http://www.asahi-kasei.co.jp/asahi/en/news/2015/e150406.html> [Accessed February 2016].
2. Civil Service College. (2007) *Water Management in Singapore*. Available from: <https://www.cscollege.gov.sg/Knowledge/ethos/Issue%202%20Apr%202007/Pages/Water-Management-in-Singapore.aspx> [Accessed February 2016].
3. Hyflux Ltd. (2015) *Hyflux*. Available from: <http://www.hyflux.com/wp-content/uploads/2015/09/Corporate-Brochure.pdf> [Accessed February 2016].
4. Kable Intelligence Ltd. (2015) *Changi Water Reclamation Plant, Changi, Singapore*. Available from: <http://www.water-technology.net/projects/changi-reclamation/> [Accessed February 2016].
5. Keppel Corporation. (2004) *Media release: Keppel Engineering wins contract to build Singapore's largest NEWater plant at Ulu Pandan*. 15 December. Available from: http://www.kepcorp.com/en/news_item.aspx?sid=899 [Accessed February 2016].
6. National Library Board. (2010) *NEWater*. Available from: http://eresources.nlb.gov.sg/infopedia/articles/SIP_1555_2009-08-11.html [Accessed February 2016].
7. The Public Utilities Board. (2006) *Desalination and Ulu Pandan NEWater DBOO Projects – PUB's Experience*. Available from: <https://sustainabledevelopment.un.org/content/documents/3385sivaraman.pdf> [Accessed February 2016].
8. The Public Utilities Board. (2010) *Press Releases: Opening of Singapore's fifth and largest NEWater plant, the Sembcorp NEWater Plant*. Available from: <http://www.nas.gov.sg/archivesonline/speeches/view.html?filename=20100510002.htm> [Accessed February 2016].
9. The Public Utilities Board. (2011) *Water - PUB Annual Report 2010/2011*. Available from: http://www.pub.gov.sg/mpublications/Lists/AnnualReport/Attachments/16/PUB_AR2011.pdf [Accessed February 2016].

10. The Public Utilities Board. (2014a) *Press Releases: BESIN-UEN Consortium to build second NEWater Plant at Changi*. Available from: <http://www.pub.gov.sg/MPUBLICATIONS/Pages/PressReleases.aspx#> [Accessed February 2016].
11. The Public Utilities Board. (2014b) *Press Releases: NEWater outreach wins UN-Water award*. Available from: <http://www.pub.gov.sg/MPUBLICATIONS/Pages/PressReleases.aspx#> [Accessed February 2016].
12. The Public Utilities Board. (2015a) *NEWater*. Available from: <http://www.pub.gov.sg/water/newater/Pages/default.aspx> [Accessed February 2016].
13. The Public Utilities Board. (2015b) *Our Water, Our Future*. Available from: http://www.pub.gov.sg/mpublications/OurWaterOurFuture/Documents/OurWaterOurFuture_2015.pdf [Accessed February 2016].
14. The Public Utilities Board. (undated) *Beyond Tap Water: NEWater wins Public Confidence in Singapore*. Available from: http://www.jwwa.or.jp/english/kaigai_shiryoku/IWA_workshop_6th_2-5.pdf [Accessed February 2016].
15. The Public Utilities Board. (various years) *Innovation in Water - Singapore*. Available from: <http://www.pub.gov.sg/mpublications/Innovation/Pages/default.aspx> [Accessed February 2016].
16. Toray Chemical Korea Inc. (undated) *Kranji NEWater Plant Phase II*. Available from: <http://www.dormeco.co.il/wp-content/uploads/2013/01/CSM-Kranji.pdf> [Accessed February 2016].

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