



Research Office
Legislative Council Secretariat

Fact Sheet

Overview of water resources management in Singapore

FSC19/15-16

1. Introduction

1.1 With a total land area of 718 sq km, Singapore has limited natural water resources such as lakes and groundwater resources. In the past, Singapore was primarily dependent on water imported from Malaysia and rainwater as the major sources of water supply. In an effort to ensure an adequate and sustainable supply of fresh water for the country, the Singapore government has over the past two decades implemented various strategies to diversify its sources of water supply, manage water demand, and support the development of local water technology industry.

1.2 Singapore currently consumes about 1.8 million cubic metres ("cu m") of water per day, sourced from its "four National Taps" comprising (a) rainwater collected from local catchment areas; (b) imported water from Malaysia; (c) NEWater (high-purity reclaimed water); and (d) desalinated water. This fact sheet provides an overview of water resources management in Singapore in terms of (a) the responsible authorities; (b) the water supply diversification strategies; (c) the water demand management strategies; and (d) research and development ("R&D") in water technologies.

2. Responsible authorities

2.1 Water resources management in Singapore is under the purview of the Ministry of the Environment and Water Resources ("MEWR") tasked to ensure a clean, sustainable environment and water supply for Singapore. MEWR comprises seven divisions, of which the Water Policy Division is responsible for formulating policies to provide a reliable and high quality water supply, manage flood risk and drainage planning, and manage water demand in Singapore.¹

¹ The other six divisions are: (a) the Corporate Development Division; (b) the Environmental Policy Division; (c) the Energy and Climate Policy Division; (d) the International Policy Division; (e) the Communications & 3P Partnerships Network Division; and (f) the Futures and Planning Division.

2.2 There are two statutory boards under MEWR, namely the Public Utilities Board ("PUB")² and the National Environment Agency ("NEA").³ PUB is tasked with managing Singapore's water resources and NEA with sustaining a clean and green environment for the country. PUB serves as Singapore's national water agency and its mission is to ensure an efficient, adequate, clean, safe and sustainable supply of water. It adopts an integrated approach in the collection, production, distribution and reclamation of water, managing the entire water loop in a holistic manner. At present, PUB comprises seven operation departments, eight policy and development departments, two engineering and technology departments and the Singapore Water Academy.⁴

3. Diversification of water supply

3.1 Imported water from Johor of Malaysia⁵ and rainwater collected had been the major sources of fresh water supply in Singapore before the 2000s. However, the heavy reliance on imported water has prompted the Singapore government to plan for achieving self-sufficiency of water supply in the long run. Hence, it has over the past decade or so (a) expanded the catchment areas to collect rainwater; and (b) diversified the sources of water supply through investment in water reclamation and seawater desalination projects. The principles underlying the above water supply management strategies are to: (a) capture every drop of rain that falls on Singapore; (b) collect every drop of used water; and (c) recycle every drop of water more than once.

3.2 In Singapore, rainwater is collected through a comprehensive collection network before it is channelled to the 17 reservoirs for storage. The completion of two new reservoirs in 2011 has increased the catchment areas to cover two-thirds of Singapore's land area. PUB has planned to further expand the catchment areas to cover 90% of Singapore's land area in the years ahead.

² PUB was initially established in 1963 as a statutory board in charge of electricity, piped gas and potable water. It was reconstituted in 2001 to become Singapore's national water agency.

³ See FSC20/15-16 for information about NEA.

⁴ The Academy works closely with industry partners and academic institutions to build expertise and groom the workforce in the water industry.

⁵ Singapore has been importing water from Johor of Malaysia. The first bilateral agreement was signed in 1961 and expired in August 2011. The second agreement was signed in 1962 and supplemented by another agreement signed in 1990. These two agreements will expire in 2061. In the early 2000s, imported water accounted for about 50% of the water demand in Singapore. See Goh, K.C. (2003).

3.3 Regarding the development of alternative sources of water supply, the first NEWater and desalination plants of PUB commenced operation in 2003 and 2005 respectively. At present, there are four NEWater plants and two seawater desalination plants operating in Singapore, meeting up to 30% and 25% of Singapore's total water demand respectively. According to PUB, daily water demand in Singapore will double to about 3.6 million cu m by the time the water import agreement with Malaysia ends in 2061. As such, the Singapore government has planned to further expand the capacity to produce NEWater and desalinated water to the extent of meeting up to 55% and 25% of the country's total water demand respectively by 2060.⁶

4. Water demand management

4.1 On water demand management, PUB has adopted strategies to encourage water conservation among users in order to maintain water consumption at a sustainable level amidst the population and economic growth. One of the strategies adopted is to set the water tariff at a rate that recovers the full production and supply costs. PUB has also introduced a water conservation tax⁷ since 1991 to reinforce the message that every drop of water is precious.

4.2 Added to the above tariff scheme, PUB has implemented a mandatory water efficiency labelling scheme ("WELS") since 2009 for water fittings and appliances, which include water taps and mixers, urinal equipment, flushing cisterns and washing machines. The scheme is to encourage suppliers to introduce more water efficient products into the market. To complement WELS, PUB further requires all new premises and existing premises undergoing renovation to install water fittings that are labelled with at least one tick under WELS.⁸ With effect from June 2015, heavy non-domestic customers with water consumption of 60 000 cu m or more in a year are required to install private water meters for measuring and monitoring consumption, and submit their annual water efficiency management plan to PUB.

⁶ See FSC21/15-16 for information about seawater desalination in Singapore and FSC22/15-16 for information about NEWater in Singapore.

⁷ The tax rate is set at 30% of the tariff for all units of water consumed by non-domestic customers and the first 40 cu m consumed by domestic customers. A higher tax rate of 45% will apply to domestic customers when they consume more than 40 cu m of water.

⁸ Under WELS, water fittings are rated to have zero to three ticks on the label to reflect their water efficiency level. The more ticks a product has, the more efficient it is.

4.3 After the implementation of the water conservation strategies by PUB, water consumption among domestic users⁹ has been on a declining trend. According to PUB, the daily per capita domestic water consumption decreased from 165 litres in 2003 to 150 litres in 2014.¹⁰ PUB has targeted to further lower the daily per capita domestic water consumption to 140 litres by 2030.

5. Research and development in water technologies

5.1 PUB has led R&D in water technologies through its Environment & Water Industry Programme Office ("EWI") which is an inter-agency body established by MEWR in 2006. EWI partners academic institutions and the private sector in promoting the development of the environment and water technology industry through the strategies of cluster development,¹¹ internationalization¹² and capability development.¹³ As such, EWI has received S\$470 million (HK\$2.6 billion) in funds from the National Research Foundation¹⁴ since 2006. As at end-2015, there were over 180 local and international water companies and 26 water technology-related research institutions operating in Singapore.

⁹ According to PUB, the domestic sector accounts for about half of the water demand in Singapore.

¹⁰ See The Public Utilities Board (2015c).

¹¹ Under the cluster development strategy, EWI aims to attract major international companies to anchor their operations in Singapore and groom local companies.

¹² Initiatives implemented under the internationalization strategy include government-led export initiatives and marketing programmes to promote Singapore's water industry.

¹³ Initiatives under the capability development strategy focus on building up Singapore's R&D and technology base, and developing the necessary talent and manpower to meet the needs of the water industry.

¹⁴ The National Research Foundation, set up in 2006, is a department within the Prime Minister's Office. It is responsible for setting the national direction for R&D by developing policies and plans on research, innovation and enterprises. It also funds strategic initiatives and builds up R&D capabilities by nurturing research talent.

5.2 To encourage research partnerships with the academic and private sectors, PUB has made available its water infrastructure (including waterworks, reclamation plants, NEWater plants and reservoirs) for test-bedding of new and promising technologies. R&D projects supported by PUB focus on six core areas, namely intelligent watershed management,¹⁵ membrane technology,¹⁶ network management, water treatment, used water treatment, and water quality and security. These research efforts aim at improving the water treatment and production processes, thereby increasing Singapore's water resources to meet future needs and reducing the operation costs.

5.3 PUB also works through its wholly-owned subsidiary, PUB Consultants Private Limited ("PUBC"), to promote the water industry in Singapore. As the commercial arm of PUB, PUBC has collaborated with Singapore-based water companies in overseas projects ranging from infrastructure development to operation and maintenance of municipal systems in water supply.

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¹⁵ The research programme on intelligent watershed management aims to leverage developments in instrumentation, controls and innovative information technology solutions as modelling tools for hydraulics and hydrology research. It helps enhance Singapore's capability in managing its water resources.

¹⁶ There are two major types of desalination technologies around the world, namely membrane technology and thermal technology. The former features the use of a special filter (membrane) to produce desalinated water, whereas the latter involves the boiling/evaporation of seawater to give off water vapour which, on condensation, yields salt-free liquid water. Singapore adopts membrane technology for its desalination plants.

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