

# Visit to Singapore

ENVIRONMENTAL ENGINEERING TECHNICAL DIVISION



by Ir. Kenneth Yeoh Teong Kim

**THE** visit to environmental sites in Singapore was organised by IEM, Environmental Engineering Technical Division (ENETD), in cooperation with Institution of Engineers, Singapore (IES). ENETD is grateful to IES for planning the itinerary of the site visits, without which the trip would not have been a success. It also enabled us to visit a restricted site, the Public Utility Board's Deep Tunnel Sewerage System or DTSS.

The 2-day 1-night trip was from 27 May to 28 May 2013. Because there were four site visits, the itinerary was tight but pleasant. It covered four environmental sites and one talk at IES on Solar Energy. There were 11 members from IEM, led by ENETD chairman Ir. Fan Hong Poh. On the second day, nine members from IES joined us.

In Singapore, we were welcomed by IES President Prof. Er. Chou Siaw Kiang and IES Council member and ENETD Chairman, Er. Alfred Wong Fee Min. The latter accompanied the group throughout the duration of the tour. The four sites we visited were:

- Singapore Marina Barrage
- Gardens by the Bay at Marina South
- PUB Changi Water Reclamation Plant and DTSS
- Bedok NeWater Visitor Centre.

Speaker for the technical talk, titled "Solar in the City State", was Christophe Inglin who has 16 years of experience in the value chain from silicon ingot to solar power plant turnkey. He touched on various subjects on photovoltaic (PV) solar panels and its implementation in Singapore's Marina Barrage, Changi Airport and some HDB blocks. Solar energy via PV is in-line with Singapore's objective in supplying 10% of Singapore's energy supply. The Solar Energy Research Institute of Singapore (SERIS) was established in 2008 to research and develop solar power in the tropics (Equator belt) aside from existing northern and southern hemisphere establishments worldwide. With the current Singapore electrical tariff of 0.26/kWh, large commercial PV systems pay for themselves in seven years.

## MARINA BARRAGE

We also visited Marina Barrage, Singapore's latest dam-reservoir which is located on reclaimed land. The Marina Barrage is Singapore's 15th reservoir and stores 10 per cent of the republic's water demand. It provides fresh water, controls flooding and is a lifestyle attraction (ownership of water) for Singaporeans. The barrage is 1/6 the size of Singapore (Singapore is approximately 714 sq km).

Marina Barrage has increased Singapore's water catchment area to 2/3 of the republic's land area since 2011. This is the most urbanised water catchment facility with the capacity to collect storm water from Ang Mo Kio, Bishan and Paya Lebar (central and south-east of Singapore) with gravity feed canals and drains.

Marina Barrage boasts of a "boat hoist" which can lift and move boats from the reservoir to the sea and vice versa. Hence

the saying that, in Singapore, "boats do fly". The barrage is impounded by nine steel-crest flood gates. Purging of water is based on high and low tides. At low tides, the crest gates release water into the sea without fear of back-flow. This cannot be done at high tide when 7 units of drainage pump discharges water from the reservoir to sea. Each drainage pump is rated at 2,500 cubic meters per second. That's approximately one Olympic size swimming pool per second! Energy saving would be leveraging on siphoning effect shortly after the pumps are activated.

Marina Barrage started as a brackish water reservoir. However, within 24 months, a process called "natural flushing" had turned it into a freshwater reservoir. Natural flushing happens when freshwater collected reduces the salt content in water (dilution) over a period of time. There is plenty of wildlife in the barrage, such as birds and freshwater fish. Fishing is a popular activity within the facility.

Located in the city, the barrage is also part of a comprehensive flood control scheme to alleviate flooding in the low-lying areas in the city as well as a venue for kayaking, boating and other water sports activities. In fact, it once hosted a dragon boat race.

## PUB'S DEEP TUNNEL SEWERAGESYSTEM (DTSS)

With the permission of the Singapore Public Utility Board (PUB), IEM and IES members visited the DTSS to understand its inner workings. The DTSS is a 48km-long by 6m-diameter tunnel that is used for collecting waste water (sewerage) for treatment, reclamation and disposal.

An elevator transported our group down to approximately 78m below ground to the restricted pump station zone. Here we saw a sequence of pumps that were used to pump and collect waste water via the DTSS. It is a rare opportunity to be able to visit the DTSS deep pumping station. I am told its visitors have included foreign diplomatic dignitaries, presidents and prime ministers of many countries including Malaysia.

## NEWATER

Our last stop was the NEWATER recycling company owned by PUB. NEWATER is a product that returns fresh drinking water to the people of Singapore. The technology consists of using a vast amount of filtration including reverse osmosis of membrane filtration, ultra filtration and ultraviolet disinfection prior to bottling. Certified to be bacteria, virus and pathogenic free, bottled NEWATER is not for sale but is given free instead as a marketing product. All visitors are presented with a bottle as a souvenir.

We bade farewell to IES soon after the visit to NEWATER. In view of the success of the trip, ENETD hopes to organise another visit to Singapore in the near future. ■

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