



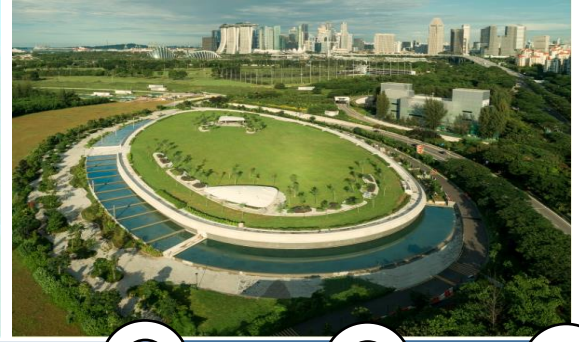
KEPPEL MARINA EAST DESALINATION PLANT (KMEDP)

MEDIA BRIEFING



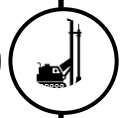
Project Overview

Roadmap to KMEDP



2017

Signing of WPA
(20 Jan 17)



2018

1st pile
(26 Sep 17)

Ground Breaking Ceremony
(29 Jun 17)



2019

Power Turn On
(27 Mar 19)



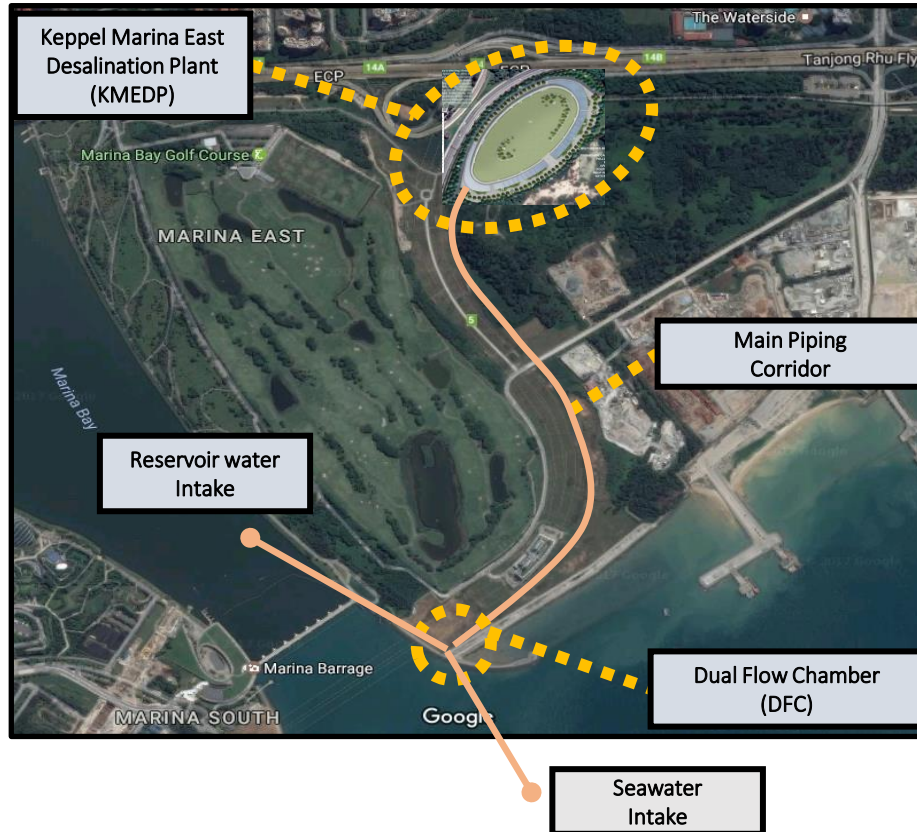
2020

Achieved Project
Commercial Operation
Date
(29 Jun 20)



2021

KMEDP Site Location & Overview



The KMEDP is Singapore's fourth desalination plant and is a public private partnership (PPP) between Keppel Infrastructure (through its wholly-owned subsidiary, Marina East Water) and PUB, Singapore's national water agency.

Built and operated by Keppel Infrastructure Holdings under the Design, Build, Own and Operate (DBOO) model, the plant can produce up to 137,000m³ of fresh drinking water daily. Keppel Infrastructure will supply product water to PUB over a 25-year concession period from 2020 to 2045.

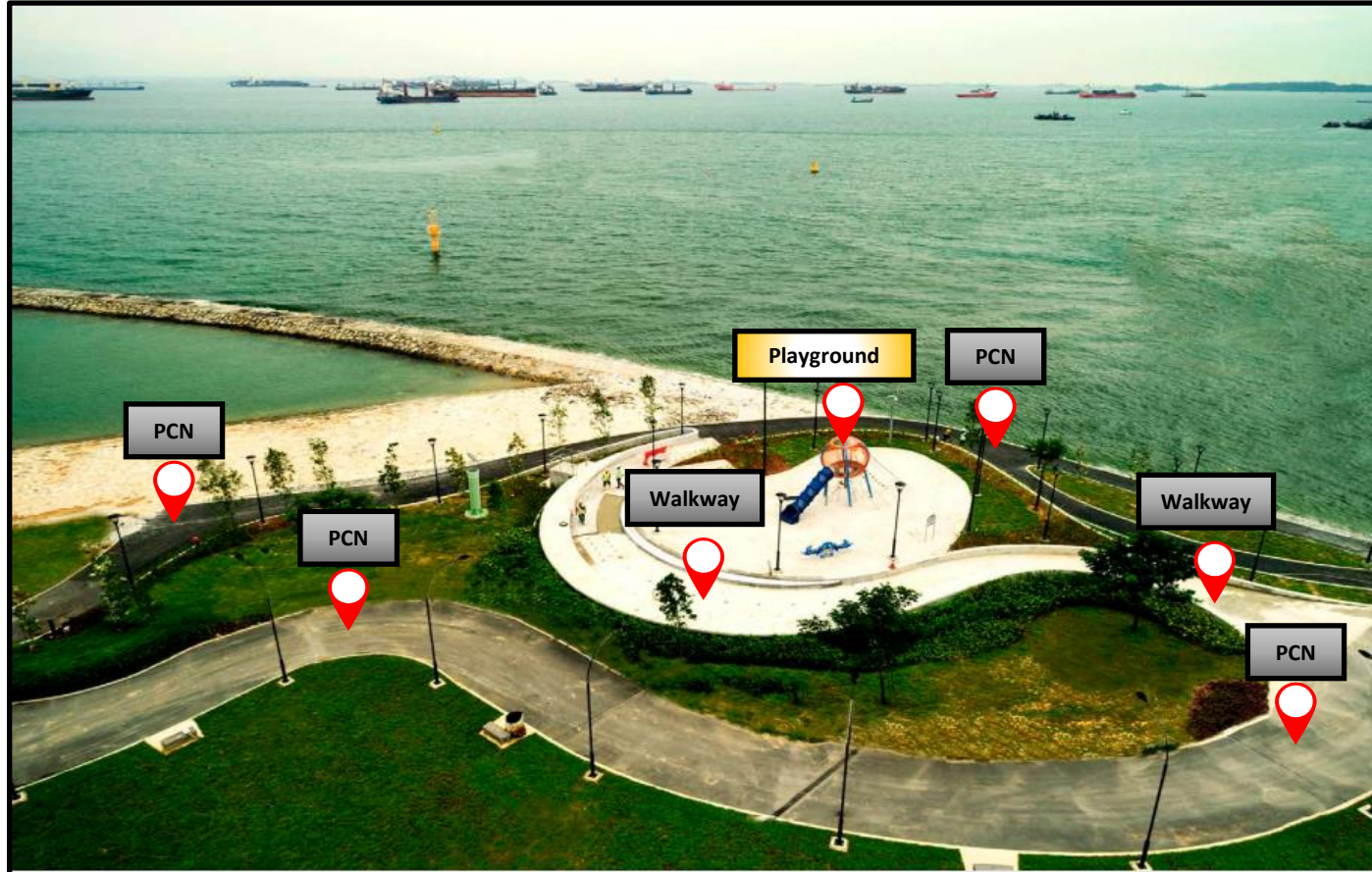
KMEDP is an innovative large-scale desalination facility and is **Singapore's first dual-mode desalination plant**, built with the ability to treat both reservoir water and sea water, depending on weather conditions.

Most compact desalination plant in Singapore with overall land area of approximately **2.8 hectares**. The plant's equipment and processes occupy an area of **2.4 hectares**

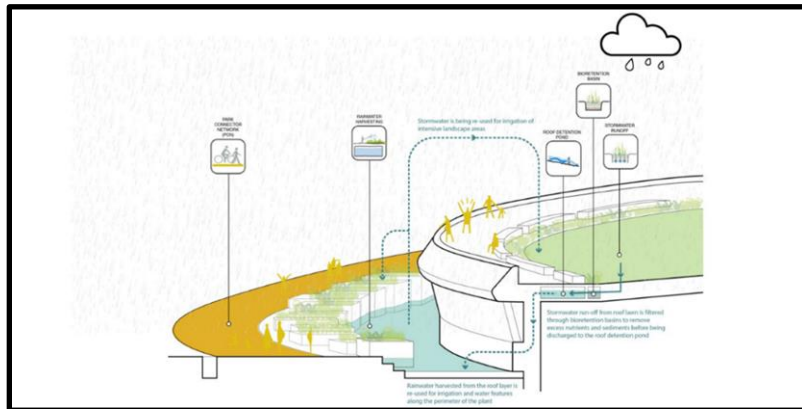
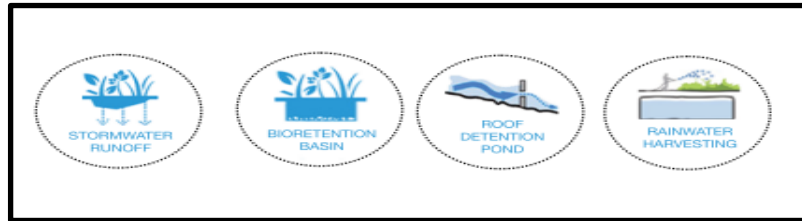
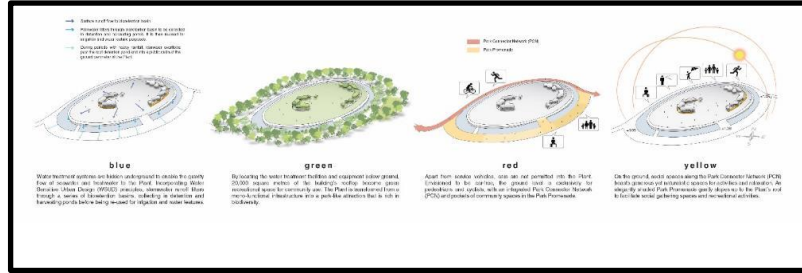
KMEDP Site Location & Overview – Main Plant



KMEDP Site Location & Overview – DFC



KMEDP Design Concept



- The KMEDP utilises the **Blue**, **Green**, **Yellow** and **Red** philosophy as a model in planning for water sustainability.
- The **Blue** philosophy incorporates Water Sensitive Urban Design principles as water sustainability measures. This translates to the hydrologic cycle, in how water is collected, treated and distributed.
- The **Green** philosophy encourages ecosystems to co-exist with the built environment, where the biodiversity reduces Urban Heat Island Effect and aids flood management.
- The **Yellow** philosophy enhances social and community spaces.
- The **Red** philosophy represents a car-free community, designed exclusively for pedestrians
- Stormwater from the roof detention tank is filtered before entering a harvesting pond. Treated water from the harvesting pond is used for irrigation of the lush landscaping and maintaining the surrounding water feature.

KMEDP – Recognitions & Awards



ABC Waters Gold Certification - Public Utilities Board (PUB), Singapore

In 2019, KMEDP became Singapore's first infrastructure project to be awarded ABC waters GOLD certificate



Municipal Landscape Category (Top Prize Gold Award), China

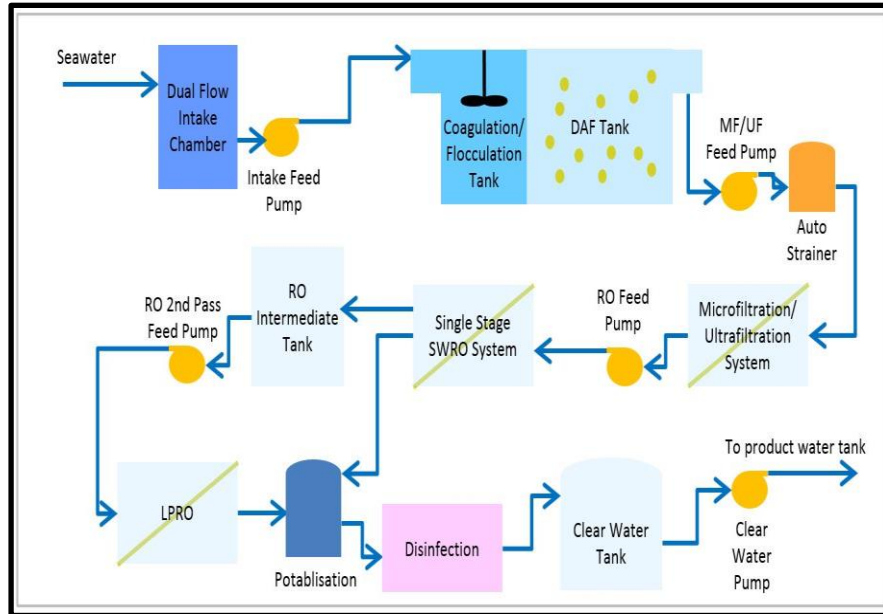
The Yuanye International Competition was founded in 2010. It aims to enhance the creativity and influence of global designers, and promote the international exchange and development of the industry.



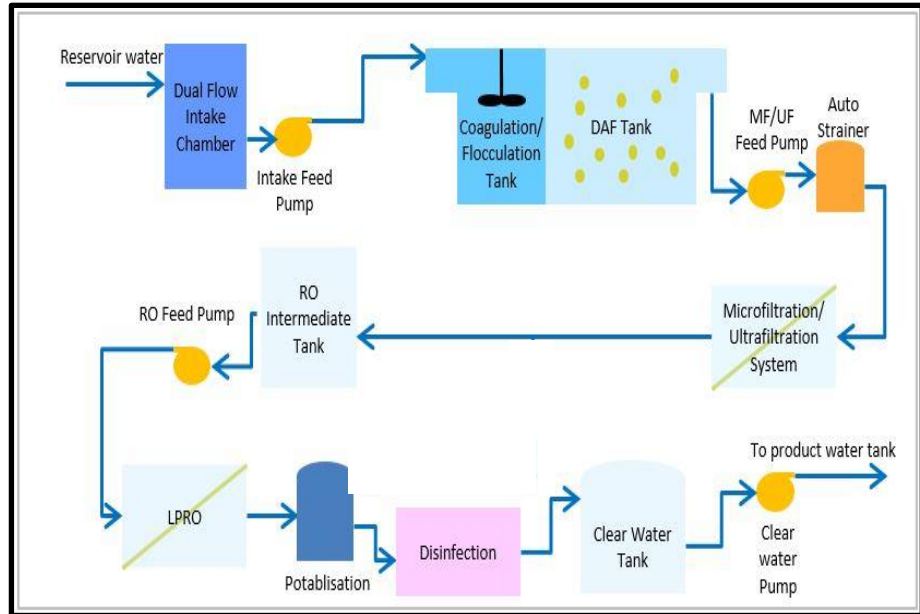
Technical Highlights

First dual-mode desalination plant in Singapore

Seawater mode:



Reservoir water mode:

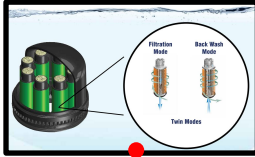


Key features of KMEDP

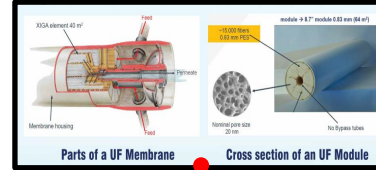
1. Singapore's First Direct Coupling Desalination Plant
 - Direct coupling of ultrafiltration and reverse osmosis systems – Omitting ONE pumping cycle results in saving of 15% of energy used in a pumping cycle.
2. Incorporation of advanced system / equipment
 - Singapore's first water treatment plant using UV as primary disinfection
3. One of the most compact desalination plants in Singapore
 - Compact Pre-treatment achieving nearly 30% reduction in space
 - Direct coupling design with omission of booster pump, cartridge filters and UF filtrate tank
 - Smaller footprint of UV disinfection system compared to conventional chlorine-based disinfection

KMEDP Unique Process Design

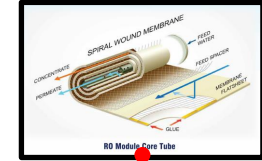
3) Auto-strainer System



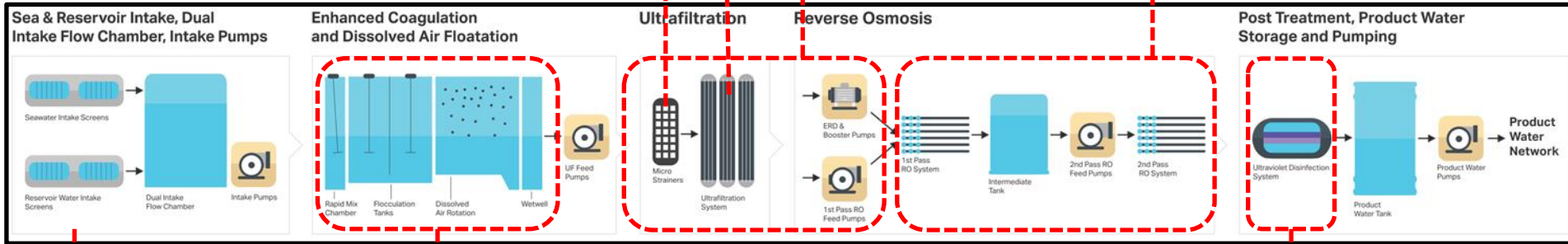
4) Ultrafiltration Membrane System



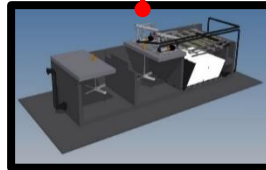
6) Reverse Osmosis System + Energy Recovery Device (ERD)



5) Energy Efficient Direct Coupling Design



1) Innovative passive intake system



2) Compact Dissolved Air Floatation



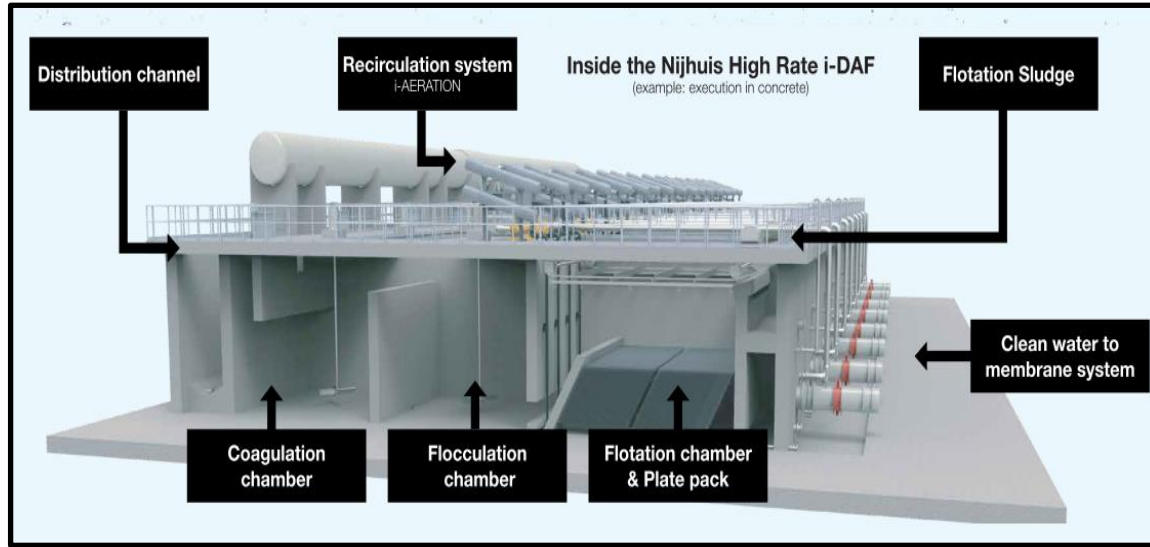
7) UV as primary disinfection process

1) Low Maintenance Passive Screen System



- Minimises risk of settlement and bio-growth
- Flexibility of backwash timing and duration to manage volume of air released
- Maintenance can be done on screen-by-screen basis without affecting plant operation
- Proven solution for performance and reliability assurance
- **No solids** handling at plant
- Selection of materials – Stainless steel for Reservoir water; Z-alloy (CuNi) for Seawater as it will repel mussel attachment and anti-bio fouling

2) Enhanced Coagulation & DAF



Did you know?

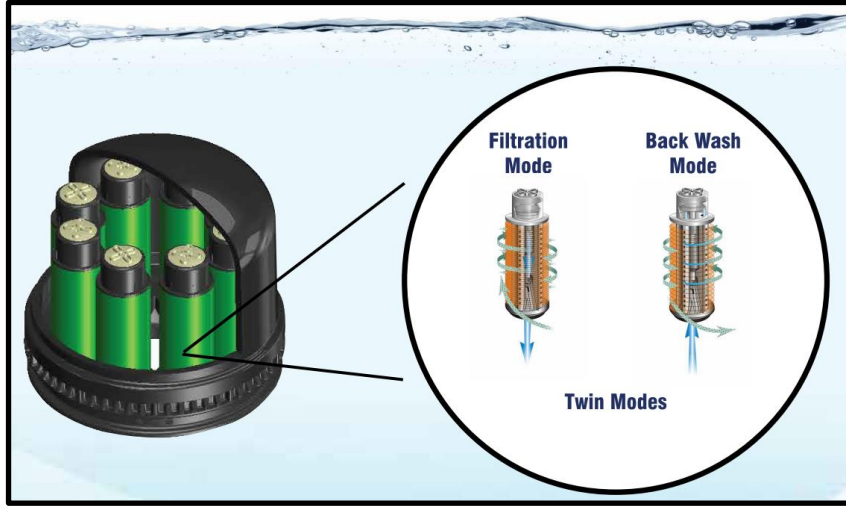
KMEDP's 8 DAF units can process a total of
14,400,000 litres of water per hour!
That is approx

6

Olympic-sized swimming pools every hour

- KMEDP DAF uses Lamella Plate Packs in its system which greatly increases the surface area for solid separation, allowing better performance and significant saving in construction space required
- **Nearly 30% reduction** in space required, allowing KMEDP to be the most compact desalination plant in Singapore

3) Auto-strainer System

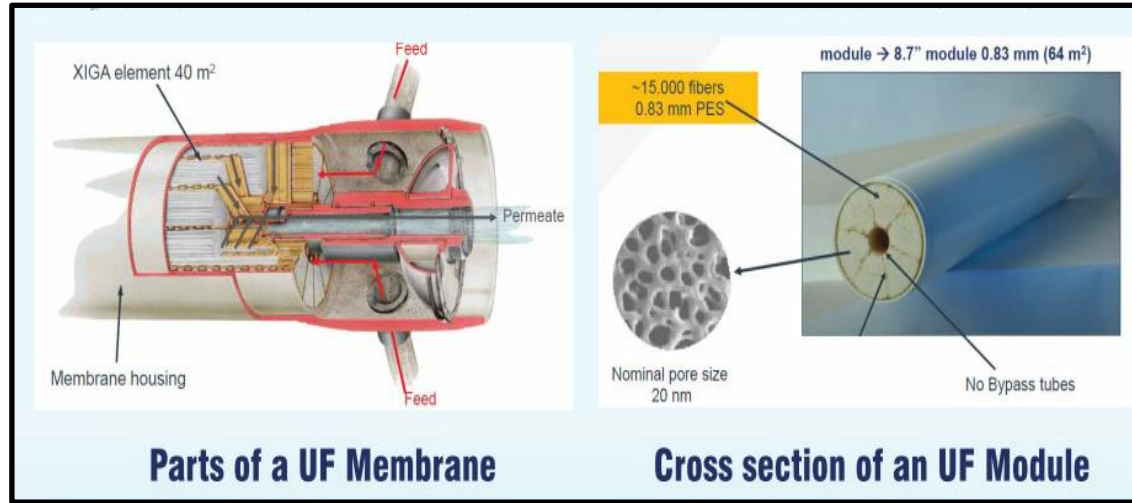


Did you know?

The filtration degree of Auto Strainer is **100 microns** which is the diameter of a strand of hair!!

- KMEDP's Auto-strainer system is an automatic self-cleaning disc filter that removes particles greater than 100 microns in size.
- It is a cost effective, low energy pre-filtration system that prevents larger debris from damaging the Ultrafiltration membrane system downstream
- KMEDP's Auto-strainer system is **one of the first** designed with periodic backwashing and enhanced chemical system

4) Ultrafiltration Membrane (UF) System



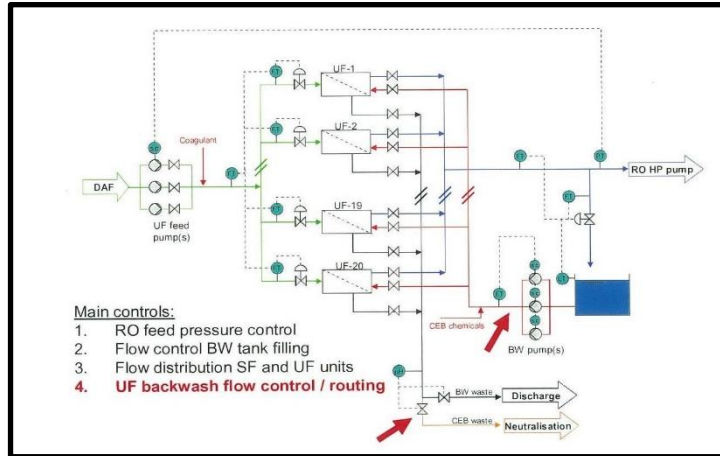
Did you know?

Each of KMEDP's 3072 UF modules contains 18,360 membrane fibres of 1.5m length.

When joined together, the fibres wrap around the circumference of the Earth's surface (40,075km) more than **twice!**

- UF membrane is a highly resistant pre-treatment screen that is used before the RO process
- With a nominal pore size of **0.02µm**, it can remove viruses, bacteria and chlorine-resistant microorganism.

5) Direct Coupling Configuration



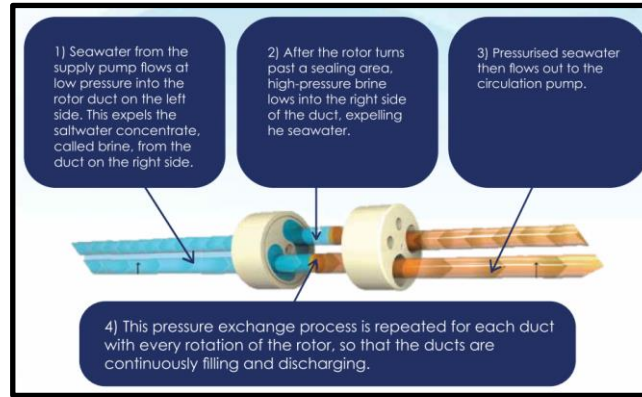
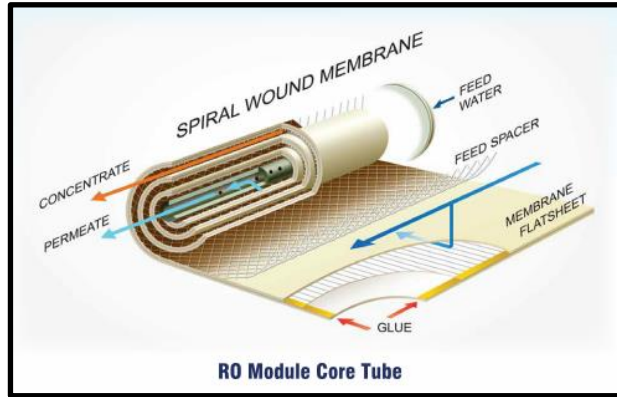
Did you know?

Each break of the pressure with the needs of additional pump is as high as **15%** of the efficiency!!

Singapore's **first** direct coupling desalination plant

- Reduces footprint due to the break tank and booster pumps
- Increases efficiency without to the “break” in pressure in between the UF and RO processes
- Reduces power consumption due to elimination of energy usage by booster pumps
- Eliminates cartridge filters and reduces maintenance activities
- Minimises microbiological growth in the break tank and cartridge filters

6) Reverse Osmosis System + Energy Recovery Device (ERD)



Did you know?

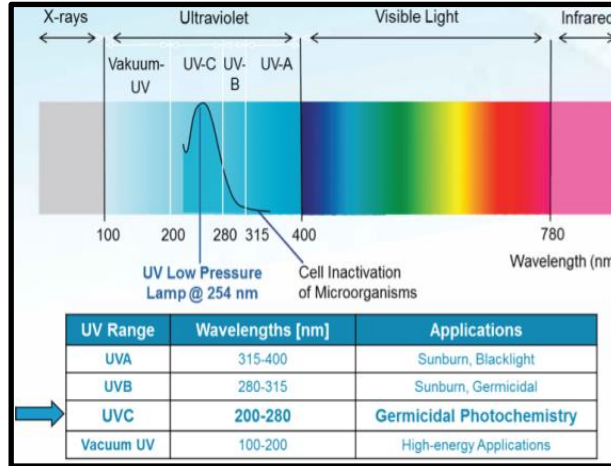
Energy saved every hour using the Energy Recovery Device (ERD) is sufficient to power

28

4-room HDB flats for a month!

- RO membrane allows pure water to pass through while filtering out small molecules and ions. The high pressure required to force the saltwater through the RO results in high energy consumption.
- KMEDP uses Pressure Exchanger (PX) to capture hydraulic energy from high-pressure RO brine stream, which is then transferred to the low-pressure Seawater stream
- This enables energy to be reused, increasing energy efficiency and reducing the power consumed during the RO process **by up to 60%.**

7) Safe and Environmental-Friendly Ultraviolet Disinfection



Did you know?

UV radiation comes in a tier system such as UVA, UVB, UVC and Vacuum UV.

KMEDP uses the UVC system which renders **99.99%** of all viruses harmless in a fraction of a second!

KMEDP is Singapore first water treatment plant to use Ultraviolet (“UV”) as the primary disinfection process, with secondary disinfection via chlorination. This offers:

- Smaller footprint
- Reduced operator risk due to non-chemical handling
- Highly stable performance



Thank You