

Delivering Water Solutions - Partnership with the Industry

Michael Toh

Director, Industry & Technology Collaboration Department
PUB, Singapore's National Water Agency



Pollution, floods and poor sanitation conditions were prevalent in Singapore in the 50s and 60s and this affected lives and livelihoods



Polluted Waterways

.....
Absence of proper sewage facilities and discharge controls turned rivers into open sewers

Seasonal Floods

.....
Common occurrence in low lying areas, especially when intense rain coincided with high tides

Open Sewer / Poor Sanitation

.....
50% of the population was served by the main sewerage network, the other 50% depended on nightsoil collection

Today, Singapore has transformed itself into one of the most liveable cities with clean waterways and reservoirs

The SG river clean-up was a mammoth undertaking which required the collective powers, knowledge, skills and resources from many agencies and ministries



One agency – PUB - manages the entire water cycle

Management of all aspects of water under one agency enhances efficiency and accelerates decision-making



**To achieve a liveable
and sustainable Singapore**

- Clean Land
- Clean Air
- Public Health



**To ensure an efficient, adequate and
sustainable supply of water**

- Water Supply
- Used Water
- Drainage
- Coastal Protection



**To ensure and secure a supply of
safe food**

- Food Safety
- Food Security

PUB has 4 mission areas, including combating sea level rise



1. Supply Good Water



2. Reclaim Used Water



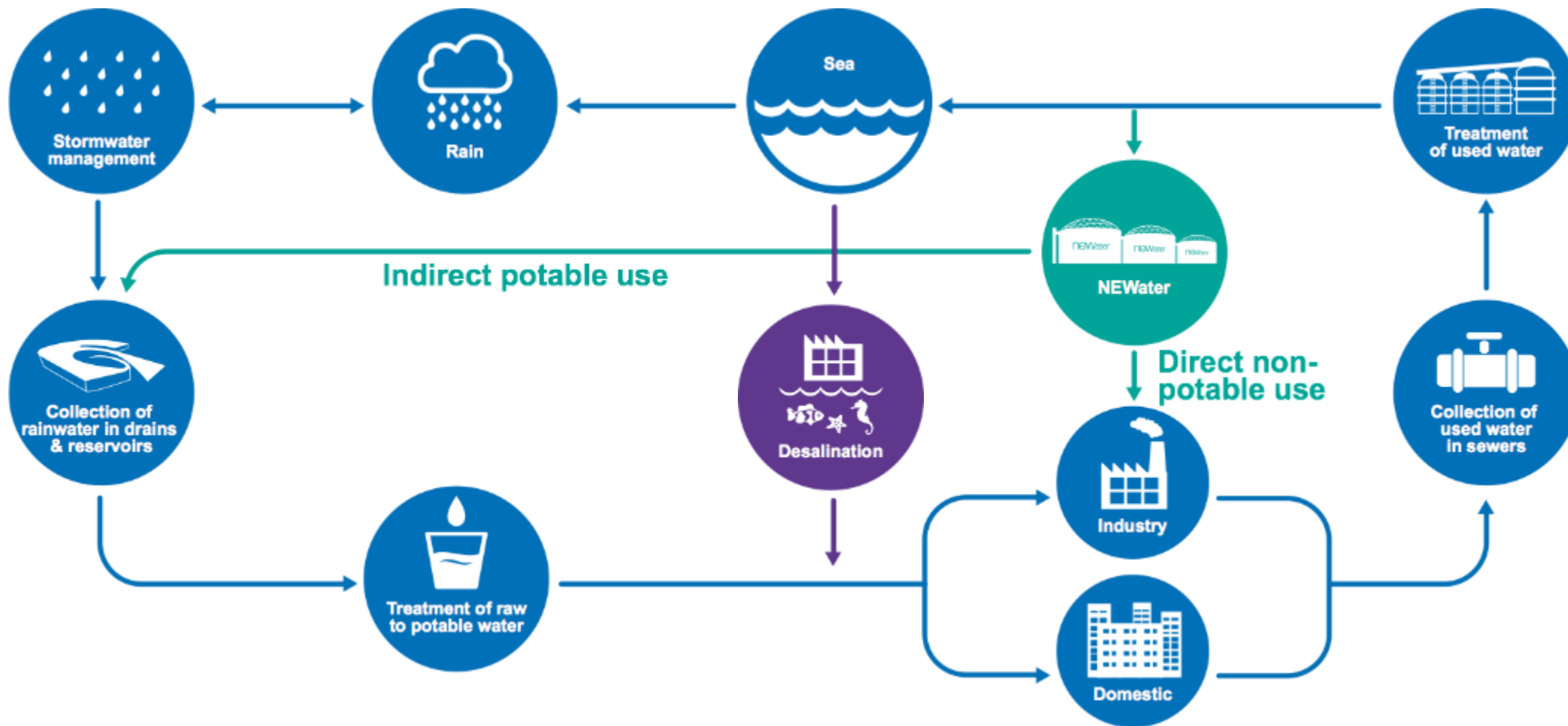
3. Tame Stormwater



4. Resist Rising Seas



PUB Manages the Complete Water Loop



Four National Taps

Diversified Sources of Water to Ensure We Never Go Thirsty



**IMPORTED
WATER**



**WATER FROM
LOCAL CATCHMENT**



NEWATER

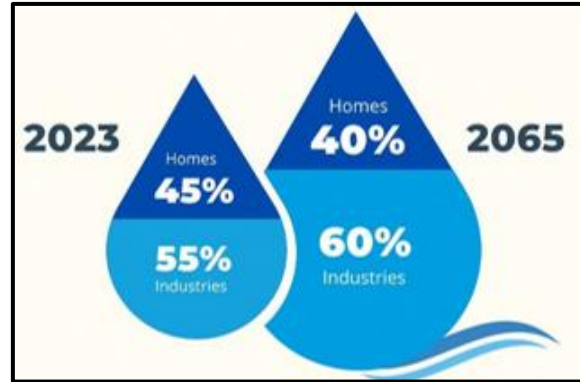


**DESALINATED
WATER**

We face 3 strategic challenges



1 Climate Change



2 Increasing Water Demand



3 Demographic Trends

Innovation and Partnership with the industry are key to address these challenges

We invest in R&D to address challenges

To date, National Research Foundation (NRF) has set aside

\$823M

to grow the water industry

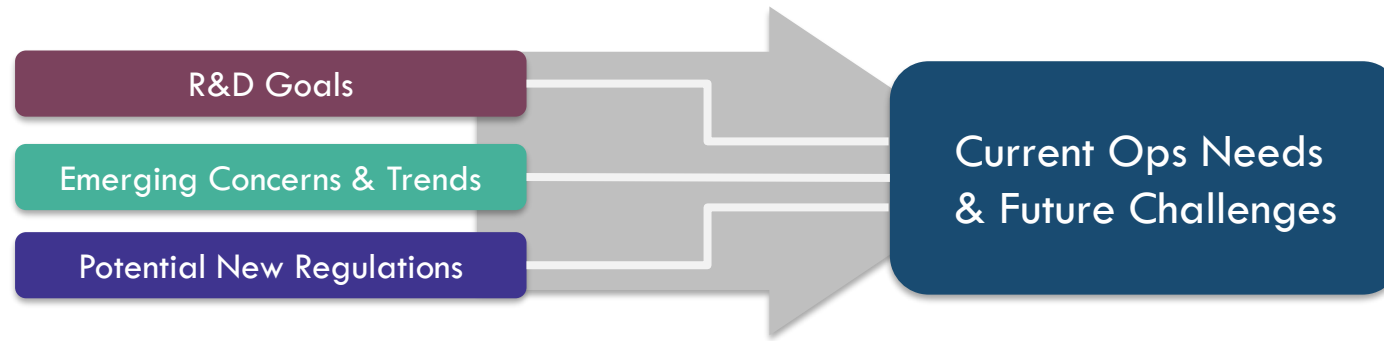
S&T2010
(2006 – 2010)
\$330M

RIE2015
(2011 – 2015)
\$140M

RIE2020
(2016 – 2020)
\$200M

RIE2025
(2021 – 2025)
\$153M

We carry out R&D with the industry and open up our facilities for pilots



Reaching out for innovations via various platforms:



Challenges



Break-throughs

Upstream fundamental research

Usually carried out in laboratory scale in universities and research institutes



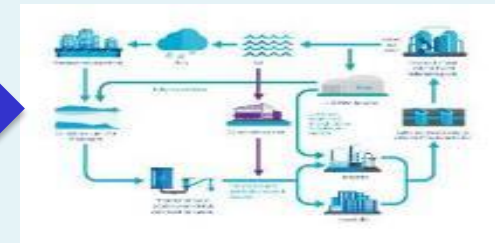
Pilot studies



Demo Plant studies



Water infrastructure



Partnering Industry for Tech Deployment – Providing Good Water

Case Study 1: Ceramic Membranes at Singapore's Choa Chu Kang Waterworks

- **2007:** Pilot project at Bedok NEWater Plant
- **2013:** 18-month demonstration plant trial at CCKWW.

Information collected from the study was used as reference for the tender called on Process Upgrading of CCKWW.

- **2019:** CCKWW upgrading to ceramic membranes.

The 40 MGD ceramic membrane system at CCKWW can treat more challenging waters using less energy, smaller land footprint and lower cost (savings of \$1.2mil/year)

Industry Partner



Partnering Industry for Tech Deployment – Protecting our Waters

Case Study 2: Microbial Electrochemical Sensor to detect heavy metal toxicity in used water

- **2010:** R&D started in National University of Singapore (NUS)
- **2015:** Development of compact prototype
- **Today:** 175 units deployed at industrial premises by **EnvironSens Pte Ltd**, a start-up company. 13 cases of illegal discharges were successfully detected.

2010-2013



Development of
MES in lab

2013-2015



Validation at
field conditions

2015-2017



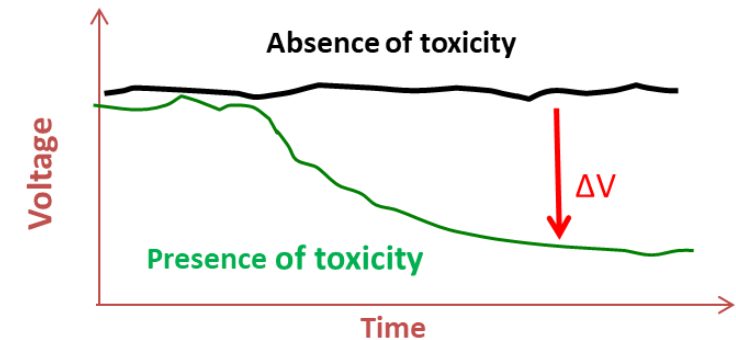
Development of
compact prototype

2018-2020



Mass production
and deployment

EnvironSens



Preparing for the Future in Partnership with the Industry

Vibrant water industry in Singapore comprises more than 300 water companies and 16 research institutes.



Increasing climate resilient sources of water - Tuas Desalination Plant



- Officially opened in 2018
- First desalination plant in Singapore to use advanced pre-treatment technology (combination of dissolved air filtration and ultrafiltration)
- Named Desalination Plant of the Year at Global Water Awards 2019.



Marina East Desalination Plant

Keppel Infrastructure

- Officially opened in Feb 2021
- Dual intake allows the plant to take source water from either the nearby Marina Reservoir or the sea, depending on weather.
- Conferred the Grand Innovation Award, at the International Water Association Project Innovation Award.



Reducing carbon footprint- Floating Solar Farm @ Tengeh Reservoir

- **60 MWp** Floating Solar Farm -
One of the world's largest inland floating solar farms



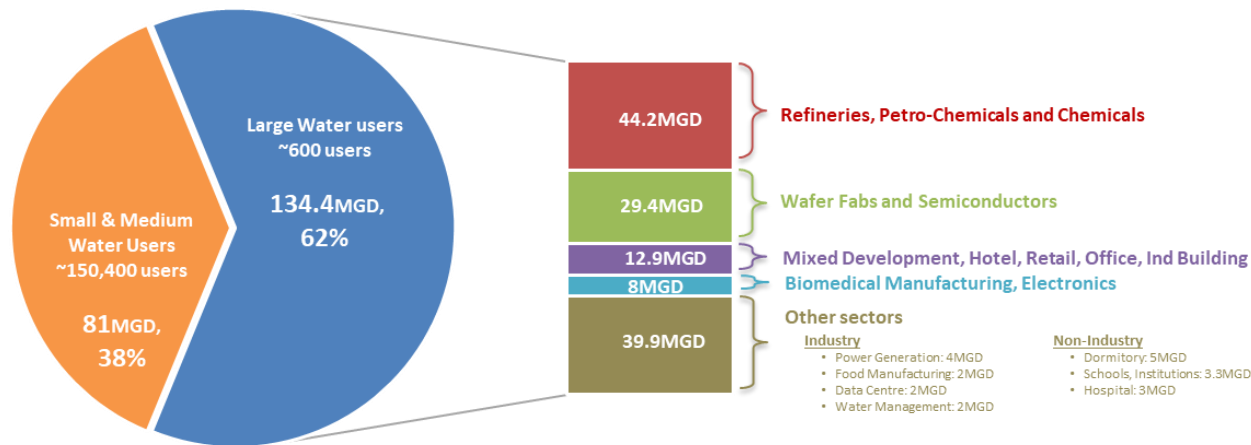
Offsets 7% of PUB's annual energy needs and reduces carbon footprint

Singapore will be one of the few in the world to achieve 100% green water treatment plants

Singapore water companies providing solutions to manage non-domestic water demand

- With economic growth, water demand for **Non-Domestic** is expected to increase more than Domestic
- PUB works with the water industry to **introduce water solutions** in non-domestic sector to **reduce water consumption**

Consumption Breakdown by Sectors



MATTEN[®]

SMART Solutions:

Digitalising the entire water system

Since the **first SMART PUB Roadmap in 2018**, PUB implemented digital initiatives across our planning & operations:

- Increase data collection capabilities
- Enhance field ops through digitalisation
- Leverage on AI and Machine Learning



Leveraging AI and Technology to address Manpower Challenges

PUB SINGAPORE'S NATIONAL WATER AGENCY

ENHANCING RESERVOIR SURVEILLANCE

PUB rolls out unmanned drone system to conduct monitoring of six reservoirs.

WHAT IS IT FOR?

- Water quality observation
- Aquatic plant monitoring
- Water activities surveillance
- Illegal fishing monitoring

How it works

- Drone takes off remotely from a pod and embarks on a programmed flight path
- From the control hub, one pilot can concurrently monitor and control up to four drones at multiple reservoirs
- If the drone detects anything unusual, an automated alert will be sent to PUB officers to take swift action

Measures 2.31m (length) by 0.68m (height)

Weighs up to 17 kg (including payload)

Flies up to 60m in height

Flight time of up to 30 mins

Camera equipped with video analytics capability

ST Engineering

1. MacRitchie [DroPort]
 2. Marina [DroPort]
 3. Kranji*
 4. Lower Seletar*
 5. Lower Peirce*
 6. Serangoon*

*Upcoming deployment in Q3

Singapore Water Exchange

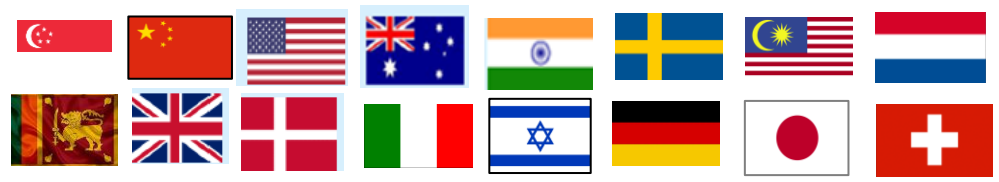
Supports the enterprise development needs of start-up companies

- The Singapore Water Exchange (SgWX) was launched at SIWW2018
- The objective is to develop a vibrant water technology, innovation and entrepreneurship ecosystem, and promote deployment of new technologies
- Since 2018, SgWX has built an active, vibrant ecosystem:

45
*water-related
 companies,
 associations and
 incubators/
 accelerators*

~200
*staff work from
 SgWX*

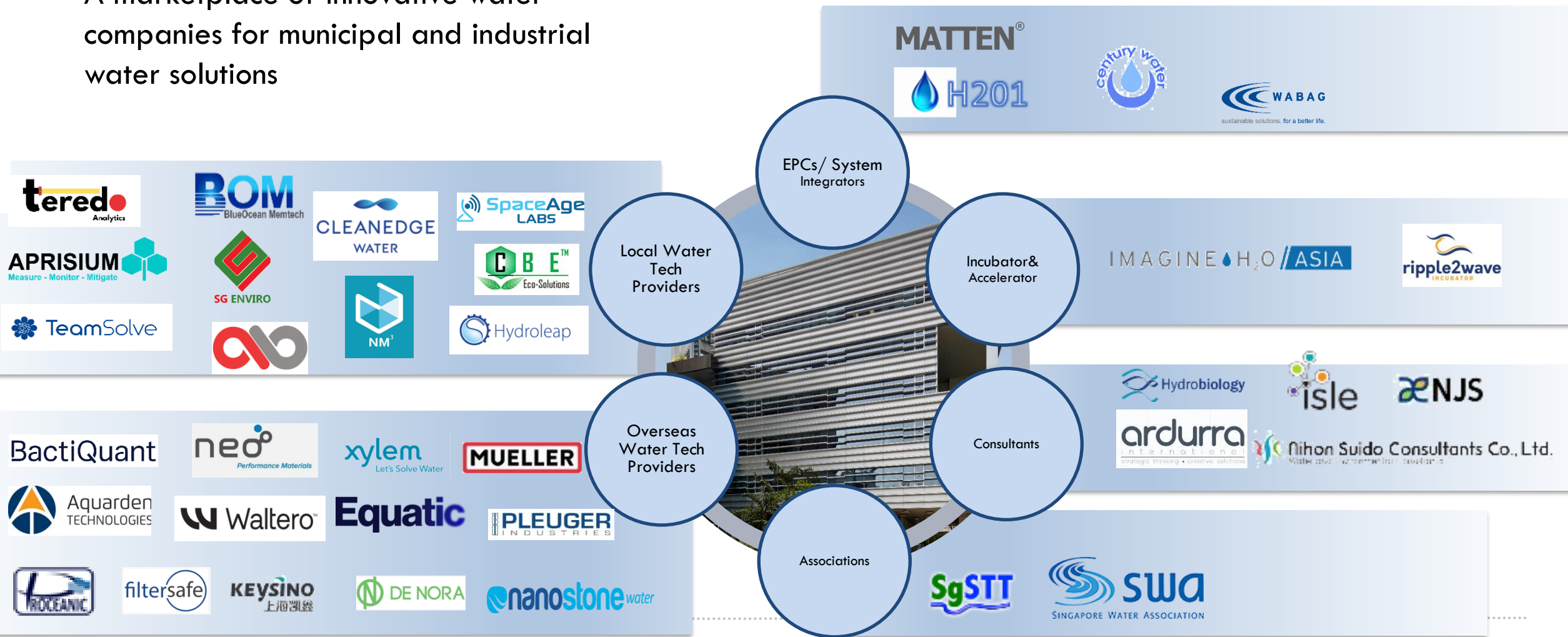
16
countries



Singapore Water Exchange

Innovative Companies are calling SgWX home

- A marketplace of innovative water companies for municipal and industrial water solutions



Partnering Industry to scale solutions

Innovation Budget (IB): Accelerate pilots/demo of innovative technologies to help start-ups/SMEs gain a track record to facilitate their commercialisation

- **Support Singapore companies** to venture overseas markets or adjacent industries.
- **Accelerate pilots/demos of innovative technologies** to facilitate their commercialisation.
- **Address funding gap for pilot demo of new technologies** to help companies build track record and first deployment.



Support up to 70%



- Singapore and the World Bank Group (WBG) launched the Singapore Water Center on 19 June 2024 during the Singapore International Water Week 2024.
- Collective effort between Singapore and WBG to ensure sustainable water solutions for countries around the world and for future generations.
- Tapping on Singapore's expertise and knowledge in urban water management to support the water sector in countries in the region through training activities, joint research projects and pilot studies of novel technologies.



**Singapore
International
Water Week**

SINGAPORE INTERNATIONAL WATER WEEK 2024 – SUCCESSFULLY CONCLUDED

THE GLOBAL PLATFORM TO SHARE AND CO-CREATE INNOVATIVE WATER SOLUTIONS

18 – 22 June 2024

>30,000
attendees

100 global water utilities and
water agencies, including
more than 50 CEOs

>400
exhibitors

New track
Coastal and
Flood resilience



Utilities CEO Roundtable attended by many ASEAN water utilities and
water agencies



SINGAPORE INTERNATIONAL WATER WEEK SPOTLIGHT 2025

THE GLOBAL PLATFORM TO SHARE AND CO-CREATE INNOVATIVE WATER SOLUTIONS



Visit SIWW.com.sg for more information

OUR UNIQUE VALUE PROPOSITIONS

- 
THOUGHT LEADERSHIP
 Insights on latest trends, solutions, and case studies in various thematic areas
- 
SOLUTIONS & TECHNOLOGY
 Innovation and solutions in urban water management, for municipal and industrial users
- 
BUSINESS & NETWORKING
 Gathering of industry, utilities and governments for business collaboration and partnerships
- 
GLOBAL EVENT, REGIONAL FOOTPRINT
 A global water event with strong relevance and application to Asia
- 
URBAN SUSTAINABILITY
 Co-located with CleanEnviro Summit Singapore to advance sustainability agenda for built urban environment



41ST IAHR WORLD CONGRESS SINGAPORE

Hosted by Spain Water and IWHR, China



22 – 27 JUNE 2025

INNOVATIVE WATER ENGINEERING FOR SUSTAINABLE DEVELOPMENT

Call for Papers opens on 1 July 2024



Visit 2025.iahr.org for more information

Thank You



PUB website www.pub.gov.sg