

We offer integrated services in
Smart Urban Development
Water and Environment

The logo for TriTech, featuring the word "TriTech" in a bold, dark blue sans-serif font. It is flanked by two horizontal bars: a green bar on top and a brown bar on the bottom.

TriTech

Agenda

An introduction to Tritech



- Tritech Group Limited
- ADAS Group – A subgroup providing integrated services to smart urban development
- Water Group – A subgroup targeting to improve our quality of life with better water technologies
- Environmental Group – A subgroup with one stop services in water and environmental protection in China
- Conclusions and Remarks

An aerial photograph of Singapore's skyline. In the foreground, the Esplanade - Theatres on the Bay is visible with its two large, dome-shaped, spiky roofs. A bridge crosses the water towards the city center. The background features a dense cluster of skyscrapers, including the Marina Bay Sands hotel with its iconic three towers and skybridge. The sky is blue with scattered white clouds.

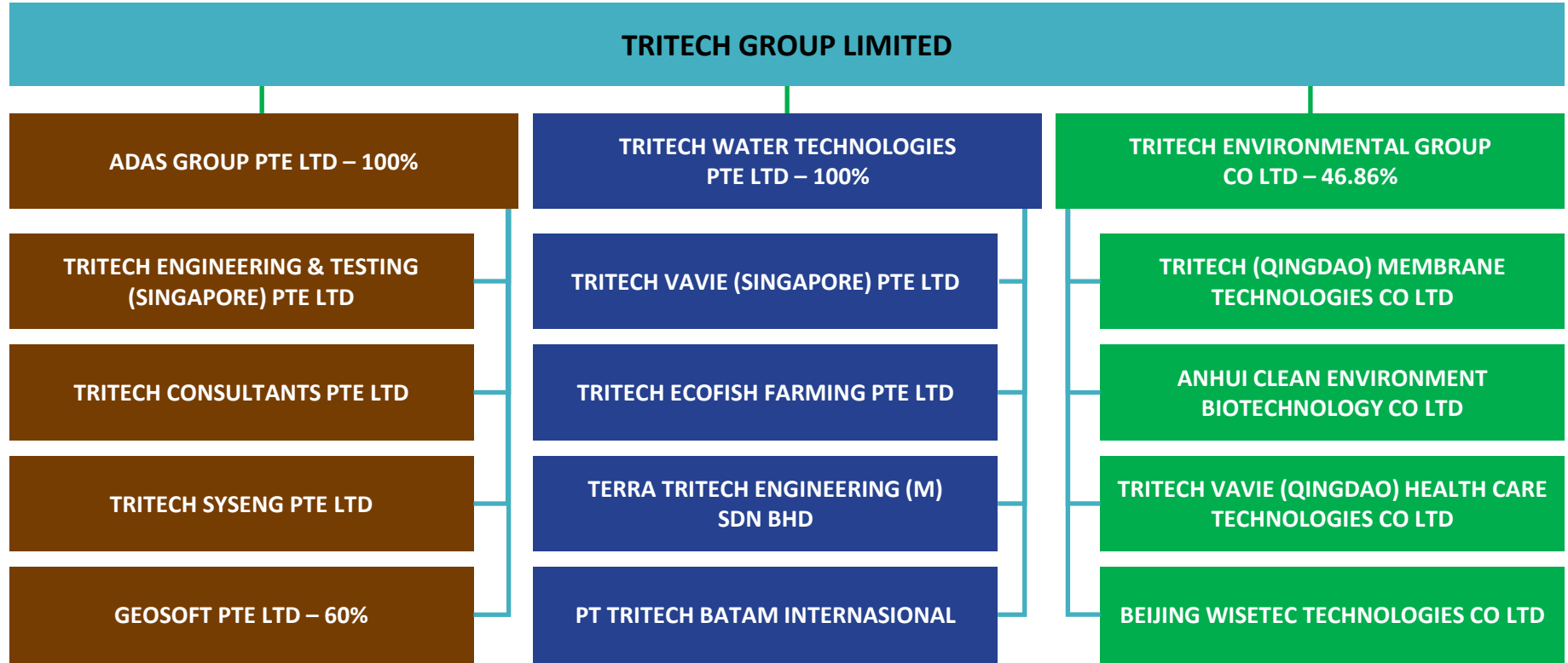
Tritech Group Limited

Business Segments

A unique SGX-listed Singapore company covering a full span of services in **Smart Urban Development and Water & Environment**.

- ❖ **Smart Urban Development Segment** – one-stop integrated service provider for smart urban development, covering urban planning, site investigation, design & consultancy, engineering survey, instrumentation & monitoring, project management, construction supervision, data collection, big data analytics, artificial intelligence and cloud computing digital platform.
- ❖ **Water & Environment Segment** - one-stop product-technology-design-build-operation service provider for water treatment & environmental protection projects, covering membrane products, smart technologies, engineering solutions, design & consultancy, construction, operation and maintenance.
- ❖ Trittech is built on the foundation of innovative technologies and wins the market through technological advantages and competency. Trittech is powered with sustainability by 3 technological centres with a large number of innovative technologies and patents:
 - **Trittech Innovation Centre**
 - **Trittech Big Data Centre**
 - **Trittech Water Institute**

Group Structure



Our Team

A united team of Professionals



- 08 PE (Civil Engineering)
- 04 PE (Geotechnical Specialist)
- 01 Registered Surveyors
- 220 Engineers (cross-nationality and cross-cultural from 10 countries)
- 9 PhD
- 54 MEng
- 120 BEng

Ranked the highest among its peers in Singapore in the number of professional engineers (specialist geotechnical) and PhD & MEng degree holders.

Licenses & Qualifications in Urban Development

Top Grades in Multi-disciplinary Domains

PEB

Professional Engineers Board
PE Service Licensed Corporation L2015-175
PE Civil Engineering
PE Specialist Geotechnical Engineering

BCA

Building and Construction Authority
Consultant CS01

MOF

Ministry of Finance
EPU/LTE/10 - Laboratory Testing And
Survey Equipment S10
EPU/CMP/10 - Computer Related
Hardware, Software & Services S10

PUB

Public Utilities Board
Approved Member of
Consultant Panel

MOF

Ministry of Finance
EPU/SER/34 - Service (Consultant)
S10 > S\$30,000,000

BCA

Building and Construction Authority
Specialist Builder
CR15 Site Investigation

LSB

Land Surveyors Board of Singapore
Licensed Corporation for Land Survey
and Engineering Survey

Licenses & Qualifications in Water & Environment

Top Grades in Multi-disciplinary Domains

MOF

Ministry of Finance
EPU/SER/34 - Service (Consultant)
S10 > S\$30,000,000

CEQS

Construction Enterprise Qualification
Standard Certificate (China)
(Environmental Engineering, Grade 1)

CEQS

Construction Enterprise Qualification
Standard Certificate (China)
(Municipal Construction, Grade 1)

PUB

Public Utilities Board
Approved Member of
Consultant Panel

BCA

Building and Construction Authority
Mechanical & Electrical
ME02, ME04, ME11

NSF

NSF Mark (USA)
Membrane Products
NSF61

M

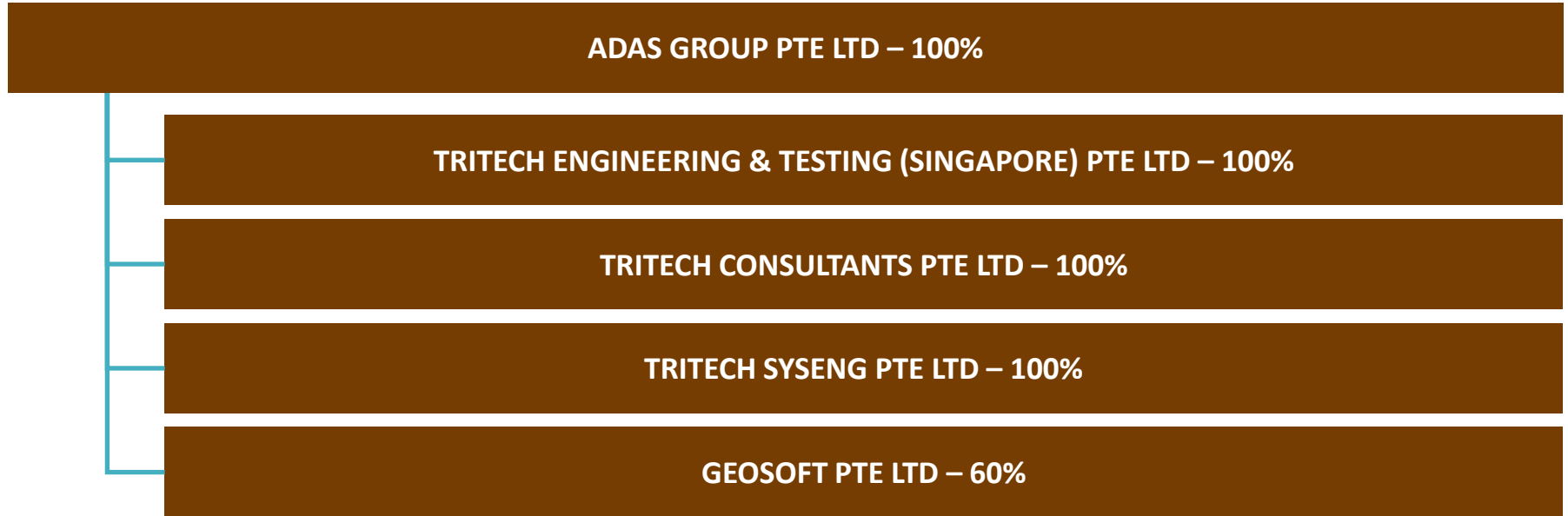
Microchem (USA)
Vavie CWS
>99.90% coronavirus removal

ADAS Group

A Subgroup Providing Integrated Services to
Smart Urban Development



Group Structure



Vision and Mission



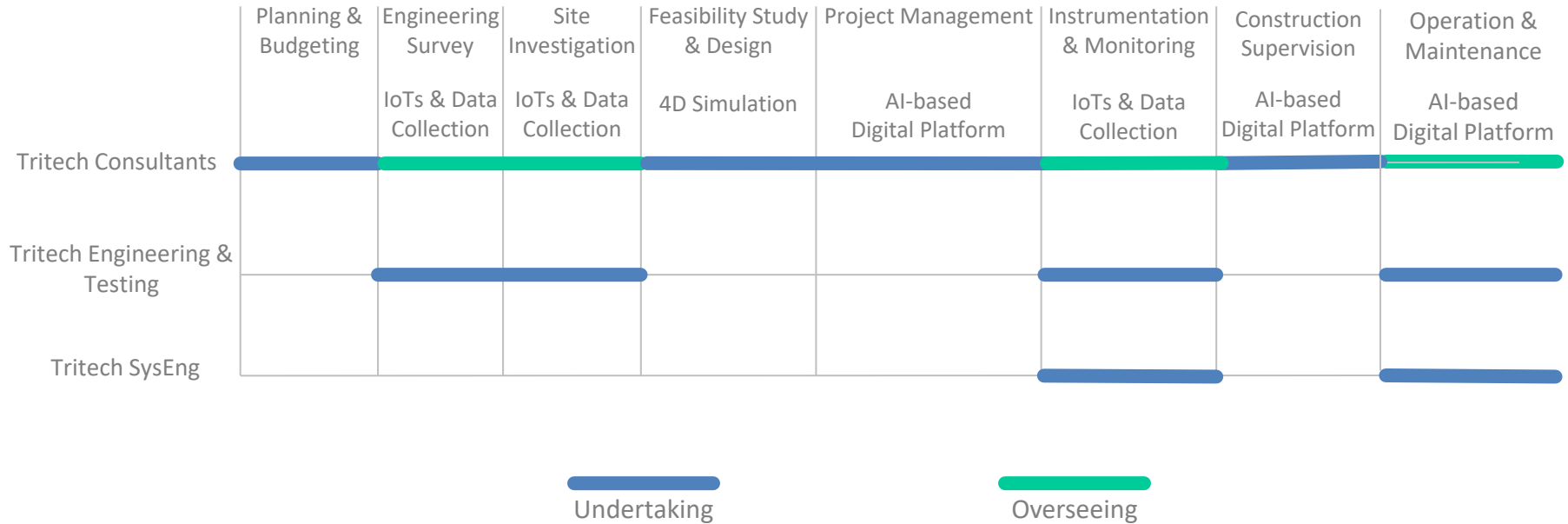
Vision - A unique group in the world
with unique services for smart urban development



Mission – Provision of integrated services
from: IoTs, data collection, data analytics, cloud computing &
4D simulation,
through: planning, design, consultancy and management of city
development by talents,
to: planning, design, consultancy and management of city
development by Artificial Intelligence (AI).

Project Workflow

A full span of services in Smart Urban Development



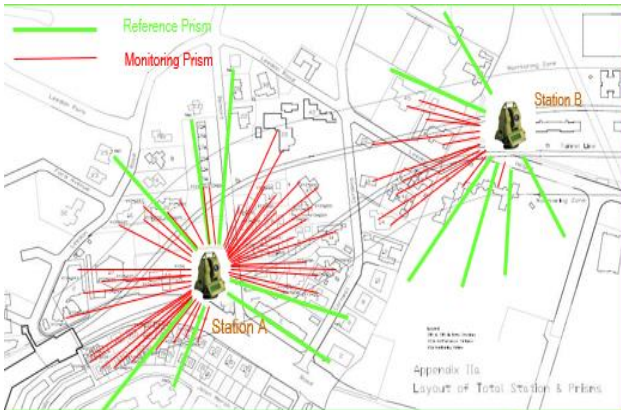
90% of projects are public infrastructures directly awarded by Singapore government agencies

Unique Group with Unique Services – IoTs and Data Collection

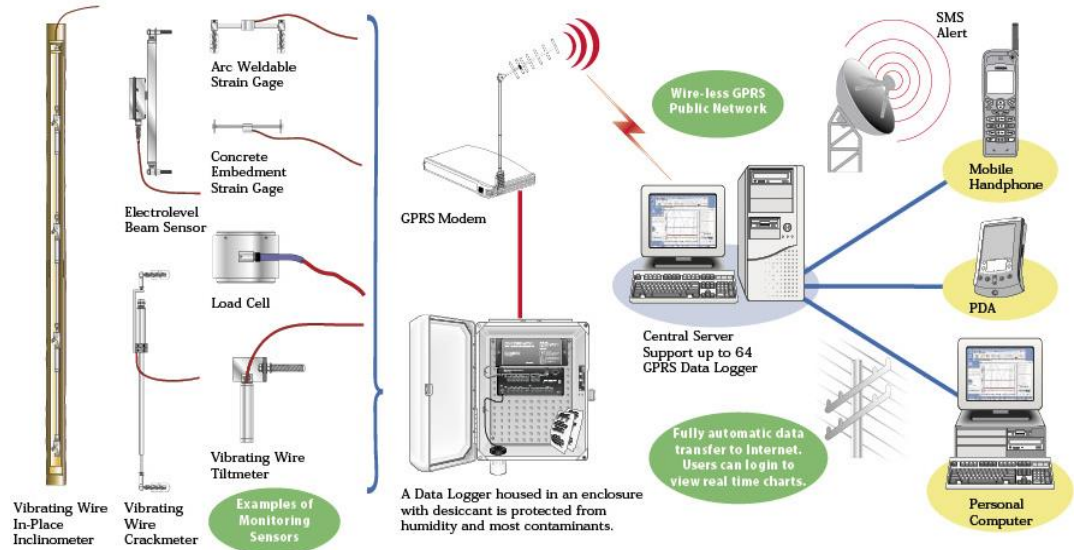
Remote Automated Real Time Instrumentation & Monitoring of Construction



Scanning high-traffic roads unmanned










Real Time eMonitoring System



MRT Construction Projects

Tritech has 60% market share in construction data collection (site investigation and instrumentation & monitoring works) of MRT projects

Project Name		Technical Information	Start Operation	Remark
East West Line		49.2 km, 31 stations	1987	Partially underground, cut & cover
North East Line		20 km, 16 stations	2003	Entirely underground, cut & cover
Circle Line		33.3 km, 29 stations	2010	TBM tunneling
Downtown Line		42 km, 33 stations	2008-2017	Fully underground. 3 stages
Thomson Line		43km, 31 stations	2019 U/C	TBM tunneling
Eastern Region Line		21 km, 12 stations	2027 U/D	TBM tunneling
Cross Island Line		50 km	2030 U/P	TBM tunneling
Jurong Region Line		20 km	2025 U/D	TBM tunneling

Unique Group with Unique Services – IoT and Data Collection

Tritech's water quality instrumentation & monitoring covers most of Singapore's water areas

TSS with Video
Surveillance

Lake Water
Quality Profiler

Water Quality &
Gauging Station

Measurement
Buoy

Meteorological
Station

Water Quality
Platform



Unique Group with Unique Services – IoT and Data Collection

Tritech's stormwater monitoring system serves most of Singapore's waterways

Select Period
- View One Day Data
- View One Week Data
- View One Month
- View Two Month

Cope Level(mRL) 104.44
Operational Level(mRL) 102.45
Invert Level(mRL) 102.44

Chart Data Station Image

Station:HPW304 PWW_Pu(Parameter: Level)

Water level report

Enable Tooltip

Select Period
- View One Day Data
- View One Week Data
- View One Month Data
- View Three Month Data

Chart Data Station Image Cross Section Reference Line m Save

Station:M_AL_1 QT Cpk Q49(Parameter: Rain)

Flow monitoring report

Depth AL(Low)
Top
Middle
Bottom
Enable Tooltips

Select Period
- View One Day Data
- View One Week
- View One Month
- View Three Month
- View Two Month Data

Cope Level(mRL) 106.67
Operational Level(mRL) 105.1
Invert Level(mRL) 105.09

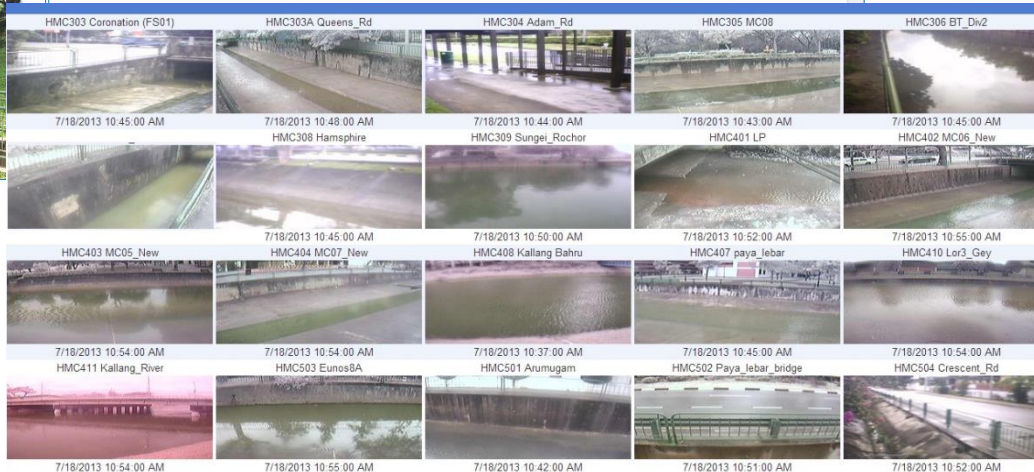
Chart Data Station Image

Time	Depth (m)	Flow (m³/s)
09-04-2012 13:21:00	0.93	106.02
09-04-2012 13:20:00	0.92	106.01
09-04-2012 13:19:00	0.87	105.96
09-04-2012 13:18:00	0.86	105.95
09-04-2012 13:17:00	0.85	105.94
09-04-2012 13:16:00	0.85	105.94
09-04-2012 13:15:00	0.87	105.96

Rainfall monitoring report

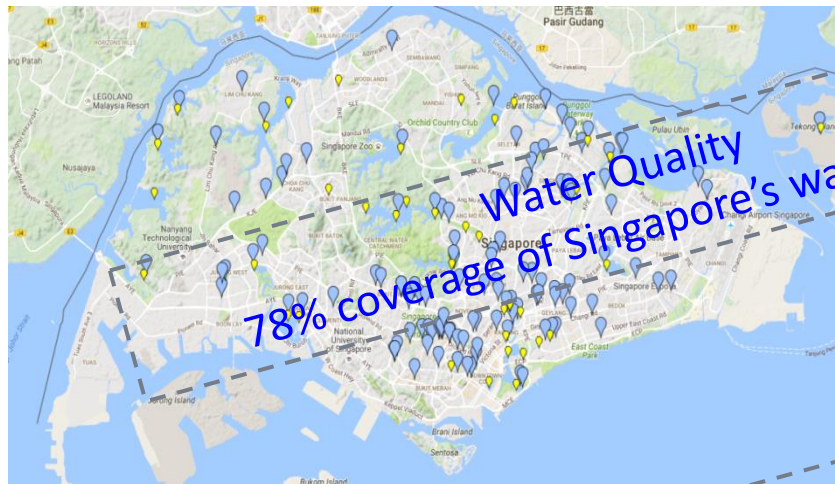
Data Sheet

Image/Video Report



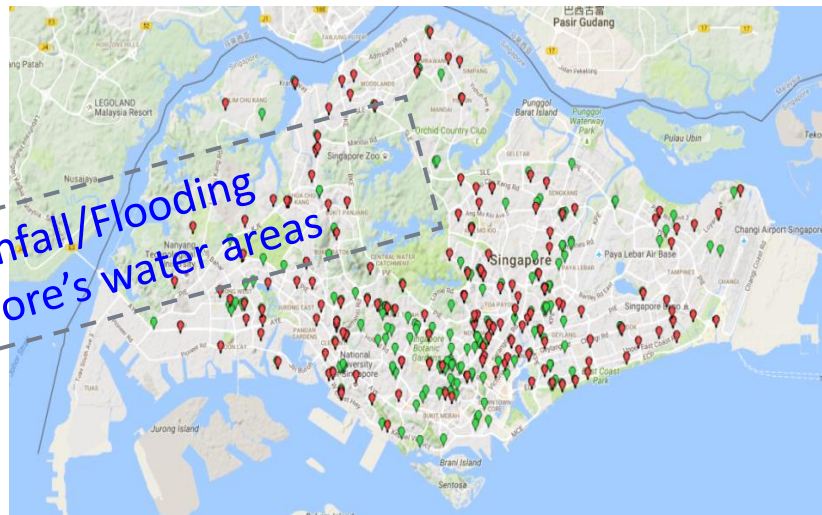
Unique Group with Unique Services – IoT and Data Collection

Water quality monitoring - 78% coverage
Water level / flow / rainfall monitoring – 90% coverage



Water Quality
78% coverage of Singapore's water areas

Water level/Flow/Rainfall/Flooding
90% coverage of Singapore's water areas



Unique Group with Unique Services – IoT and Data Collection

National Water Monitoring Center @ PUB of Singapore

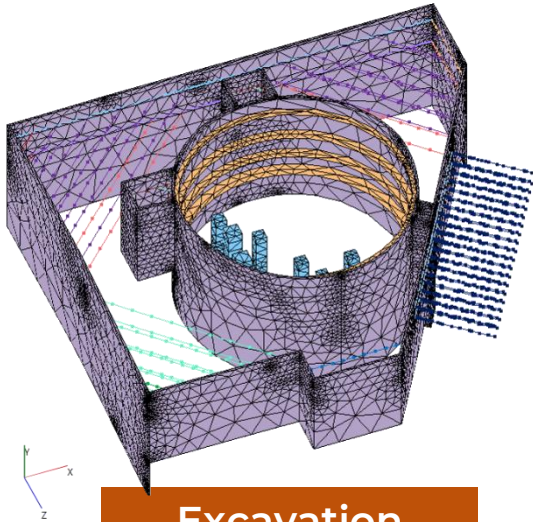


- Integration of data collection, processing, management and storage
- Comprehensive monitoring and user display platform
- Remotely assess water quality via the system
- Analysis of the individual parameters
- Observe abnormal data to identify potential water quality problems

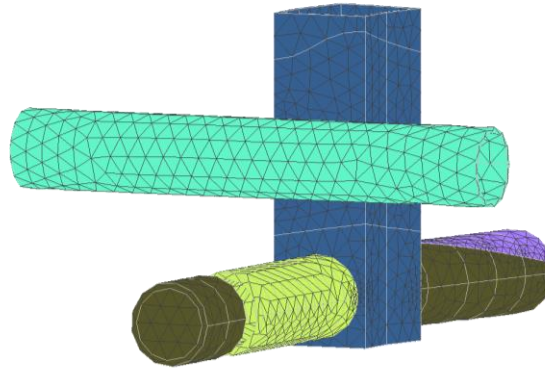
Unique Group with Unique Services – 4D Simulation

GEOFEA@ADAS – Geotechnical Finite Element Analysis

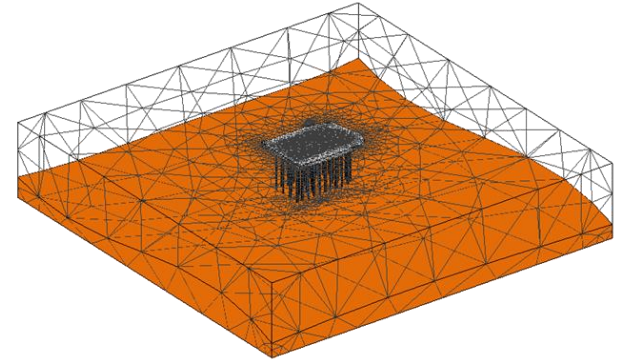
Planning & Construction



Excavation



Tunnel



Foundation

Real 4D simulation for urban infrastructure projects.

Planning, Design, Management of City Development by Talents



TriTech

Unique Group with Unique Services

Planning, Design, Management of City Development by AI

AI-based Data Analytics System (ADAS) Development

Digital Age

Now we're firmly entrenched in the digital age, and businesses of all sorts are creating smart, effective, and disruptive ways of leveraging technologies.

Tritech's know-how knowledge & technologies can be collectively transformed into an integrated digital service platform



Unique Group with Unique Services

Transformation from Talents to AI & Automation



Big data
is source



IoT is
vehicle



AI + Automation
provide solution

Focused on the applications of

- ✓ Automation
- ✓ Internet of Things (IoT)
- ✓ Big Data Analytics
- ✓ Artificial Intelligence (AI)

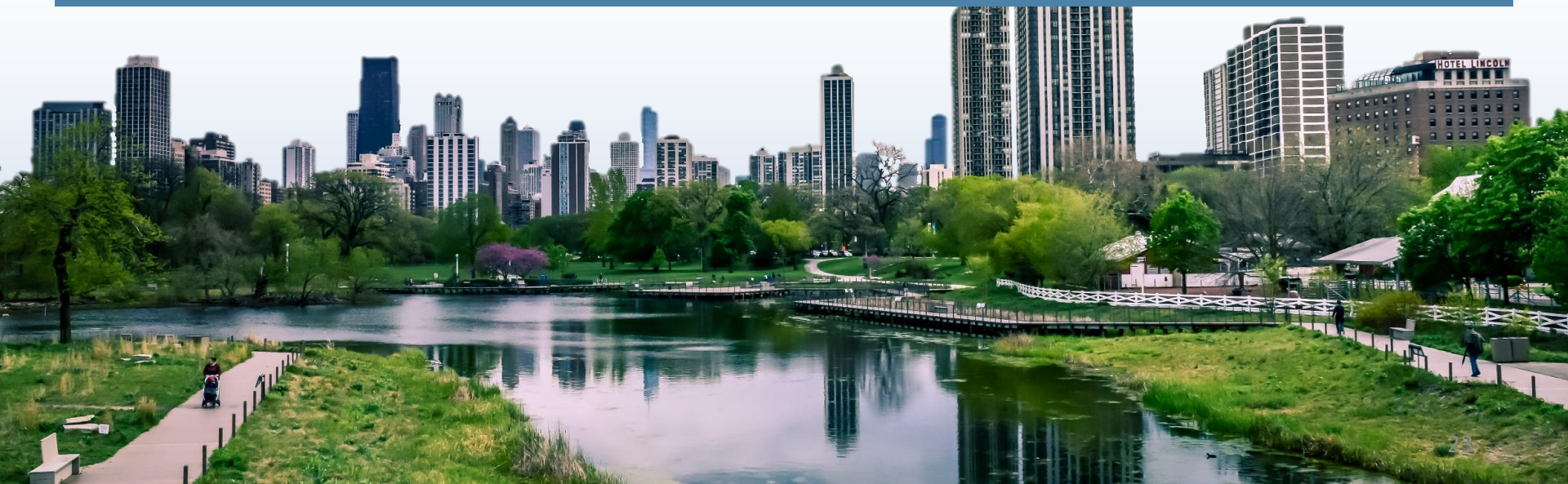
It has energised Trittech into a technology-driven company.

**Trittech
Innovation
Centre**



With new work models... ...and shifting business needs

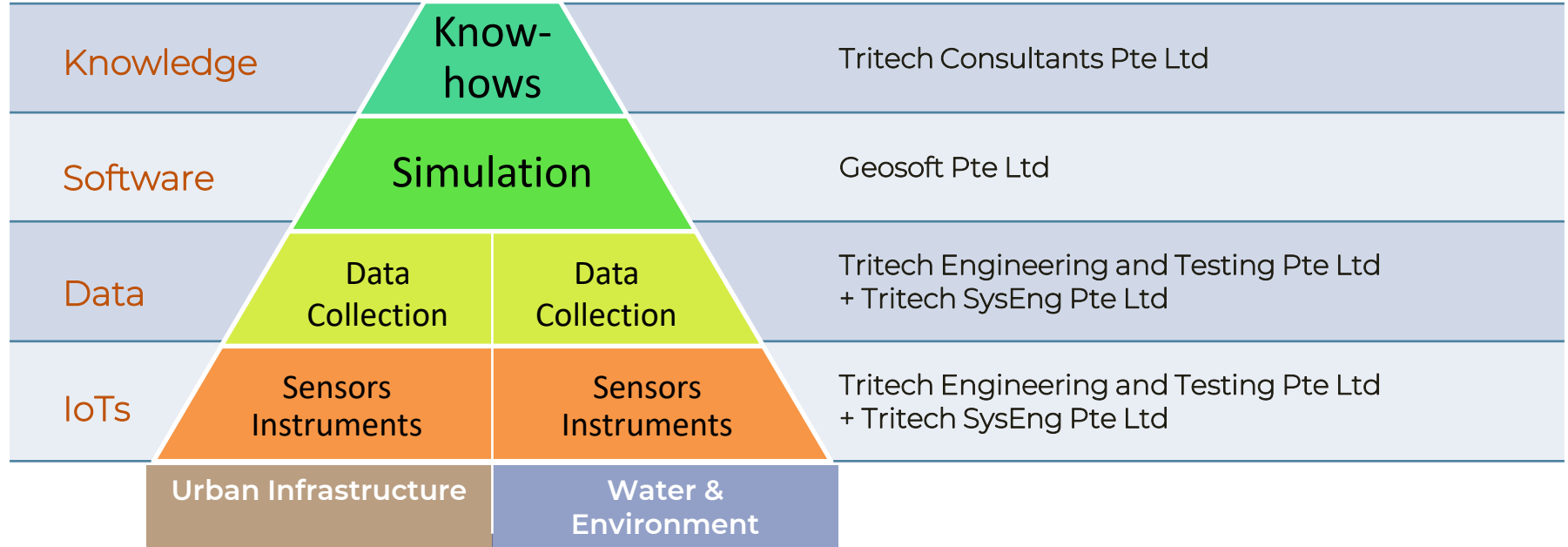
Transformation from talents to AI - An Integrated AI-based digital platform for smart urban development has been developing.



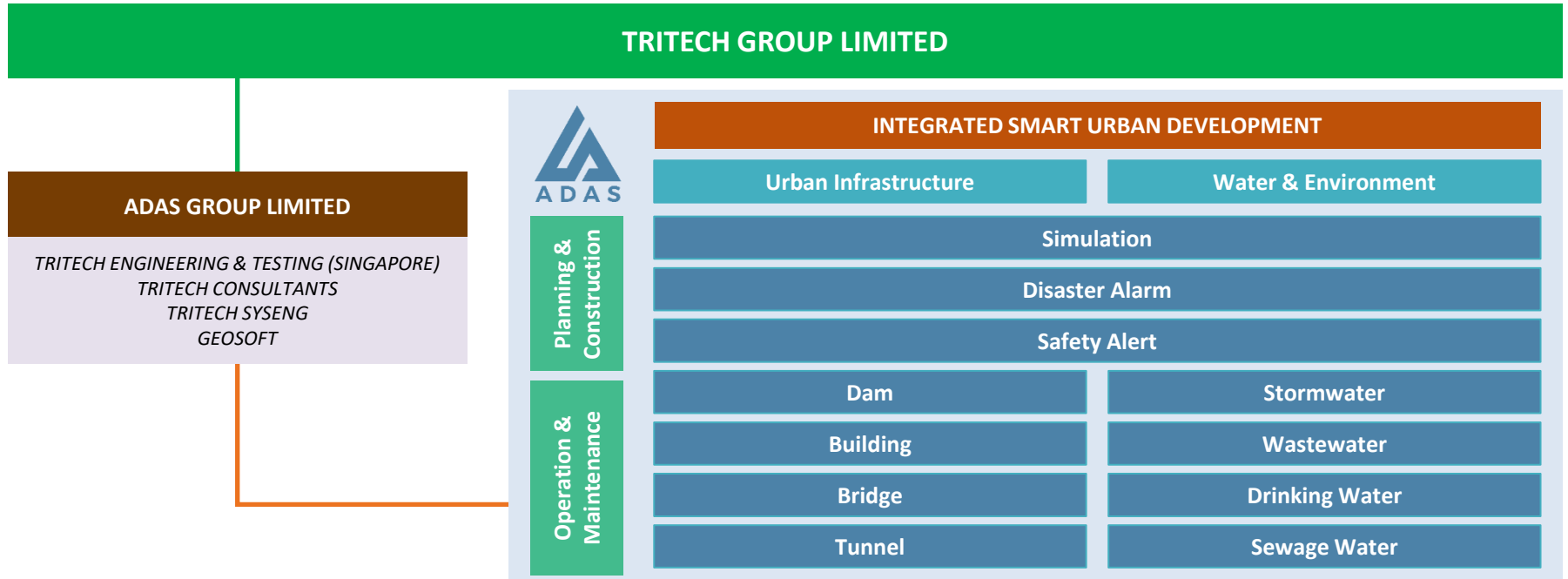
Artificial intelligence



ADAS Group Limited

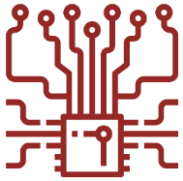


Probably the **one and only** integrated services platform of its kind for smart urban development.



Integrated services for smart urban development platform

	Urban Infrastructure		Water & Environment		
Planning & Construction	Simulation	GEOFEA@ADAS Geotechnical Finite Element Analysis			
	Disaster Alarm	BTDA@ADAS Bored Tunnelling Big Data Analytics			
	Safety Alert	TEMS@ADAS Tunnelling and Excavation Monitoring System			
Operation & Maintenance	Dam	DAIMS@ADAS Dam Infrastructure Monitoring System		Stormwater	SIMS@ADAS Stormwater Information Management System
	Building	BDIMS@ADAS Building Infrastructure Monitoring System		Wastewater	TIMS@ADAS Treatment Information Management System
	Bridge	BRIMS@ADAS Bridge Infrastructure Monitoring System		Drinking Water	WGMS@ADAS Water Grid Management System
	Tunnel	TNIMS@ADAS Tunnel Infrastructure Monitoring System		Sewage Water	SGMS@ADAS Sewer Grid Management System



Fast Analytics

Connect and visualize your data on demand with lightning fast connectivity



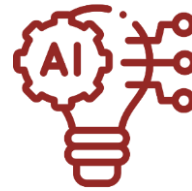
Ease of Use

Intuitive and smart, build for users by users



Custom Dashboard

Your own smart dashboard with combined view for ease of data visualization



Smart Technologies

With machine learning technology for your prediction needs in Smart Water

Glory and Expertise

Tritech conducted the geotechnical design & construction monitoring for all of the high rise commercial & residential buildings at Marina Bay CBD.



Marina Bay Sands Singapore



Geotechnical Design and Construction Monitoring

Marina Business and Finance Center (MBFC)



Geotechnical Design and Construction Monitoring

Sails@Marina Bay



Geotechnical Design and Construction Monitoring

Marina One Residence



Geotechnical Design and Construction Monitoring

The Interlace



Geotechnical Design, Construction Monitoring & Ground Engineering

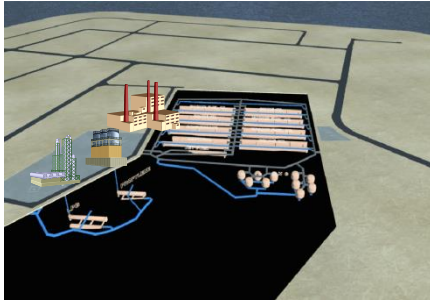
Garden by the Bay



Geotechnical Design, Construction Monitoring & Ground Engineering

Underground Space Development

Jurong Rock Cavern (JRC) for oil storage (below the sea)



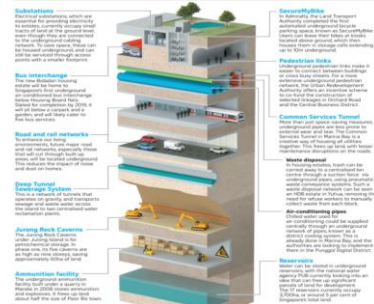
Client: JTC (2006 to 2019)

Task: Project management and technical review

Award:

- Platinum Award (2015 Singapore Good Design)
- Prestigious Engineering Achievement Awards (IES, 2015)
- Distinguish Award (International Tunneling Association, 2016)

Masterplan for underground rock caverns in Singapore

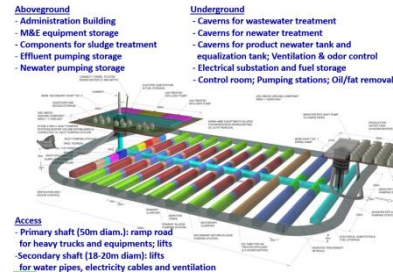


Client: JTC (2007)

Task: Planning & feasibility study

Underground rock cavern (URC) usage feasibility study

Water Reclamation Plant



Client: JTC & URA on behalf of Inter-Agency Underground Master Plan Taskforce Sub-Group 2 (UMPTFS2) (2007 – 2009)

Task: Feasibility & conceptual design of nine types of underground facilities including Data Center

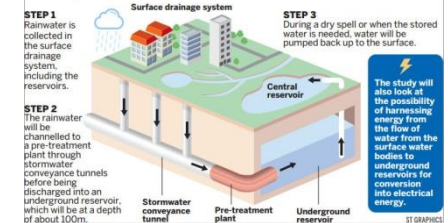
Award:

Singapore Ministry of Trade and Industry Innovation Award (Year 2009)

Underground drainage and reservoir system (UDRS) of Singapore

Going underground

PUB is exploring the possibility of using underground space for drainage and water storage to help Singapore overcome the effects of climate change, such as more intense rain and prolonged dry spells. A tender for a feasibility study will be called in the coming months.



Client: PUB (2016 -2018)

Task: Feasibility study

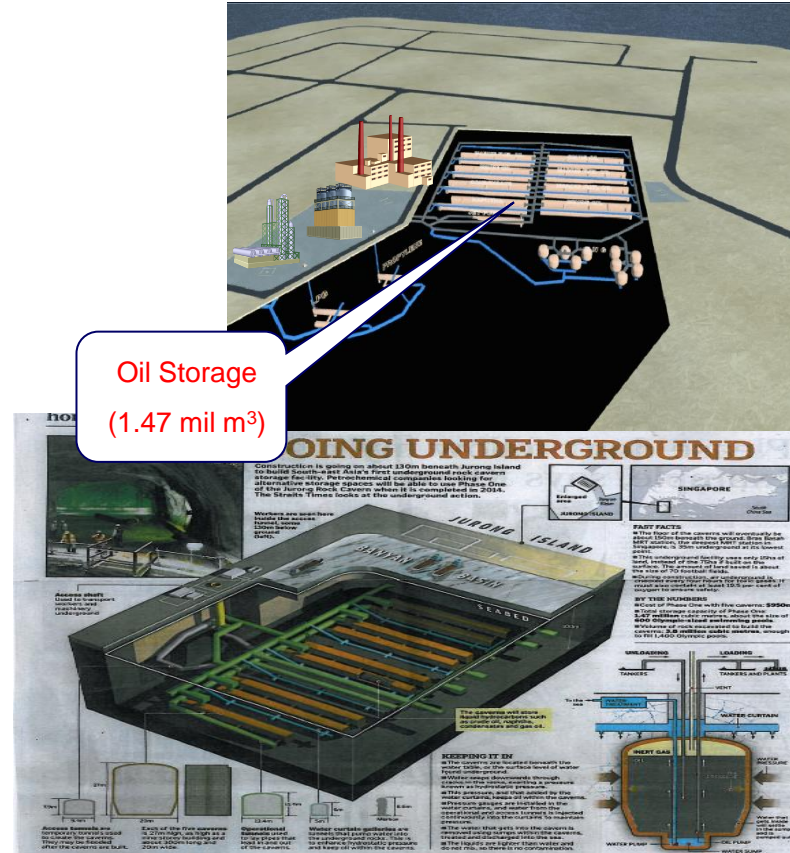
- Flood prevention
- Pumped storage hydroelectric power station
- Extra water storage up to 100 million m3
- Aggregate mining for construction

Jurong Rock Cavern (JRC) for Oil Storage

Tritech, together with Norwegian Partners, has applied our underground space technology into oil & gas industry.

Jurong Rock Cavern (JRC) sits at the depth of 140m beneath the sea bed.

JRC is the first oil storage cavern in South-East Asia.



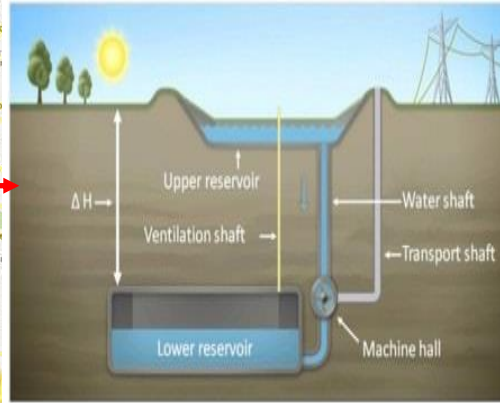
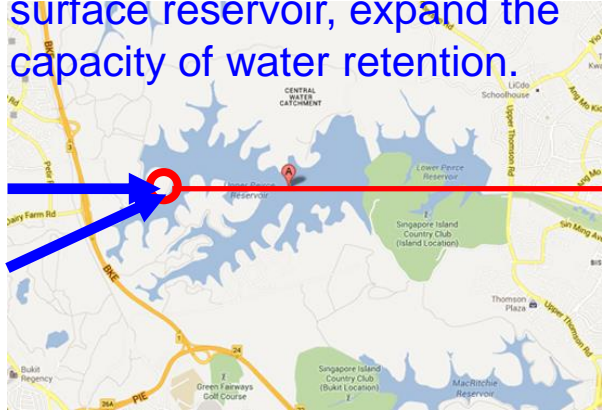
Awards to Jurong Rock Cavern Project

- Platinum Award (2015 Singapore Good Design)
- Prestigious Engineering Achievement Awards (IES, 2015)
- Distinguish Award (International Tunneling association, 2017)



Underground Drainage and Reservoir System (PUB)

Located below the existing surface reservoir, expand the capacity of water retention.





Tritech, in collaboration with Back & Veatch, is conducting feasibility study (to be completed by middle of 2018).

Inlet shafts & tunnels system bring stormwater to underground reservoir.

National Critical Facility (NCF) with multi-functions:

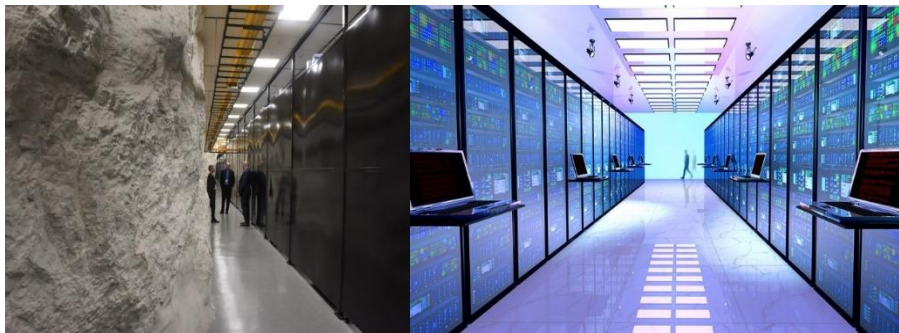
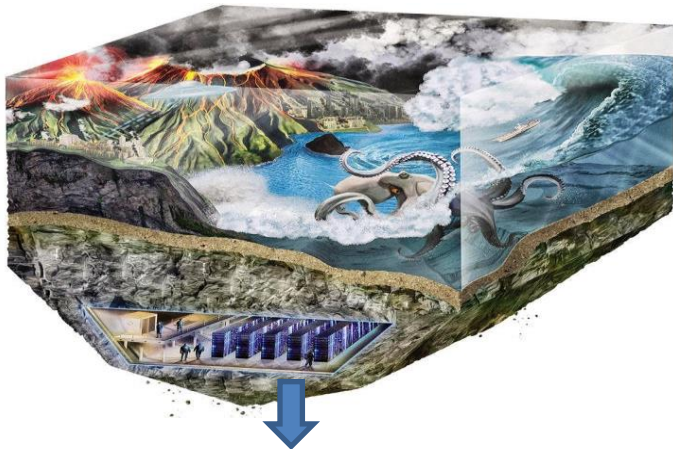
- **Flood control and prevention**
- Pumped storage hydroelectric power station
- Extra water storage up to 100 million m³
- Aggregate mining for construction



Stormwater
Discharge
Tunnel

Underground Storage & Data Centre below Sea with Seawater Cooling

Tritech has made a **patent filing** on a Seawater Cooling System and an Underground Storage System (including data centre). Such innovation will save land, have super security, save energy and reduce carbon foot print.



联合早报财经版（2019年10月2日）

财经 | 新闻

数据中心成REIT和上市公司新宠

订户

来自 / 吕爱丽

发布 / 2019年10月2日 9:14 PM

调整字体: 小 中 大

本地房地产投资信托（REIT）和上市公司近期频频在海内外收购数据中心，它们今年以来的表现优于大市，更受到机构投资者的青睐。

吉宝数据中心房地产信托（Keppel DC REIT）、丰树工业信托（Mapletree Industrial Trust），以及房地产发展商永泰控股（Wing Tai Holdings）都在9月份宣布收购数据中心。

Development Concept @ Old Pasir Panjang Power Station

A “Live-Work-Play” Digital Hub - no travel from-office-to-home against pandemic (work-from-home concept)

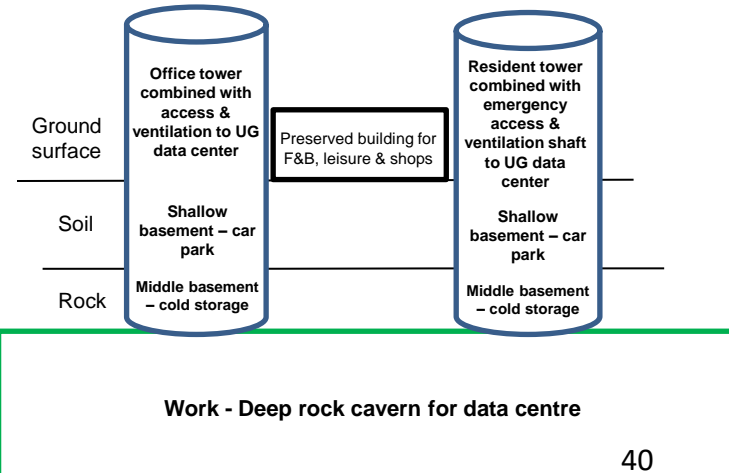
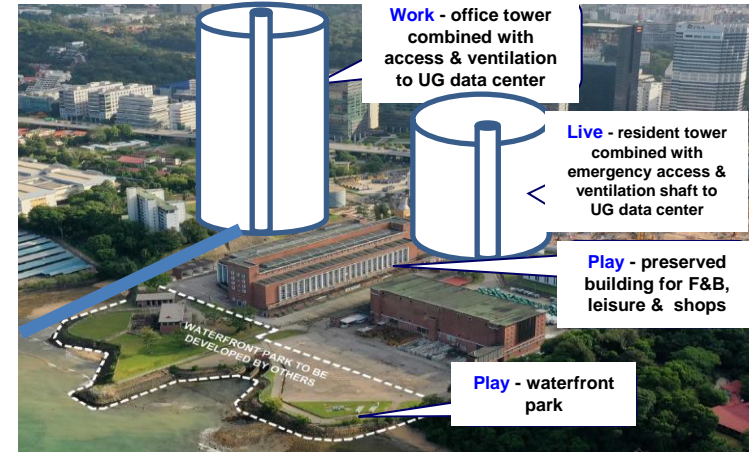
1. **Live** - resident tower, looking like chimney (maintaining the original power station image).
2. **Work** – office tower and underground data center & cold storage.
3. **Play** - existing heritage power station buildings for F&B, leisure and shops, and waterfront park.

Benefits to Sustainability of the PPP District Development:

- Maintain the existing heritage building and image of Power Plant
- Land saving through underground space creation



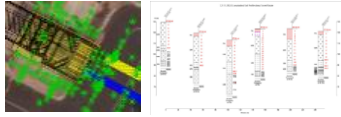
Chimney concept for maintaining the power station image by others



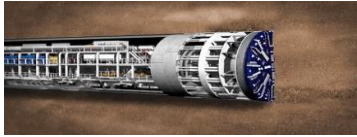
TEMS@ADAS – Tunnelling and Excavation Monitoring System

TEMS is used by LTA for 100% ongoing MRT construction projects

Design Information &
Ground Condition



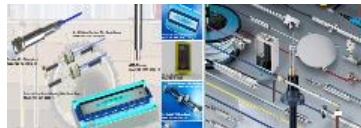
TBM Operating Parameters



Site Activities



Monitoring Data



Governmental Awards to TEMS

Ministry of Transport (MOT) Innovation Awards in 2015 and 2020

MOT Awards Ceremony 2015

Land Transport Authority of Singapore

An Integrated Tunnelling and Excavation Monitoring System

Dr Goh Kok Hun Team Leader
Dr Jeyatharan Kumarasamy
Yen Ling Paterson
Seetoh Hon Hoy
Lem Kiah Chen
Gary Lim
Aarti Budhiraja

Silver Zone – Re-engineering Road Safety for Seniors

Dr Chin Kian Keong Advisor
Dr Chuai Chip Tiong Advisor
Ho Seng Tim Team Leader
Ding Woon Keong
Wah Teh Hoong
Andrew CS Tan
Lin Hongxiang
Lee Ruo Xuan
Ong Tien Boon
Jamie Cheong
Chan Clarence Jude Silva
Muhammad Hasni Karsani
Dennis KY Yeo
Candra Hoon
Chen Ruifen
Siti Nuraisyah
Muhammad Affan Rahman

Wireless Anti-Collision Sensory Protection (W.A.S.P)



MINISTER'S INNOVATION AWARD Distinguished Award

Land Transport Authority - TEMS 2.0: Enhanced Tunnelling and Excavation Monitoring System



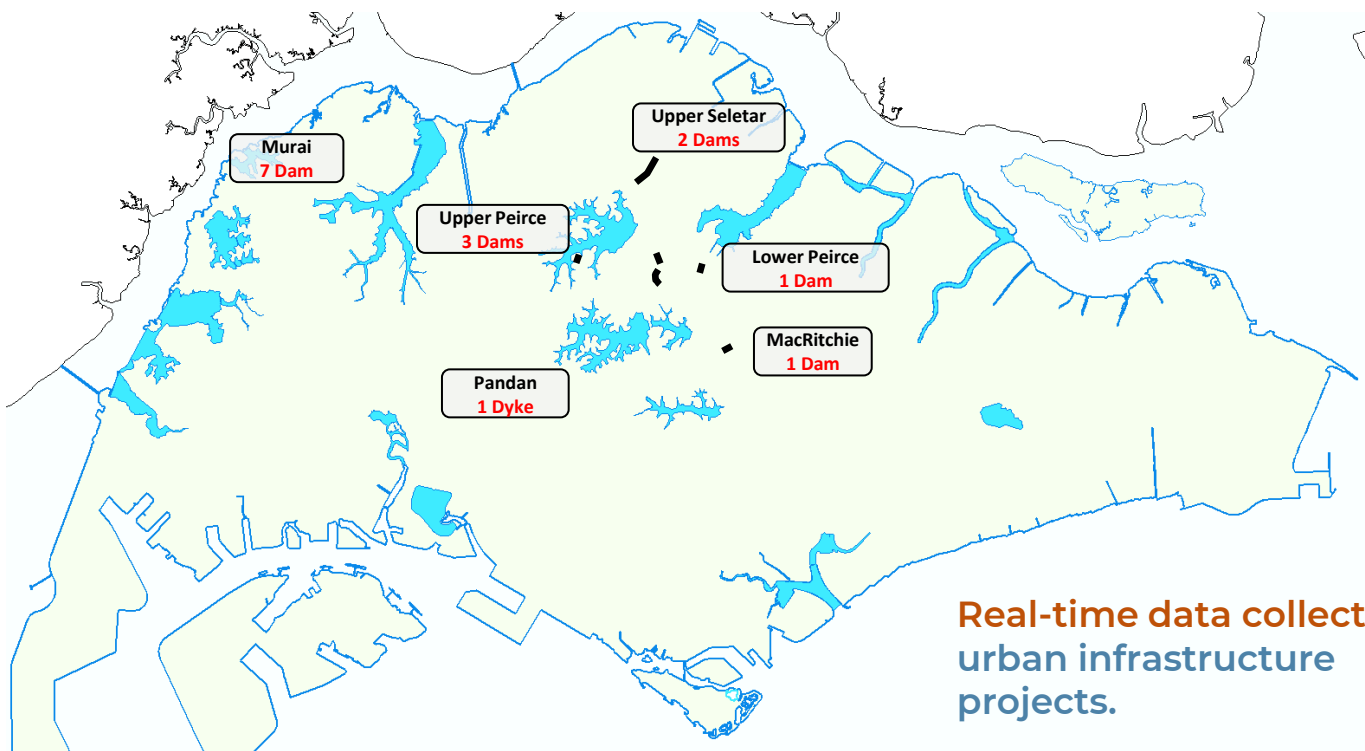
Project Team



Mr Paul Fok	Team Advisor
Ms Choo Chai Foong	Team Advisor
Ms Neo Bian Hong	Team Advisor
Dr Goh Kok Hun	Team Advisor
Dr Jeyatharan Kumarasamy	Team Lead
Ms Jennifer Lee	Member
Mr Wong Kah Chou	Member
Ms Rain Yong	Member
Ms Aarti Budhiraja	Member
Mr Ravindra Kumar Manda	Member
Mr Harul S/O Mariadas	Member
Ms Michelle Teo	Member
Ms Wong Han Ee	Member

DAIMS@ADAS – Dam Infrastructure Monitoring System

DAIMS is used by PUB for 60% reservoirs

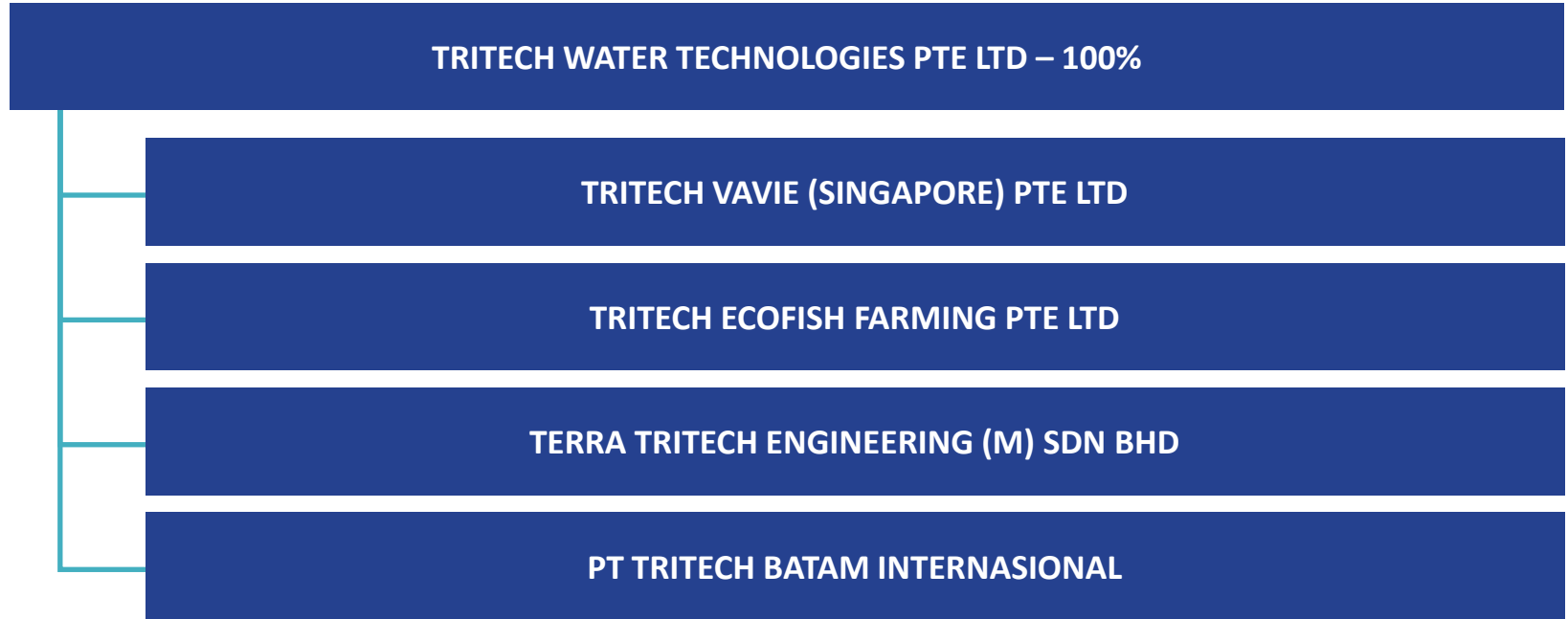


Tritech Water Group

**A Subgroup Targeting to Improve our Quality of Life
with Better Water Technologies**



Group Structure



Vision and Mission



Vision:

Improve our quality of life with better water technologies



Mission:

- Become a leading player in water related business in the region;
- Produce Vavie Alkaline drinking water, Vavie Alkaline water dispensers, Vavie CWS (Clean, Wash, Sanitize);
- Produce fishery to Singapore market as a national keystone.



Vavie Products

A Better Protection of Public Health



三泰 VaVie Clean Wash Sanitize (CWS)

VaVie™ CWS is an environmentally friendly, odourless, colourless, and safe cleansing solution with a pH of 12.7-13.2, alcohol-free and without any harmful chemicals.

It kills $\geq 99.90\%$ of human coronavirus and $>99.9999\%$ of bacteria

This product has been included in Singapore NEA's Interim List of Household Products Effective Against Coronavirus" as indicated in the link below <https://www.nea.gov.sg/our-services/public-cleanliness/environmental-cleaning-guidelines/guidelines/interim-list-of-household-products-and-active-ingredients-for-disinfection-of-covid-19>

1. Eco friendly, a green product

- ✓ Produced using purified water and food grade material (GRAS) as ingredients
- ✓ No harm to the environment and does not leave behind harmful chemicals
- ✓ Non alcohol and Water based product



三泰 VaVie What is CWS ?



1. Eco friendly, a green product

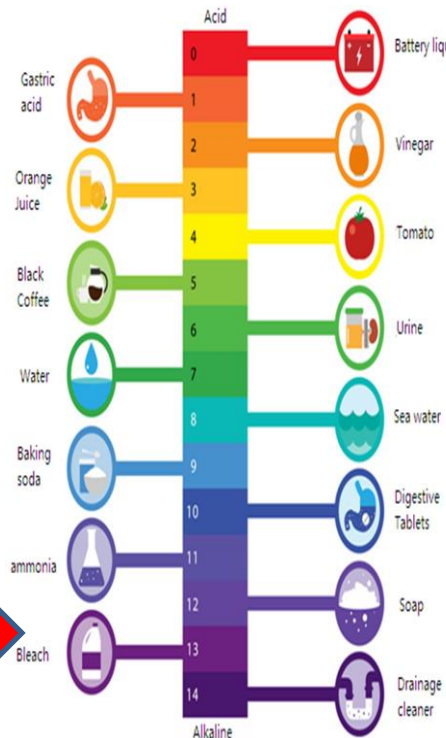
- ✓ Produced using purified water and food grade material as ingredients
- ✓ No harm to the environment and does not leave behind harmful chemicals
- ✓ Water based , proprietary technology to achieve PH 12.7 to 13.2

2. A Substitute: Effective against stubborn oil and dirt stains

- ✓ One to one substitute for most existing cleaning product on the market
- ✓ General household cleaning solution for the kitchen, cooking utensils, bathroom etc
- ✓ Industrial and commercial facilities cleaning

3. Sterilization of surface

- ✓ VaVie™ CWS passed the 'Antibacterial Activity and Efficacy Test that utilized a Suspension Time-Kill Procedure '.
- Using the modified ASTM-E2315 procedure, the following experimental results were obtained:
- ✓ After 15 seconds, it can kill >99.99996% or >6.38 Log10 of bacteria



三泰 VaVie What is CWS?



Alcohol based ? Sensitive skin?
Toxic ? Effective against virus or
only bacteria/fungus ?

<https://www.hsa.gov.sg/topical-antiseptics/overview>

4. Eliminates the human coronavirus

- ✓ VaVie™ CWS passed the test for “Virucidal Efficacy of a Test Substance For Use on Inanimate, Nonporous Surfaces”. Using the ASTM E1053 procedure against the human coronavirus 229-E strain, ATCC VR-740, the following experimental results were obtained:
- ✓ After 15 seconds, it can kill $\geq 99.90\%$ or $\geq 3.00 \text{ Log}_{10}$ of viruses.
- ✓ After 15 seconds, it can kill $>99.99996\%$ or $>6.38 \text{ Log}_{10}$ of bacteria

5. Very safe , no toxicity

- ✓ Water based , non alcohol based, non flammable
- ✓ Food grade active ingredients

The FDA just updated its list of hand sanitizers you should avoid to include products that contain the deadly chemical methanol

Bethany Biron Jul 12, 2020, 3:52 AM



Rachel Askinasi/Insider

- The Food and Drug Administration updated its list of hand sanitizer containing the dangerous chemical methanol, adding five formulas made in Mexico and bringing the total to 59 products.

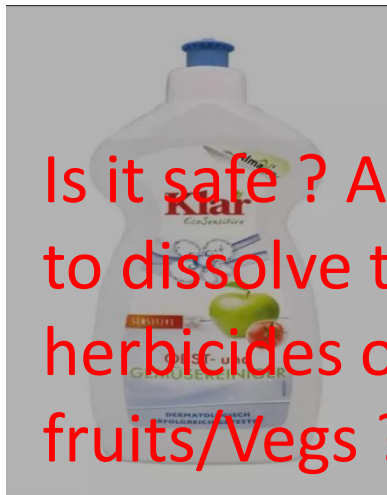
https://www.bloomberg.com/news/articles/2021-03-24/carcinogen-found-in-hand-sanitizers-that-plugged-pandemic-gap?utm_source=url_link

<https://www.fda.gov/drugs/drug-safety-and-availability/fda-updates-hand-sanitizers-consumers-should-not-use>

FDA does not accept viral claims on hand sanitizers.

三泰 VaVie What is CWS ?

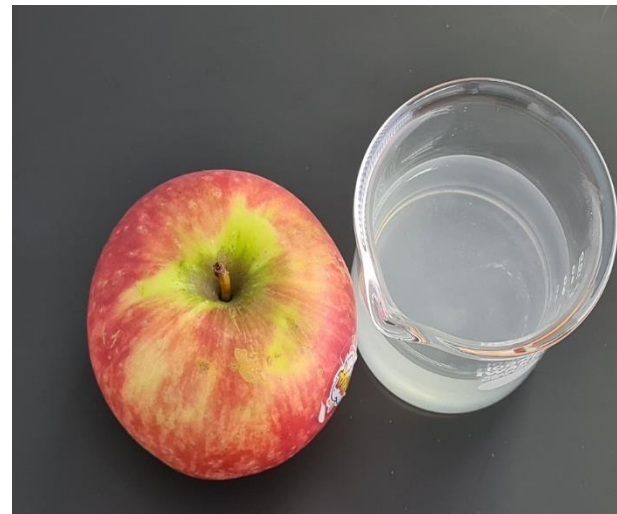
Is it safe ? Are addon chemicals used to dissolve the residual pesticides, herbicides or heavy metals on the fruits/Vegs ?



6. A Safe Substitute: Effective as a Fruit/Veg wash

- ✓ Reduces and eliminates the residual contaminants and pesticide found on fruit/veg. More effective than rinsing with water alone.
- ✓ Ensures that our fruit/veg is safe for consumption
- ✓ Prevent long term consuming of excessive amount of pesticide and heavy metal residue

Apple wax residue after application of CWS

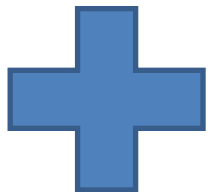


三泰 VaVie CWS: All in one



General purpose cleaner
Effective against stubborn oil and dirt stains

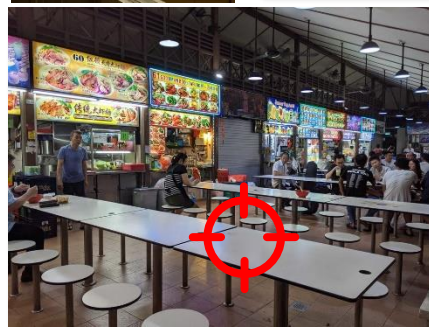
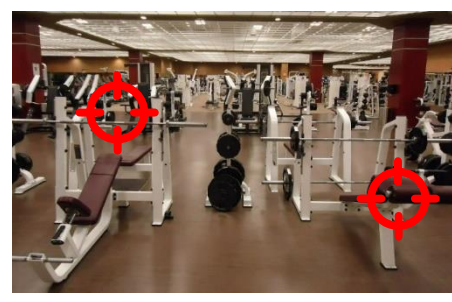
Many times more effective
as a Fruit/Veg Wash



Sanitizes : After 15 seconds, it can kill >99.99996% of bacteria
and $\geq 99.90\%$ of human coronaviruses.



三泰 VaVie CWS is everywhere



Aircraft and Airport : Cross border infections

1) Only general cleaning and disinfectant requirement

Source : International Civil Aviation Organization , Council Aviation Recovery Task Force (CART)
Take-off: Guidance for Air Travel through the COVID-19 Public Health Crisis
Montréal, Canada, 27 May 2020

Source: Guide to Hygiene and Sanitation in Aviation, WHO

1) The aircraft manufacturers **recommend the use of a 70% Isopropyl Alcohol (IPA)** as a disinfectant for the touch surface in the cockpit, cabin and cargo holds. For other surfaces, as per the WHO, cleaning and disinfection products shall have at least 60% alcohol to effectively destroy the virus.

2) Cleaning and disinfection products should comply with and be certified according to **SAE standards AMS1452, AMS1453, AMS1525 or AMS1526**

Source: Aircraft cleaning and disinfection during and post pandemic Ed. 1 – 19 June 2020,
IATA



三泰 VaVie CWS: Commercial Application

Commercial buildings/ Public areas

CWS can be used for the cleaning and disinfection of buildings, shopping centers, sports clubs, leisure facilities, outdoor activities, and the cleaning and hygiene control of hospitals, nursing facilities, kindergartens and other school facilities. Without any synthetic surfactants or toxic chemicals, CWS is a safe to use, user-friendly and environment-friendly product i.e. does not require the use of detergents or preservative solutions, nor does it leave a foam, which makes rinsing easier

Main Uses

- Building maintenance/cleaning, disinfection, deodorization and infection control



三泰 VaVie CWS: Industrial Applications

Food Processing Application

It is a multi-purpose water with a high degree of cleanliness, bactericidal, deodorizing and anti-corrosive properties. It is colorless, odorless and non-irritating. Suitable for general food processing plants for the cleaning, disinfection and deodorization of food processing machinery for sanitary purposes Control and HACCP (Food Safety Standards). In agriculture and animal husbandry, it can be used to fight pests and diseases. It not only contributes to soil improvement and growth of crops, but also contributes to the sanitary control of barn and livestock.

Main Uses

- Food processing plant machinery cleaning and disinfection, filling machine, mixing pot, tank, food conveyor belt etc.
- Restaurants and food service facilities cleaning and disinfection of cooking utensils, cutlery.
- Pest control, soil improvement, and crop growth promotion.
- Facilities/equipment interior, floor and wall cleaning, pipe



三泰 VaVie CWS sterilises surface, kills bacteria



STUDY REPORT

Study Title

Antibacterial Activity and Efficacy of Tritch Water Technologies' Test Substance Using a Suspension Time-Kill Procedure

Test Method

Modified ASTM International Method E2315
Assessment of Antimicrobial Activity using a Time-Kill Procedure

Study Identification Number

NG14799

Study Sponsor

Kuan Kang Mun
Tritch Water Technologies PTE LTD
31 Changi South Ave 2
kuanm@tritich.com.sg

Test Facility

Microchem Laboratory
1304 W. Industrial Blvd
Round Rock, TX 78681
(512) 310-8378
Report Author: Sarah Warner, B.S.



Test Substance Information

The test substance was received on 09 MAR 2020 and the following image was taken.



Note: The above image represents the test substance used on the day of testing.

Test Substance Received: VaVie Strong Alkaline Cleaning Water

The test substance arrived ready to use and was not diluted prior to testing.

Test Microorganism Information

The test microorganism(s) selected for this test:

MS2 Bacteriophage (MS2), ATCC 15597-B1

This virus is a non-enveloped, protein-coated RNA virus of the bacteriophage family Leviviridae. Bacterial cells are the hosts for bacteriophages, and E. coli 15597 serves this purpose for MS2 bacteriophages. Its small size, icosahedral structure, and environmental resistance has made MS2 ideal for use as a surrogate virus (particularly a phage of piscivorous such as salmonids and human recreational water quality and disinfectant studies.

Penetration Heat Cell System for MS2: Bacteriophage (MS2), 15597

Page 3 of 7

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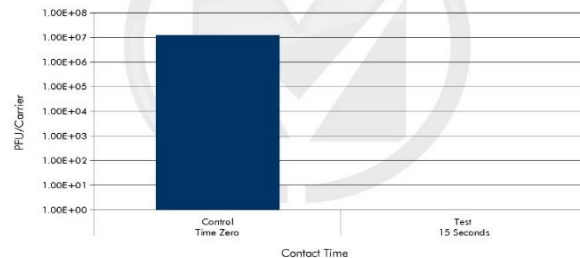
TEST SUBSTANCE AND MICROORGANISMS



Results of the Study

Test Microorganism	Contact Time	Sample Analyzed	PFU/ml	Average PFU/ml	Percent Reduction Compared to Control Substance at Time Zero	Log ₁₀ Reduction Compared to Control Substance at Time Zero
MS2 Bacteriophage ATCC 15597-B1	Time Zero	Inoculum	1.02E+09	1.20E+07	N/A	N/A
		Control Replicate 1	1.25E+07			
		Control Replicate 2	1.30E+07			
		Control Replicate 3	1.05E+07			
	15 Seconds	Test Replicate 1	<5.00E+00	<5.00E+00	>99.99996%	>6.38
		Test Replicate 2	<5.00E+00			
		Test Replicate 3	<5.00E+00			

The limit of detection for this assay is 5 PFU/ml and values below the limit of detection are noted as "<5.00E+00" in the data table and zero in the graph.



The results of this study apply to the tested substance(s) only. Extrapolation of findings to related materials is the responsibility of the Sponsor.

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After 15 seconds, it can kill >99.99996% or >6.38 Log10 of bacteria



STUDY REPORT

Study Title
ASTM E1053 Method
Virucidal Efficacy of a Test Substance For Use on Inanimate, Nonporous Surfaces

Product Identity
Vavie Strong Alkaline Cleaning Water
Lot: 03032020

Test Microorganism
Human Coronavirus, Strain 229-E, ATCC VR-740

Study Identification Number
NG15022

Author
Emily Cox, B.S.

Study Completion Date
22APR2020

Testing Facility
Microchem Laboratory
1304 W. Industrial Blvd.
Round Rock, Texas 78681

Study Sponsor
TriTech Water Technologies PTE, Ltd.
Kuan Keng Mun
31 Changi South Avenue 2
TriTech Building
Singapore 486478

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E1053-1A

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TriTech Water Technologies PTE, Ltd.

Study ID: NG15022



STUDY CONCLUSION

The purpose of the study was to determine the virucidal efficacy of Vavie Strong Alkaline Cleaning Water (Lot: 03032020) against Human Coronavirus Strain 229-E ATCC VR-740, with no additional soil load, at a contact time of 15 seconds, and at an exposure temperature of 27.0°C and 47% Relative Humidity (RH).

The Plate Recovery Control demonstrated a viral titer of 3.50 Log₁₀ TCID₅₀ per 0.1 ml and 3.80 Log₁₀ TCID₅₀ per carrier.

The Virus Control demonstrated a viral titer of 4.00 Log₁₀ TCID₅₀ per 0.1 ml.

Taking the cytotoxicity and neutralization control results into consideration, the evaluated test substance, Vavie Strong Alkaline Cleaning Water, demonstrated a ≥ 3.00 Log₁₀ reduction (99.90%) in viral titer.

No test substance cytotoxicity was detected in the test substance assayed (≤ 0.50 Log₁₀).

The Test Substance Neutralization Control demonstrated that the test substance was neutralized at ≤ 0.50 Log₁₀.

The test substance will be disposed of 30 days after the completion of this study, unless otherwise requested by the Study Sponsor.

The results of this study apply to the tested substance(s) only. Extrapolation of findings to related materials is the responsibility of the Sponsor.

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E1053-1A

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After 15 seconds, it can kill $\geq 99.90\%$ or ≥ 3.00 Log₁₀ of human coronavirus. Covid 19 is under this class of virus

Vavie Drinking Water

Alkaline Bottled Water



Our Alkaline bottled water does not contain additives or preservatives. We have two water production and bottling facilities, one in Singapore and the other in Qingdao, China. Our manufacturing facility utilizes modular design, which is scalable, easy to replicate and quick to set-up. System uses remote monitoring to ensure supervisory control and quality assurance.

Vavie Alkaline Water Dispenser

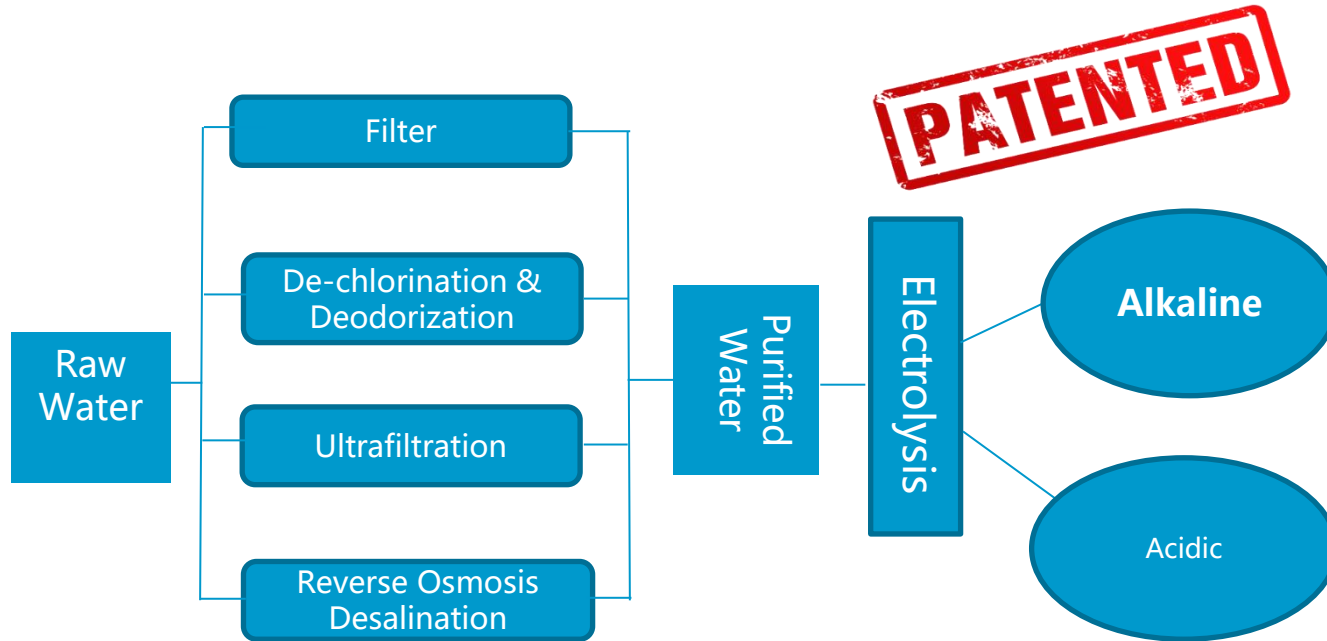
Commercial Dispenser



Household Dispenser

- Alkaline water helps to balance body pH by neutralizing excess acidic waste
- Our range of alkaline water dispenser comes standard with advance multi-stage filtration and purification using membrane technology
- Excellent removal of rust, heavy metals, bacteria, antibiotics and unpleasant odours
- Design redefined with quick-fit technology for ease of replacement of filter cartridges

Alkaline Drinking Water Production Process - Patented



Benefits of Alkaline Drinking Water

WHAT IS ALKALINE WATER?

Alkaline water is the superior tasting and healthy water produced from tap water using advanced purification and ionization technology. The alkaline water can be taken for various purposes such as drinking, cooking, cleaning and beauty of human being.

BALANCE BODY pH AS AN EFFECTIVE ALKALIZING AGENT

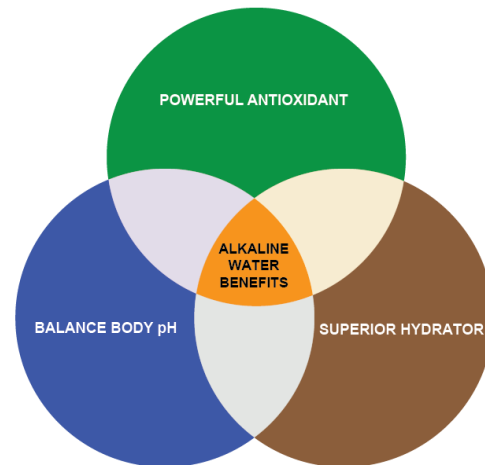
Keeping the body at a healthy pH level (mildly alkaline) is people's first line of defense in fighting any disease. Alkaline ionized water creates a major impact in balancing the body's pH level. A body that is too acidic provides an ideal environment for diseases to manifest and thrive in.

POWERFUL ANTIOXIDANT

The centerpiece of ionized alkaline water is its antioxidant properties. These hydroxyl ions seek out and neutralize free radicals, making them wonderful free radical scavengers and enabling a body rich in oxygen and energy.

SUPERIOR HYDRATOR AND A POWERFUL DETOXIFIER

One of the primary causes of disease is chronic cellular dehydration, which leaves the body's cells in a perpetual state of weakness and defense. Drinking alkaline water is six times more hydrating than "conventional" drinking water. Effective hydration also helps skin look healthier and smoother.





Tritech Automated Eco Fish Farming

Provide More with Less Cost



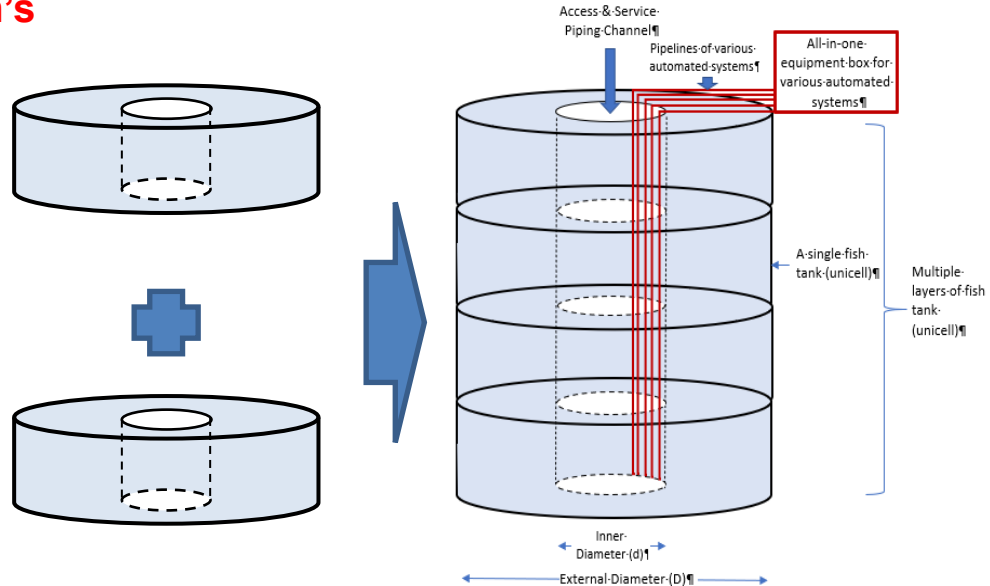
Tritech Eco-friendly Automated Unicell Fish Farm

Proprietary Technology leveraging on Tritech's domain knowledge and experience in:

- Geotechnical
- Underground Design
- Infrastructure Building
- Water treatment
- Water monitoring

Modular Design Concept

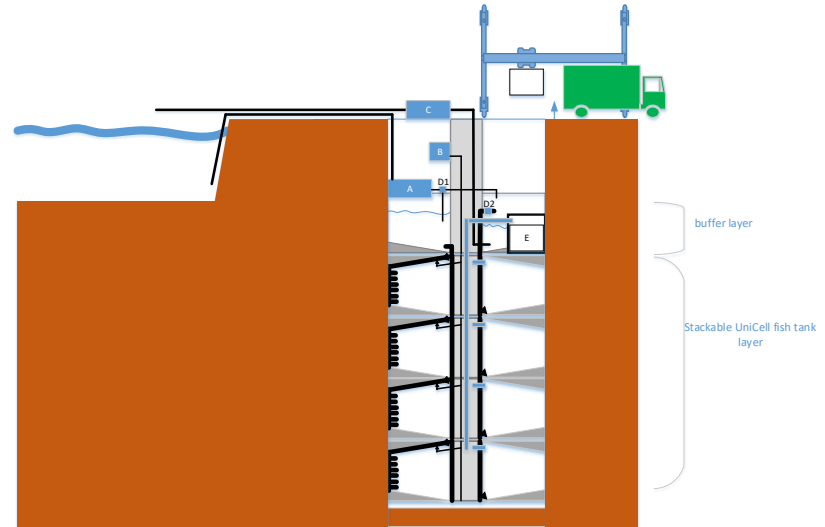
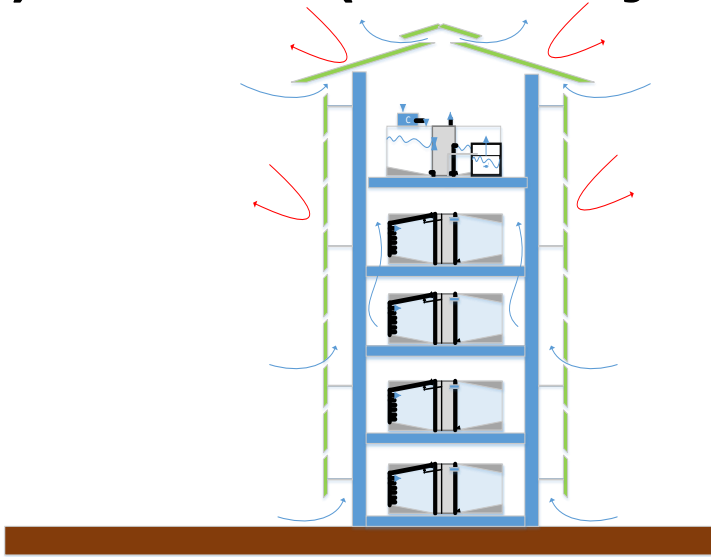
- Standardized Design
- Flexible Installation – Lego Concept
- Pipe Interconnect With Coupling
- Easy Maintenance



*Design patent pending approval

Tritech's Unicell Fish Farming System can be installed under different conditions:

- 1) On Land,**
- 2) Underground, &**
- 3) In the Sea (Modern-Styled Kelong type)**

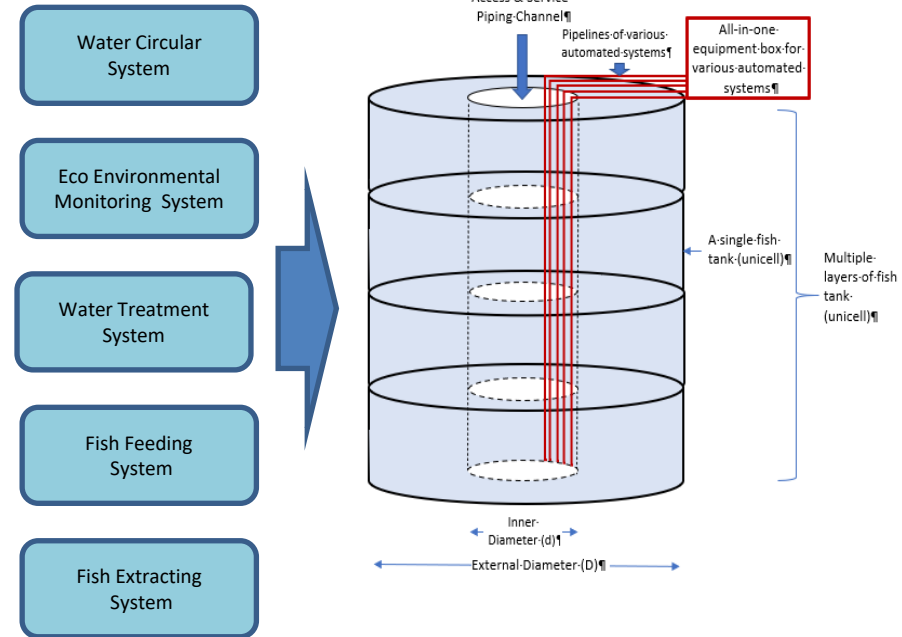


KEY CHARACTERISTICS OF TRITECH ECO-FRIENDLY AUTOMATED UNICELL FISH FARM CONCEPT

Fully Automated Support System

(Higher Efficiency & Productivity)

- Reduce manpower
- Reduce power consumption
- Improve growth rate
- Improve fish quality
- Increase productivity
- Reduce waste of feed

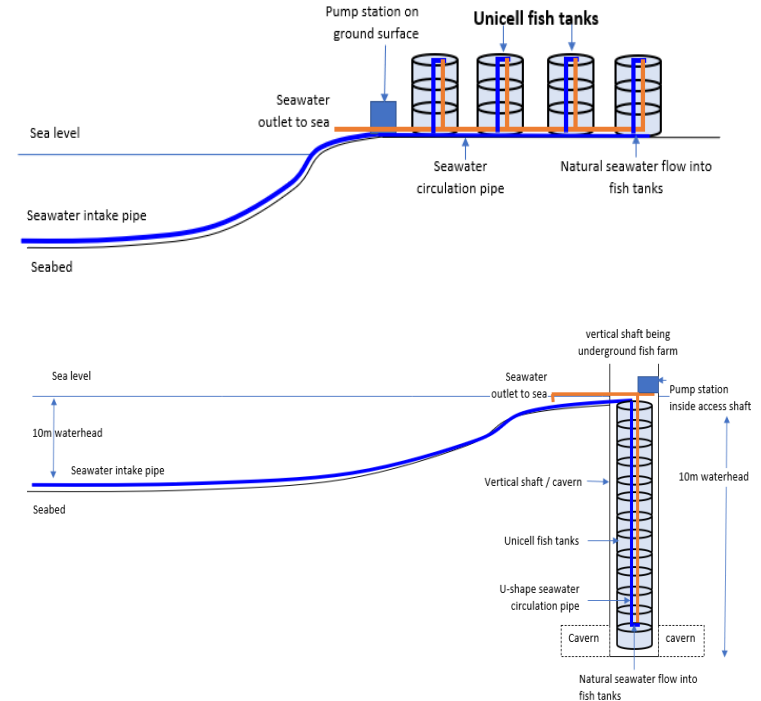


KEY CHARACTERISTICS OF TRITECH ECO-FRIENDLY AUTOMATED UNICELL FISH FARM CONCEPT

Water Circulation System

(Cost Saving and Resilience)

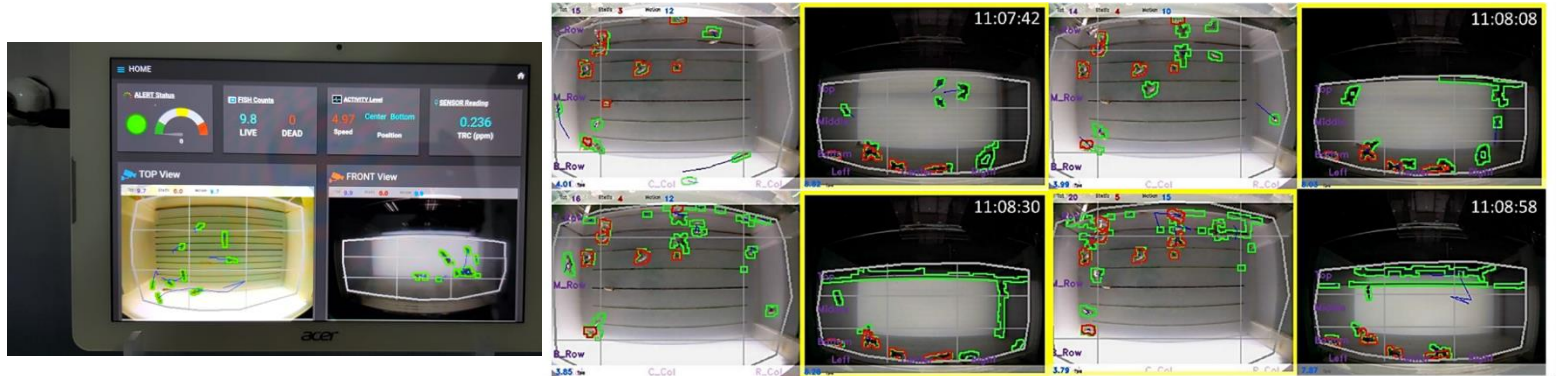
- Natural water intake to system using inverted U shape pipe arrangement
- Energy saving due to syphon concept on water intake
- Natural water used for fish farming reduce power consumption compared to RAS system
- Unicell modular design in water circulation system prevent cross contamination of fish, increase fish market supply resilience
- Redundancy system with standby backup power design, to prevent downtime during emergency period



KEY CHARACTERISTICS OF TRITECH ECO-FRIENDLY AUTOMATED UNICELL FISH FARM CONCEPT

Eco- Environmental Monitoring System (Leverage on High Tech e.g. Big Data and AI)

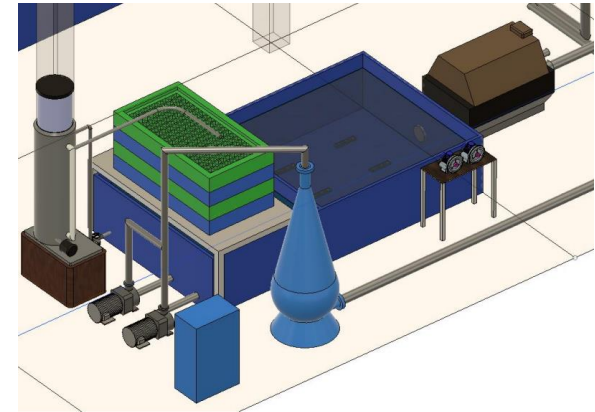
- Trittech state of the art Real Time Fish Monitoring Solution to monitor the fish behavior, growth size, quantity, health and stress index
- Based on AI and big data analysis, automatically control feeding pattern and alert for action
- DO, pH, Salinity, HN_3 , Algae and temperature will be real time monitored to protect fish health
- Fish Farming database can be built for continuing improvement on fish farming technique
- Web-based platform for all data and analysis for fish status and system status



KEY CHARACTERISTICS OF TRITECH ECO-FRIENDLY AUTOMATED UNICELL FISH FARM CONCEPT

Water Treatment System (Safe Controlled Environment)

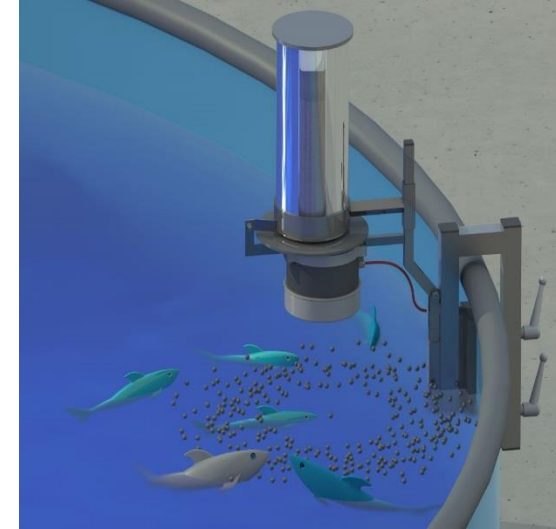
- Tritech's domain knowhow and technologies on water treatment will improve the efficiency on the inlet and outlet treatment
- Filtration and disinfection on natural water can reduce the bacteria level and remove algae, no need for antibiotic and herbicide to protect fish (cannot be achieved in a cage system)
- Optimum stocking rate can be achieved with oxygen level control by our eco-environmental monitoring system
- For outlet discharge, effluent is treated and monitored to protect environment from farming activities
- Using our proprietary "BubbleMax" technology to reduce power consumption in water treatment and water recycling



KEY CHARACTERISTICS OF TRITECH ECO-FRIENDLY AUTOMATED UNICELL FISH FARM CONCEPT

Fish Feeding System (Optimal Breeding, Reduce Wastages)

- Based on fish species expert database and feedback from fish behavior system to achieve optimum feeding based on appetite
- Feeding nutrient and volume can adjust automatically based on different stage of growth and fish species from database
- Feeding structure pattern can ensure the feed is evenly distributed so all fish can have optimum feed
- Optimum growth rate with feeding times synchronize with lighting control based on fish species expert database
- With optimum feeding can reduce fish sewage and pollution on the environmental, which help to reduce farming OPEX



KEY CHARACTERISTICS OF TRITECH ECO-FRIENDLY AUTOMATED UNICELL FISH FARM CONCEPT

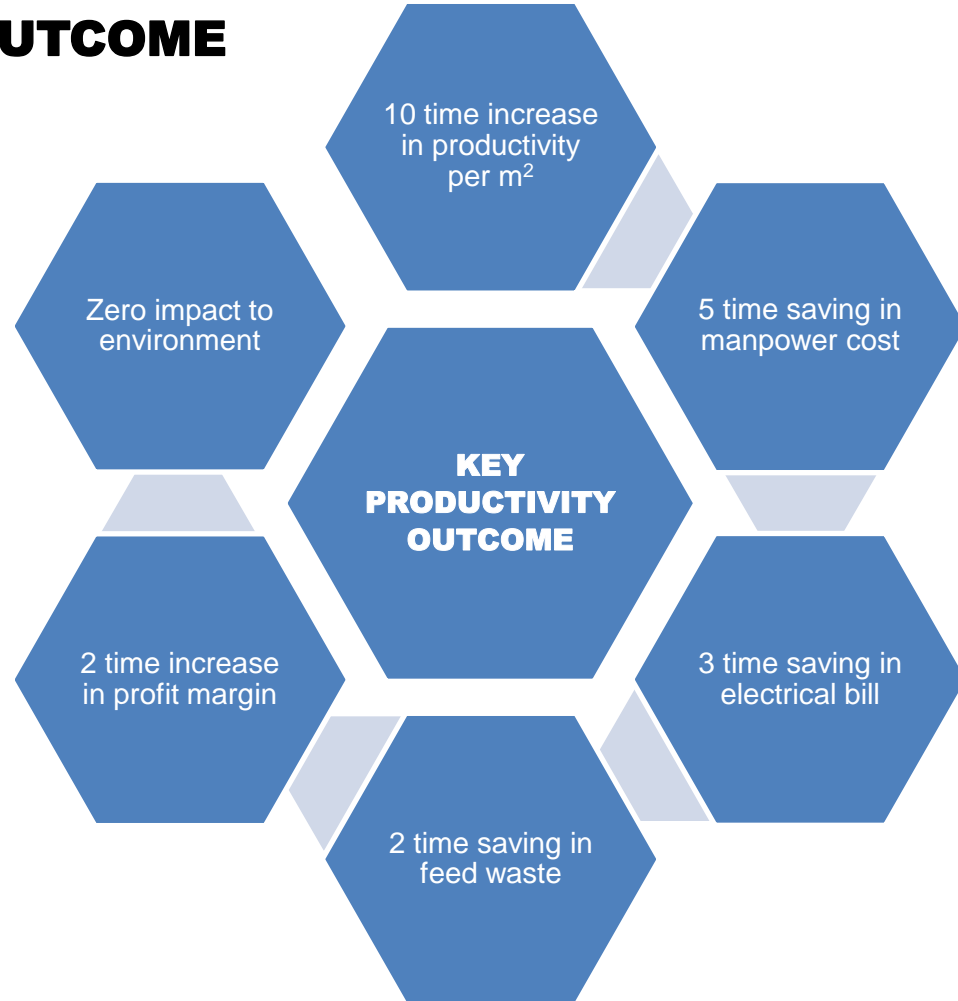
Fish Extract/Harvest System

(Maximize Output)

- Optimum harvesting time is based on fish species data base
- Soft material is used for interconnection pipe to transfer fish from Unicell to fish tank truck
- Our automated harvesting system is designed to stimulate fish moving in nature pattern with minimum stress on fish during transfer and protect fish quality (fish skin)



KEY PRODUCTIVITY OUTCOME



COST COMPARISON FOR TRITECH ECO-FRIENDLY AUTOMATED UNICELL FISH FARM CONCEPT

Item	Land Based RAS	Open sea Based	Tritech Unicell
Land cost	High	No (license fee)	Low
Structural cost	Low (outdoor)	High (cage system)	Medium
System cost	High (RAS)	Low	Medium
Maintenance cost	Medium (RAS)	High (cage system)	Low
Power consumption	High (RAS)	Low	Medium
Operation cost	High (antibiotic, water)	High (algae, sea lice, safety, mortality, escape)	Low
Logistic	Medium (from farm to city)	High (transfer from sea to land)	Low
Insurance/Risk cost	Medium	High (climate issue, risk)	Low



Contents lists available at ScienceDirect
Aquacultural Engineering
journal homepage: www.elsevier.com/locate/aquaengin



Comparative economic performance and carbon footprint of two farming models for producing Atlantic salmon (*Salmo salar*): Land-based closed containment system in freshwater and open net pen in seawater
Yajie Liu^a, Trond W. Roatzen^a, Kristian Henriksen^a, Erik Skontorp Hognes^a, Steve Summerfelt^b, Brian Virdi^c
^a STERIS Fisheries & Aquaculture, P.O. Box 4700, 2400 Frankfort, Norway
^b The University of Maryland System, 1000 Route 1, Poolesville, MD 21774, USA



ADVANTAGES OF TRITECH ECO-FRIENDLY AUTOMATED UNICELL FISH FARM CONCEPT

- Small footprint, could co-exist with other application activities, minimizing disruption of other uses of land or ocean space and resources
- Ensure sustainability of site, minimize environmental damages resulting from aquaculture activities (pollution, herbicides, fish sewage etc.)
- Protect native fish eco system from possible escape of non native species
- Minimize waste of feeds – feeding according to appetite
- Minimize/ no use of drugs (antibiotic, hormones etc.) on fish (organic fish is possible)
- Minimize the mortality rate and lost profit due to natural predators
- Free from climate issues (operation safety, harvesting anytime)
- Low maintenance cost, structure free from corrosion issue, net cleaning activities
- Low carbon foot print
 - for logistic (could setup near city area, close to market)
 - for power consumption

A HOLISTIC, SUSTAINABILITY AND RESILIENCE SOLUTION FOR FOOD SUPPLY

- **Food Security**
 - Able to achieve local supply needs
 - Robustness design ensure sustainable supply under emergency situation
- **Productivity**
 - Per m³ stock density able to achieve the optimum level
 - Per m² increase the productivity by 10 time with 10 level of Unicell
- **Land Saving**
 - Land saved could use for other farming activities
- **Environmental Risk Management**
 - Water resource protection
 - Pollution prevention of air, water and land
 - Eco-system protection
- **Urbanized Farming**
 - Co-exist with other urban activities
 - Reduce carbon footprint



TRITECH 'S PATENTED FISH FARMING SYSTEM IS A MORE SUSTAINABLE SOLUTION FOR SINGAPORE'S 30 BY 30 VISION

- **Volume**

- Multiply the yield rate/meter square :

Eg., for the same volume, we will have higher yield rate as the automatic monitoring system offers real time feedback and prompt remedies to pre-empt issues.

- Multiply the yield rate/meter square :

Eg., for a eight layers Unicells, we have at least 8 times the productivity for normal fish farming on current available land.

- **Variety**

- Multi depth species aquaculture within a single setup

Eg., our automatic eco-friendly Unicells can simulate different fishing environment of either varying sea depths, or different water types i.e. river fresh water or sea water.

- Multi type aqua products to meet local market demand

Eg., the application of Unicells is able for us to produce different fish specifiers e.g. fish, prawns in different Unicells.

- **Value**

- Fishes are grown organically;
- Fish cultured can match or lower than the prices of the oversea imports due to higher productivity and lower Opex cost;
- Eco-friendly for Singapore environmental protection

Tritech Environmental Group

A Subgroup with One Stop Services
in Water and Environmental Protection in China



Group Structure



Vision and Mission



Vision:

Target to be one of the largest service providers in the Asia for water and environmental protection

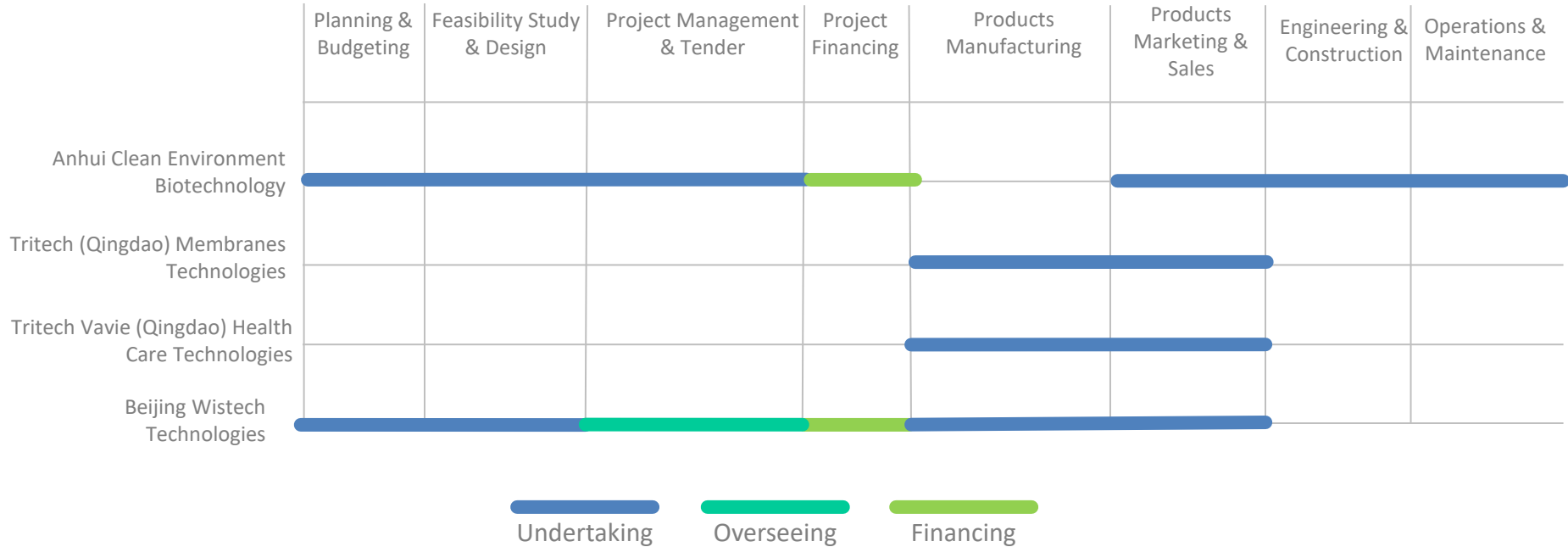


Mission:

- Become one of the largest membrane manufacturer in the region;
- Provide one stop service platform in waste water, water recycling and supply in China;
- Provide environmental protection services to China
- Become a services platform to China market for all Trittech's services and products.

Project Workflow

A full span of services in Water & Environment



Membrane Products and Technologies

Hollow Fiber Membrane Modules and Spiral Wound Membrane Elements

PoroMax™ TIPS Hollow Fiber UF



- NSF certified for potable use.
- High strength with long life span.
- For NEWater and sewerage desalination pretreatment.



PermaMax™ Reinforced Hollow Fiber MF/UF



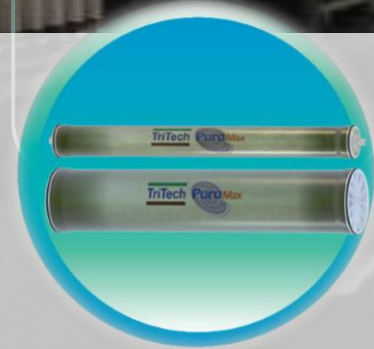
- Low energy with BubbleMax™.
- High quality filtrate with turbidity <0.2NTU.
- For wastewater treatment and used water recycling.



PuroMax™ Reverse Osmosis Element

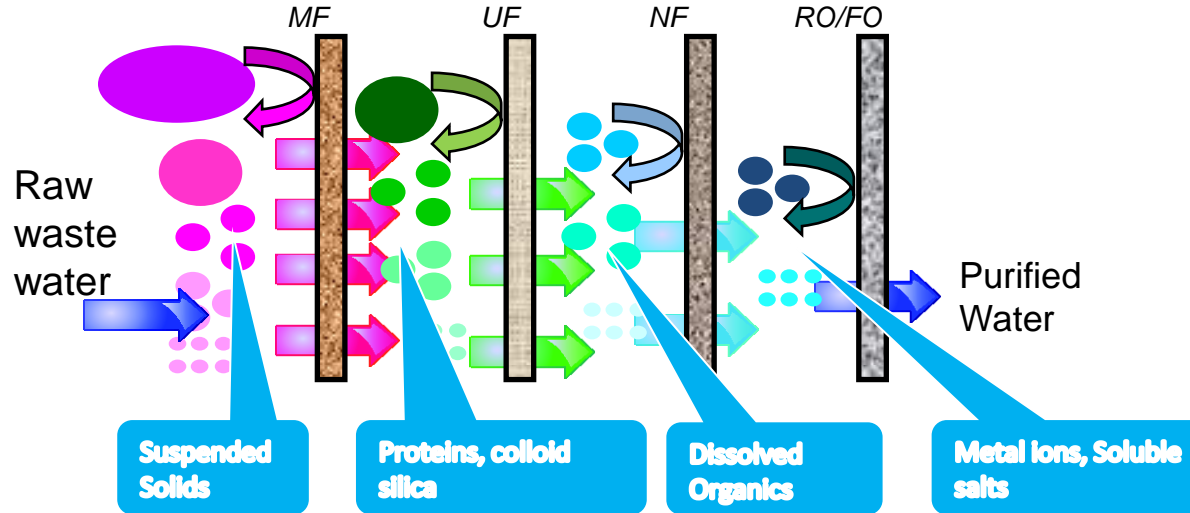


- Wide range of products to suit your applications.
- Cost effective options.
- For brackish water desalination and pure water production.



Membrane Introduction

Membrane is the latest technology in water treatment, which can filter out pollutants/contaminants of all sizes.



Types of Membranes:

Microfiltration(MF) (10 μ m – 100nm)

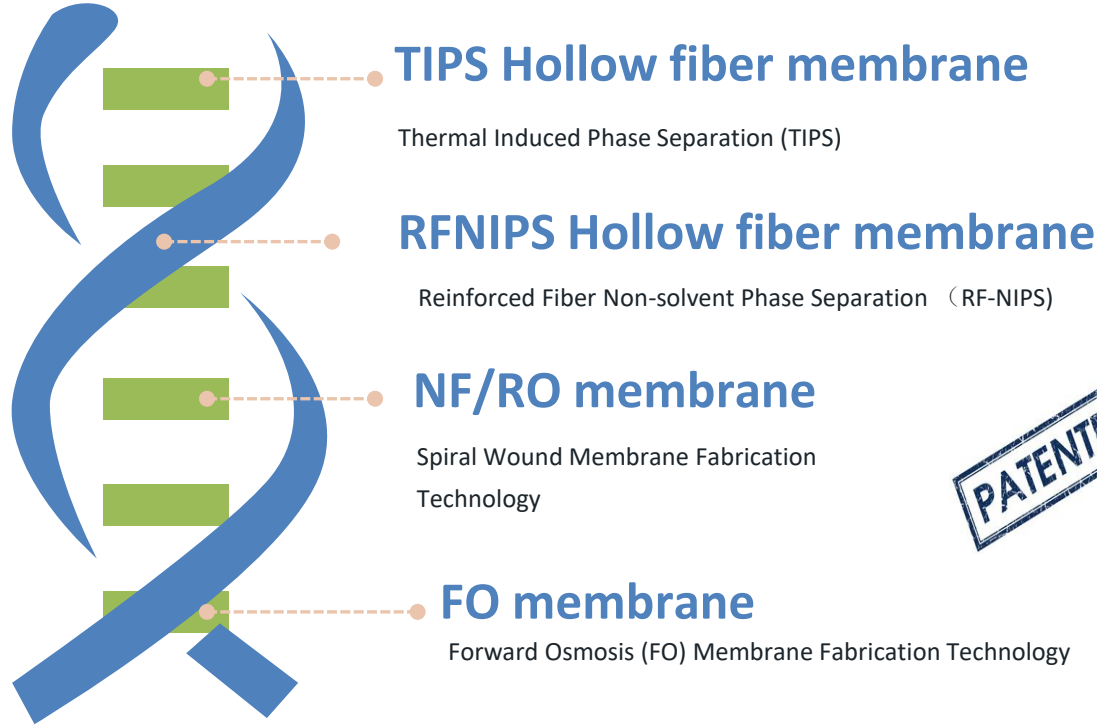
Ultrafiltration (UF) (100nm -10nm)

Nanofiltration (NF) (10nm -1nm)

Reverse Osmosis (RO) (<1nm)

Forward Osmosis (FO) (<1nm)

Tritech Membrane Core Technologies (Patented)



Advantages of Trittech Membrane Products

	Trittech	Competitor B
Type	MBR	MBR
Material	PVDF	PVDF
Process	TIPS	TIPS
Strength	~1.0 kg.f	~1.0 kg.f
Structure	3D mesh	3D mesh
Size	0.1μm、0.2 μm、0.4 μm	0.1μm
Distribution	Narrow	Narrow
Flux	<32LMH	<32LMH
Price	Medium	High

Trittech Membrane is of **High Performance-Cost Ratio** compared with any other similar products in the world.

Registered Trade Mark:

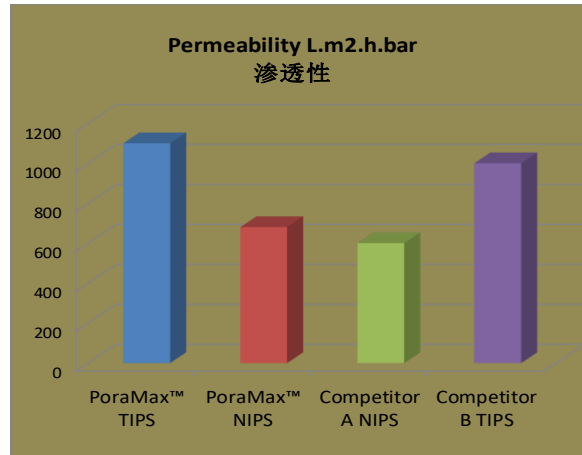
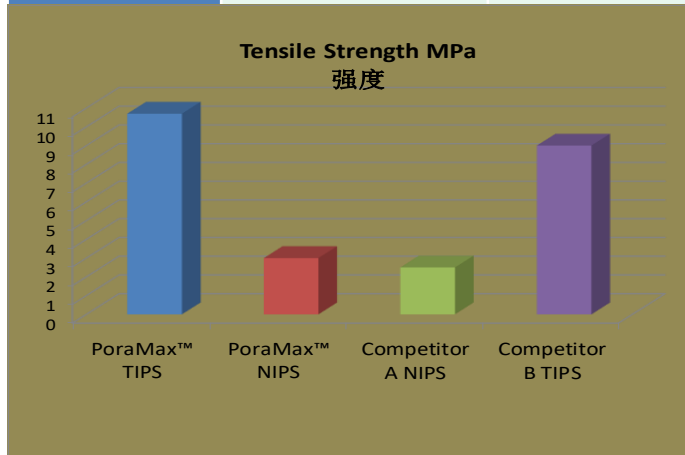
Trittech®
PoraMax™
Ultrafiltration



Trittech®
PermaMax™
Membrane
Bioreactor (MBR)

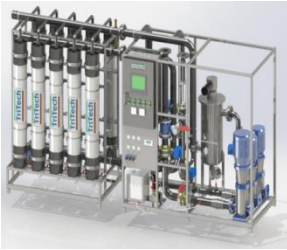


Trittech®
PuroMax™
Low Pressure
Reverse Osmosis



Membrane Related Equipment and Technologies

iCMF Series



Product: Continuous Membrane Filtration System using Ultrafiltration

Benefit:

- High-quality water production (Turbidity<0.1NTU, SDI<3, TSS <1 mg/l)
- High removal efficiency of pathogens
- High recovery rate up to 96%
- Fully automatic touch screen PLC operation

iRO Series

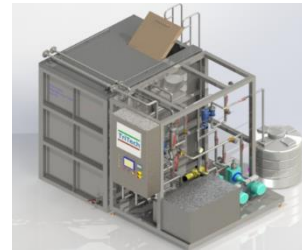


Product: Reverse Osmosis System for Pure Water Production

Benefit:

- High quality (cond. less than 10 μ s/cm)
- High salt rejection rate
- Stable water output
- Low energy consumption
- Fully-automatic operation system

iMBR Series



Product: Compact Membrane Bioreactor

Benefit:

- High quality output to meet more strict discharge criteria, even for direct reuse
- Land saving 70-80% compared to traditional treatment plant
- Minimum sludge, cost saving for sludge treatment and disposal
- Fast delivery and installation
- Low energy consumption

iDES Series



Product: Seawater Desalinator for potable use

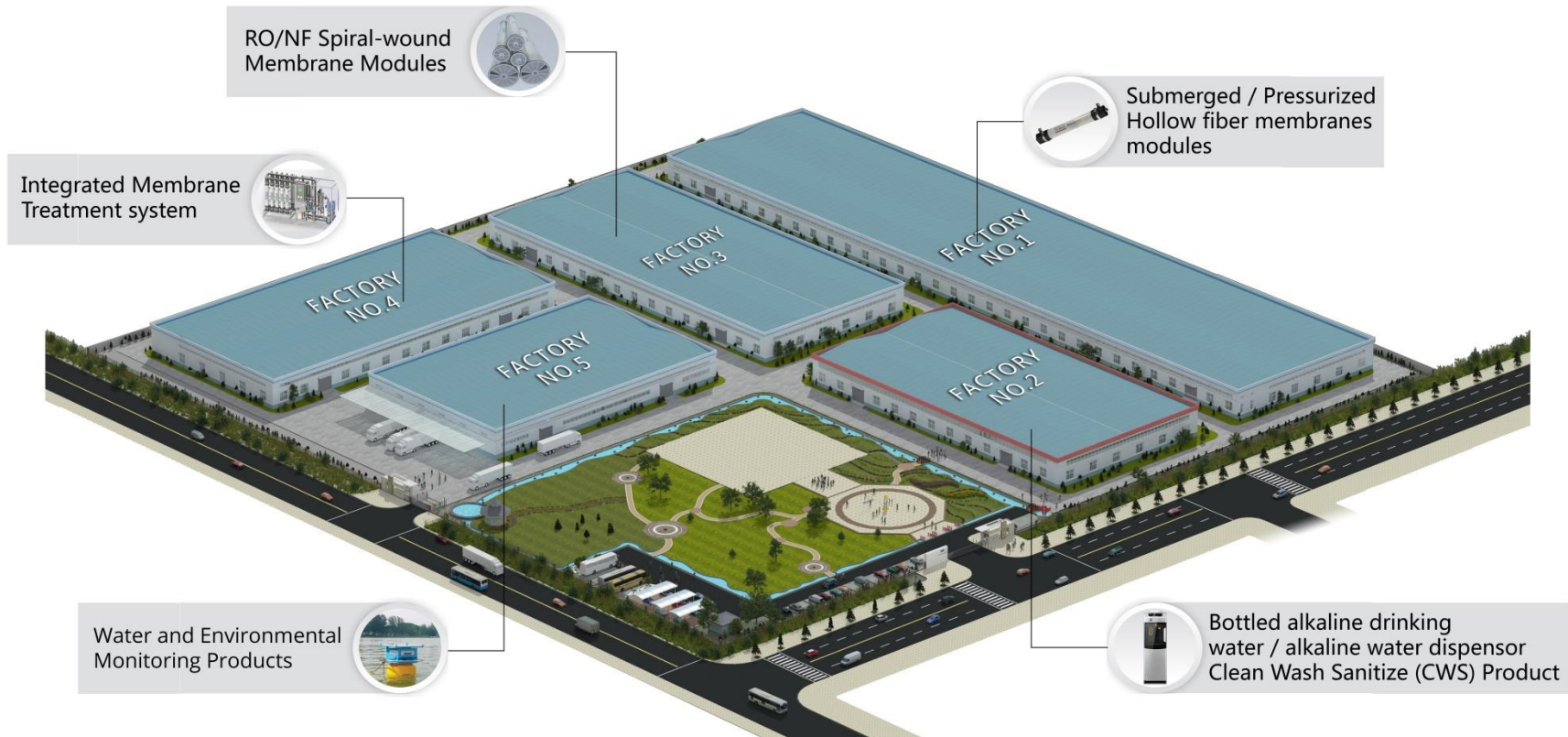
Benefit:

- Compact design
- Light weight
- Automatic operation
- Convenient maintenance
- Suitable for different capacity processing (400L~10,000L/day)

- Standard pre-engineered modular design
- Containerized solutions

Membrane and Vavie Water Products Manufacturing Base in China

Qingdao, China



One Stop services for Waste Water Treatment



- Capability to provide one-stop services from design & construction to operation & maintenance of water plants, sewage treatment plants, water reclamation plants and seawater desalination plants.
- Trittech has world-class underground engineering technology, and integrate water treatment project and underground engineering together to solve the land shortage issues for metropolitan waterworks.

Engineering Services For All Kinds of Water Treatment Demands

NEWater



- Pillar of Singapore's water sustainability strategy
- High-grade reclaimed water
- Three stages filtration:
 - MF + RO + UV sterilization

Municipal Water / Wastewater / Desalination



- Utilizing state-of-the-art membrane technologies
- Flexible contractual agreements and financing options
- Smart treatment plants with AI to optimized process control to achieve savings

Industrial Wastewater



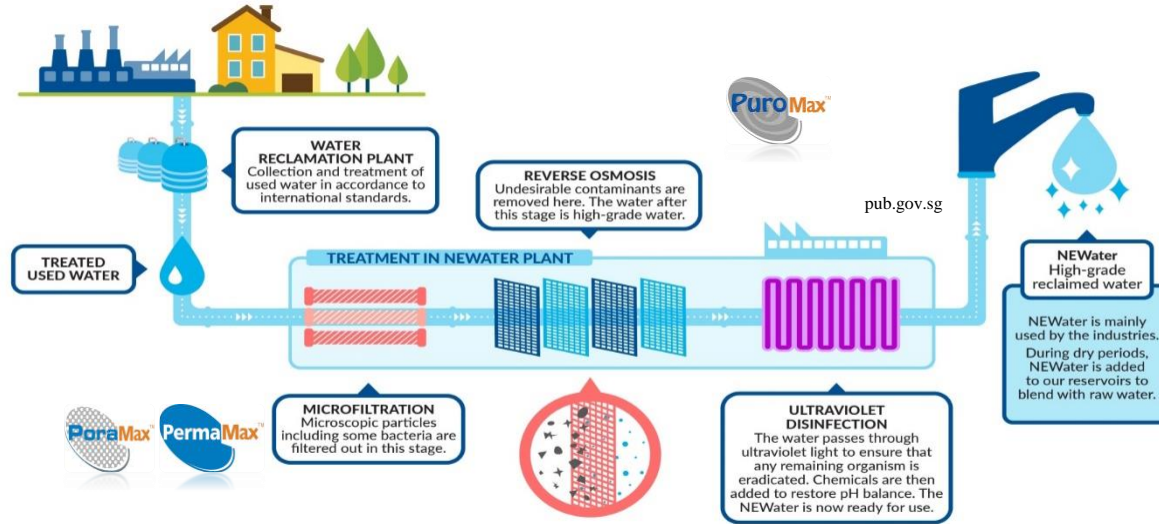
- Specialist in treating high BOD/COD wastewater
- Retrofit and upgrade of existing plant to comply with discharge regulations
- Customized treatment solutions

Rural Water / Wastewater



- Specialist in development of ease-to-use water / wastewater treatment system for small communities
- Provide flexible and advanced integrated system solution with various treatment techniques
- Remote monitoring

NEWater Technology



Membrane treatment processes are adopted in NEWater factories.

Tritech can provide high-quality membrane for NEWater production, including PermaMax™ and PoroMax™ microfiltration / ultrafiltration hollow fiber membrane modules, and PuroMax™ reverse osmosis membranes.

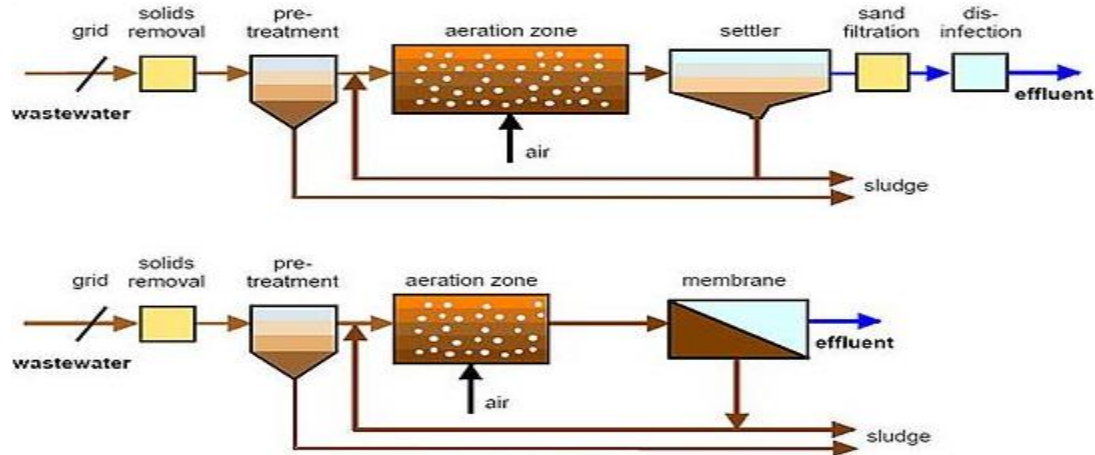
Municipal Wastewater Treatment Technology

Tritech can provide a comprehensive solution for municipal wastewater treatment. Tritech has been producing MBR membranes, providing professional design experience and engineering capabilities for more than ten years. Tritech has design, consulting, construction, installation, operation and management qualifications and all-rounded capabilities.

With an emphasis placed on global wastewater treatment with discharge requirements and stricter discharge requirements, Tritech has excellent advanced MBR wastewater treatment technology that can meet and guarantee wastewater treatment and discharge requirements. At the same time, MBR's high-quality effluent can meet general industrial or miscellaneous water standards.

Water Discharge Standards	COD _{Cr}	BOD ₅	NH ₄ ⁺ -N	SS	TN	TP
GB18918-2002	50	10	5	10	15	0.5
GB3838-2002 IV	30	6	1.5	--	1.5	0.3
NEA EPM-2008 (Controlled Watercourse)	60	20	--	30	--	2
MBR	30	6	1.5	5	10	0.3

Municipal Wastewater Treatment Technology



Compared to the conventional treatment, the MBR treatment plant covers an area of only 40-50% of the conventional treatment plant. At the same time, the quality of water discharged is compliant to the required standards. Trittech's manufacturing base in Qingdao is able to provide high-quality PermaMax™ membrane products for this solution. The membrane product adopts the current advanced reinforced RF-PVDF membrane, and the turbidity of the water can be $<0.1\text{NTU}$, which meets the strict standard of California Title 22.



High Concentration Industrial Wastewater Treatment Technology

- Anaerobic Treatment Technologies

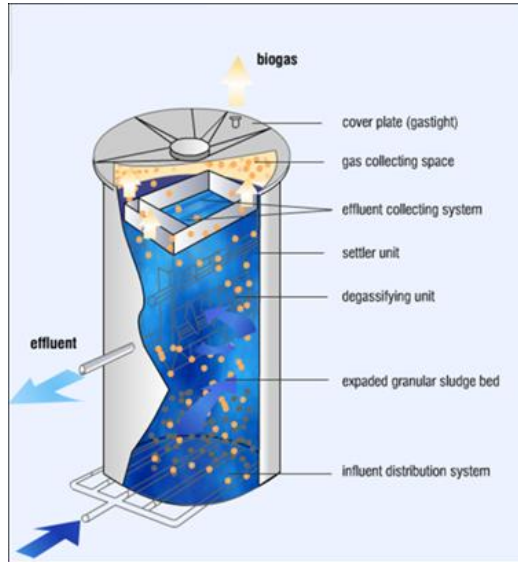
Tritech Environmental Group is a leader in medium and high concentration industrial wastewater treatment. The group has processed more than ten years and hundreds of industrial wastewater treatment projects with internationally leading anaerobic water treatment technology, which is an advanced technology developed in the past decade and effective for high-concentration industrial wastewater treatment. Tritech partakes in projects in the beer, wood and other special industries, occupying a big market share. Tritech is an integrated company with design, consulting, construction, installation, operation and management qualifications and capabilities.



High Concentration Industrial Wastewater Treatment Technology

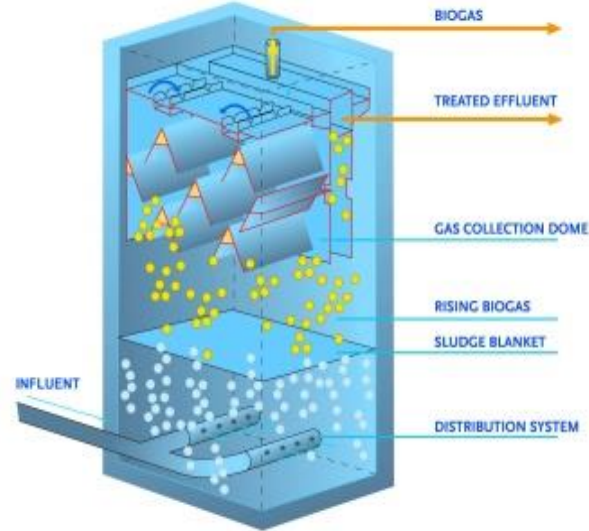
- Anaerobic Treatment Technologies

Environmental Group has industry-leading technology of anaerobic treatment process for high concentration industrial wastewater. This technology is energy saving and can recycle by-product methane generated during treatment. With our patented process technology, our group has successfully implemented hundreds of industrial wastewater treatment projects that are widely acclaimed in the industries.



EGSB Bio-reactor

*EGSB:Expanded Granular Sludge Bed



UASB Bio-reactor

*UASB:Upflow anaerobic sludge blanket

Advanced Environmental Protection Services

– Innovative Solution for Sustainable Water Supply



Since 2000, Singapore has used NEWater obtained by membrane treatment of wastewater, while 94% of NEWater is supplied to industries as high-grade clean water, 6% is mixed into our reservoirs and supplied as municipal potable water after waterworks treatment. Currently, there are 4 large-scale NEWater plants in Singapore, supplying 40% of Singapore water consumption.

China is one of the 13 water-shortage countries in the world. Of the 660 cities, 410 have water shortages and 110 are severely water-stressed cities. 300 million people nationwide do not have good quality potable water. The cost of NEWater through membrane treatment is lower than the cost of fresh water obtained from south-to-north water transfer in Shandong, Beijing and Tianjin, which allows for wider application and a bright market prospect for membrane used in water treatment and recycling.

Advanced Environmental Protection Services

– A Comprehensive Solution



iMBR integrated sewage treatment system:

Integrated Membrane Bioreactor, referred to as iMBR, is an integrated MBR high-efficiency point source wastewater treatment equipment independently developed by Trittech.

Product features:

1. There are many types of treatment capacities, a wide range of applications, and highly targeted;
2. It has the characteristics of modularity, smart management, convenient transportation, fast installation, high efficiency and energy saving;
3. It is suitable for various small and medium-sized decentralized domestic and industrial organic wastewater treatment.

Trittech can provide one-stop design, manufacturing, construction, installation, and operation services, providing complete and professional solutions.

Conclusions and Remarks

- ❖ Tritech Group is a leading player having two unique business segments of smart urban development and water & environmental protection in both Singapore and China markets.
- ❖ These two unique business segments have a very strong complementarity in nature, which can effectively generate synergistic effects.
- ❖ Tritech Group has a huge market potential and is a prosperous business platform, but it faces marketing and capital challenges.
- ❖ Tritech shall generate prosperous financial returns and great strategic benefits.



COOPERATION FOR A BRIGHT FUTURE !

携手三泰 共赢未来 !