

This webinar seeks to provide a better understanding of how R&D supports water technology deployment when partnering EWTCOI

WELCOME

Fostering WATER Technology Partnership

27 August 2020, Thursday
4:00pm – 5:00pm

Programme

Time	Agenda
4.00 - 4.02 pm	Opening & Housekeeping
4.02 - 4.10 pm	Welcome Address by Dr Chen Chia Lung, SWA/EWTCOI
4.10 - 4.35 pm	Multiple Supports from EWTCOI by Dr Jason Tang, EWTCOI
4.35 - 4.50 pm	Developing Super Hydrophilic Water Filtration Membrane with EWTCOI by Mr Pung CT, Firmbase
4.50 - 4.55 pm	Q & A
4.55 - 5.00 pm	Closing

Housekeeping

- ✓ To ensure a smooth webinar, please mute your microphone and turn off the camera. You may communicate with us after the webinar.
- ✓ Please share your questions in the chat where we will try to provide answers where possible in the Q & A Segment.
- ✓ Do identify yourself so we can respond to any unanswered questions after the webinar
- ✓ We will be recording this webinar session and reserve the rights to the video
- ✓ Please complete a post event survey which upon return, we will forward the recording and presentation deck to the respondents.

Disclaimer

- ❖ All information in this webinar is for general information only and does not contain or convey any legal advice or administrative assistance.
- ❖ Information shared today is true and accurate as of publication date.
- ❖ SWA and EWTCOI reserve all rights in the provided materials

Multiple Supports from EWTCOI



Dr Jason Tang

EWTCOI

Director

Dr Jason Tang, has been with EWTCOI for more than 10 years supporting technology development in the area of environment and water technology. Trained as a molecular biologist under ASTAR's Institute of Molecular and Cell biology, he has moved on to develop a unique 20 year background in multiple forms of research (basic, clinical & translational) as well as business development and strategic planning providing EWTCOI's clients with unique advantages.

Developing Super Hydrophilic Water Filtration Membrane with EWTCOI



Mr Pung Choong Theng

Firmbase Pte Ltd

Founder

Mr Pung Choong Theng (CT) is the founder of Firmbase Pte Ltd which was started in 2011. Firmbase focuses on development opportunities in advanced polymeric materials to meet the growing needs on water, energy, and infrastructure and has been advancing on new generation of hydrophilic additives for polymeric water filtration membranes. Prior to his venture, CT has worked for a Global Fortune 500 Company in the Specialty Chemical industry for over 20 years with extensive senior management experiences in Asia Pacific Business Leadership and Operations Management.

Welcome Address

SWA Webinar : Fostering WATER Technology Partnerships
27 August 2020



Dr Chen Chia Lung

**Singapore Water Association
Council Member
EWTCOI, Deputy Director**

SWA Initiatives

Since April 2020

SWatch !



SWAssist



SG United Updates



SWA Marketplace Assist Platform (SWA-MAP)

Multiple Supports from EWTCOI



Dr Jason Tang

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EWTCOI

NGEE ANN POLYTECHNIC

27 Aug 2020

Dr Jason Tang
Director, EWTCOI



**Enterprise
Singapore**



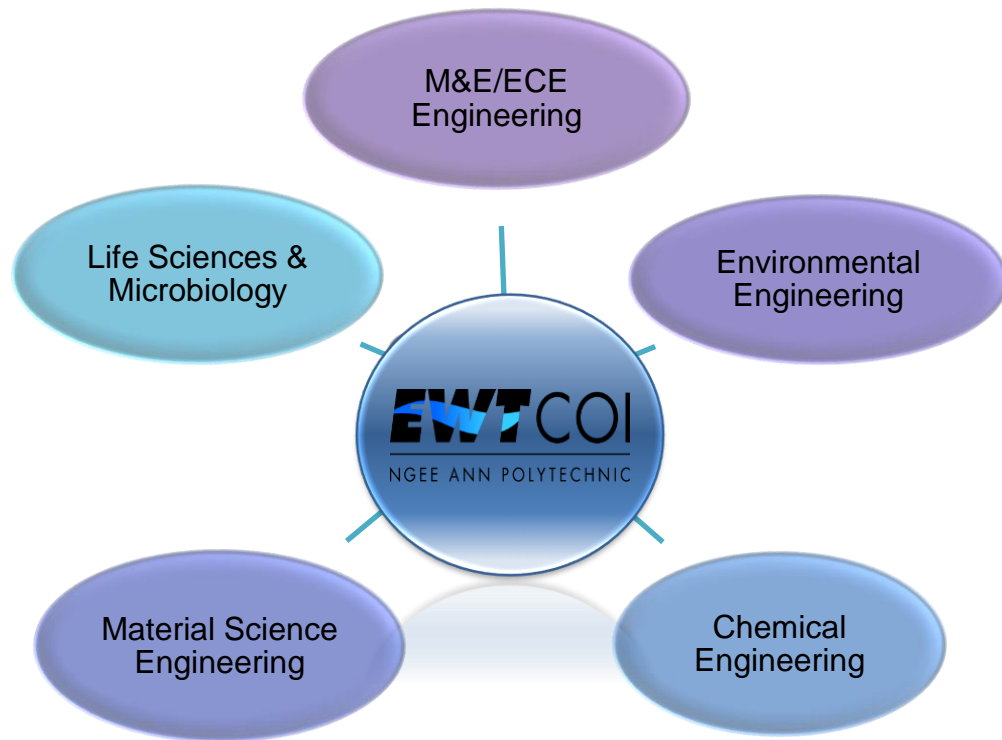
An ESG-NP Partnership Since Oct 2006



Today's Innovations for a
Sustainable Tomorrow

Our Capabilities

Core Capabilities



Technology Domains

Membrane Development & Applications

Energy Efficiency Management

Sustainable Materials & Resource Recovery

ABOUT US

>\$20M

Worth of
Projects



>400

Consultancy,
R&D projects

EWTCOI

NGEE ANN POLYTECHNIC

Since 2006

INDUSTRY
ENGAGEMENT

14

Patents

15

Laboratories and
Workshops



>1000

Industry Contacts
Engaged



78%

Industry partners
are SMEs

25

Multi-disciplinary
staff

>20

Knowhows
and trade

TOP SECRET

Common Statements

“Can my proprietary product be made more energy efficient?”

“Can you help assess if my product can be deployed in a new area of application?”

“My manufacturing process generates some wastewater that I currently have to pay for disposal. Is there anything that can be done?”

“Do you have any technology that can I can license and generate a new revenue stream for my company?”

“Can my technology be deployed in any other applications to expand my market?”

Stepwise Water Recycling System

Treats water for reuse back into the manufacturing process

Noodle and Tofu Production

1

Save up to 20% of total water consumption and reduce discharge by up to 90%

2

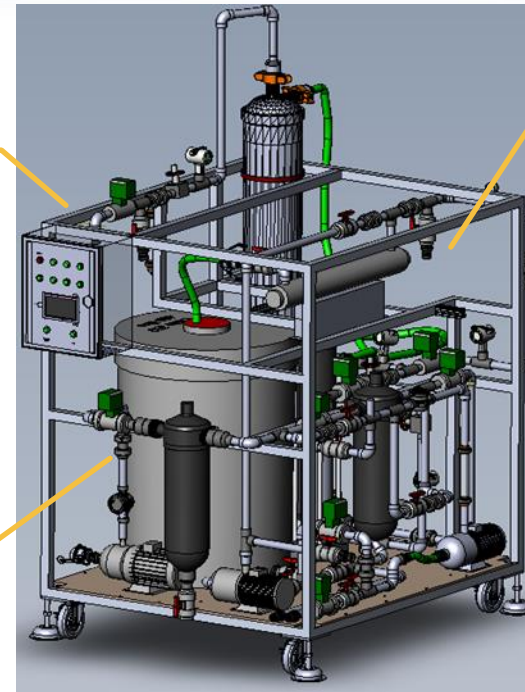
ROI as short as 6 months depending on volume and existing water tariffs

3

System is modular and micro-sized to cater for SME manufacturing scale

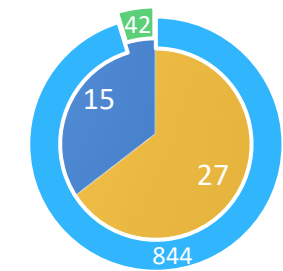
More sustainable production process with reduced reliance on PUB water

Can be deployed within 3 months



Helps SMEs meet the discharge requirements

Industry Target Market



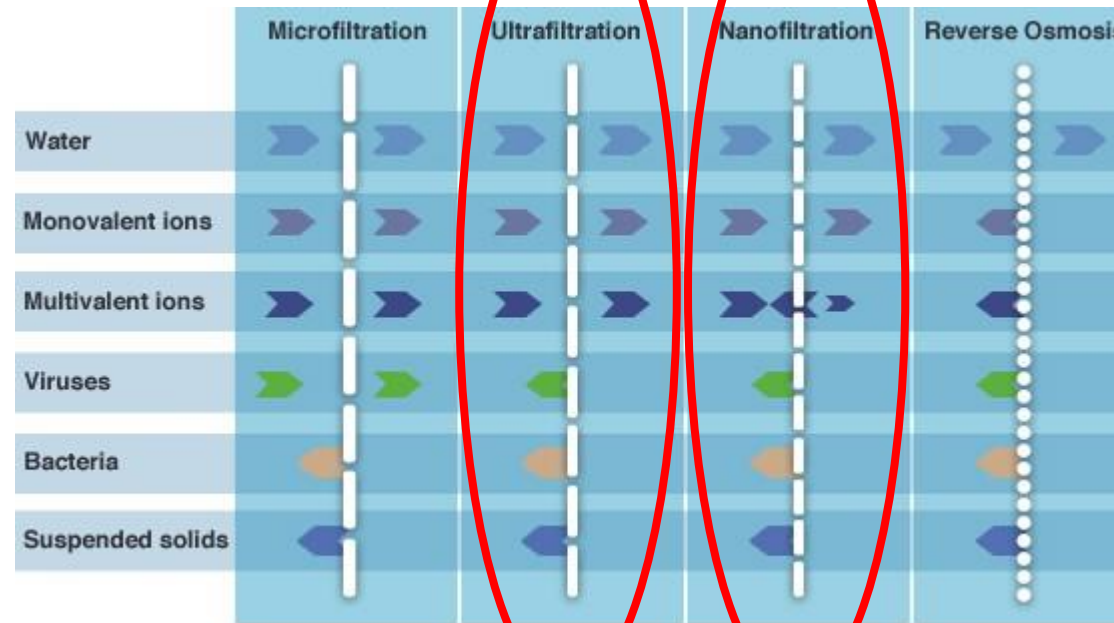
■ Noodle SMEs ■ EWTCOI SME partner

Membrane Development

WO 2016/171615 - Graphene-based membrane and method of producing the same
WO/2016/171622 - Functionalized Single-Layer Graphene-based thin film composite and method of producing the same
Patent Pending - Fast And Easy Synthesis Of Graphene Oxide In Large Scale And Method Of Producing The Same



APPLICATIONS

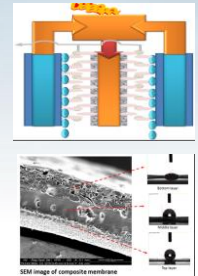


© Membrane Center

Product Recovery & waste minimisation

WO2013151498 A1- A Vacuum Air Gap Membrane Distillation System For Desalination
WO2013074040 A1- A Triple Layer Hydrophobic-hydrophilic Membrane For Membrane Distillation Applications

TRL 4-5



Desalination

DiStil™



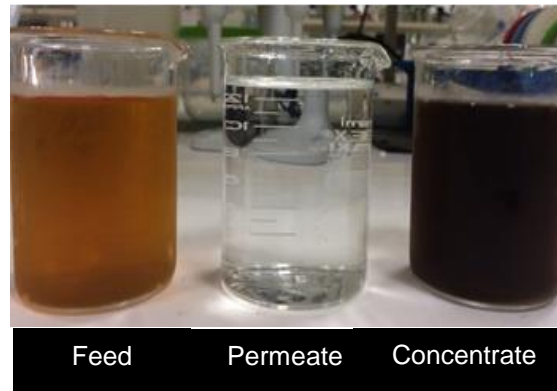
Demo Plant 1000-5000L/day
@ Marina Barrage



Portable System 10-50L/day

Fertiliser Recovery

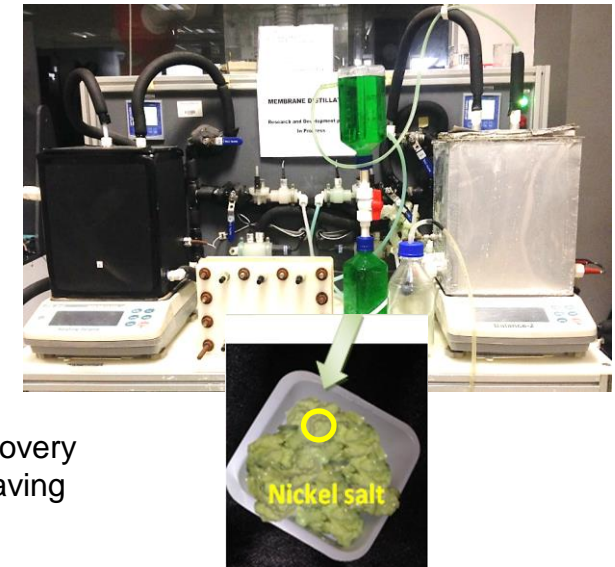
周 Chew's 氏



Up to 90% water recovery
Up to 40% energy saving

Electroplating

华利企业私人有限公司
Q & M ENTERPRISES PTE LTD



Industrial Innovations

Development of Soft Shell Crab Molting Detection System

Automated car washes with on-site water recycling

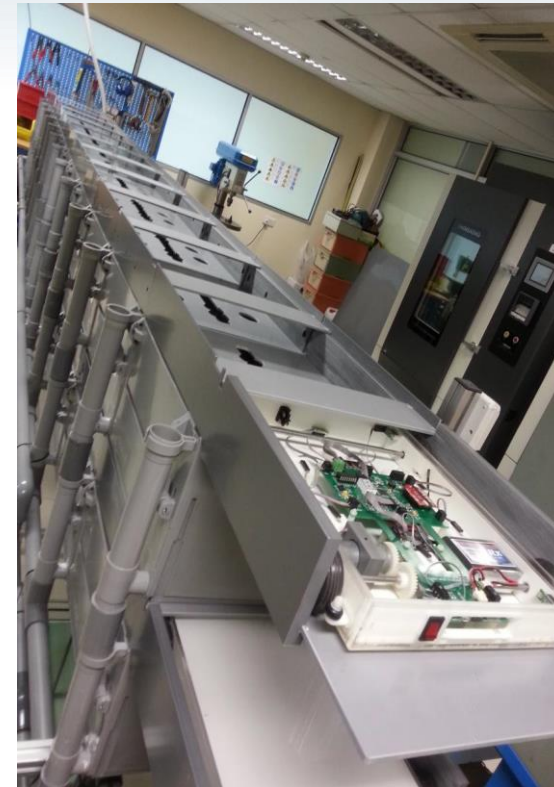


HOCK CHEONG AUTOMAC PTE LTD

Laundry rinse water recycling



NKH BUILDING SERVICES PTE LTD

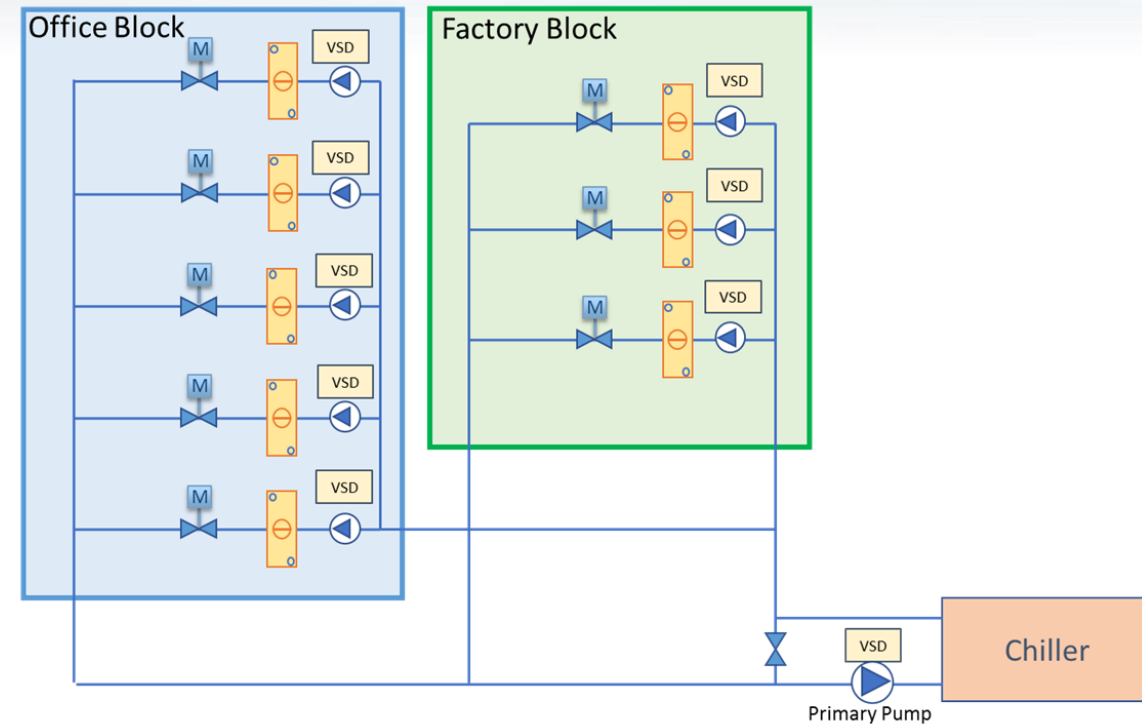


APOLLOAQUARIUM
SINGAPORE

- Electronics & Controls
- Image Processing
- IT
- Artificial Intelligence

Distributed Pumping System (DPS)

Demo Site: Grundfos Singapore



Pump

55%

Chiller

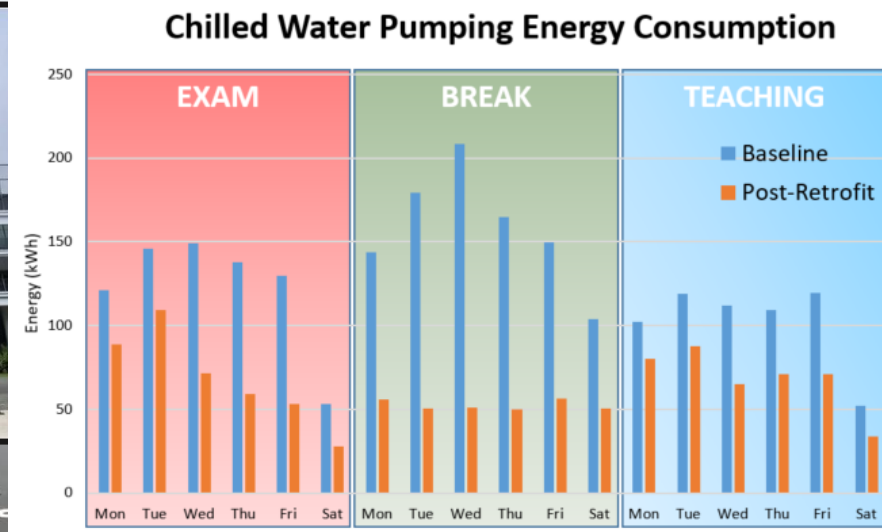
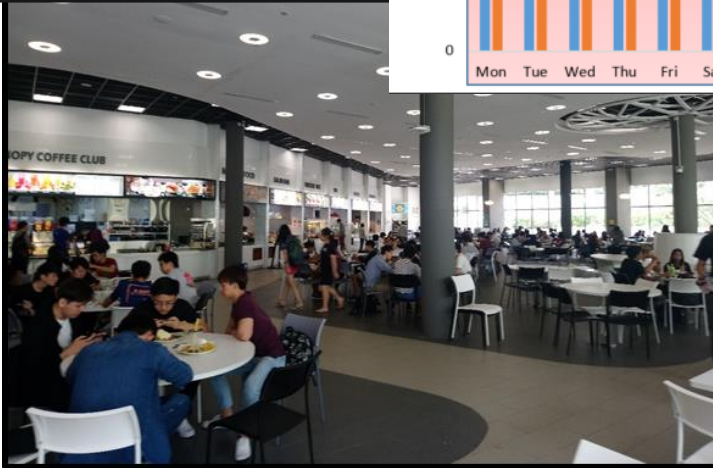
12%

**Chiller
Plant**

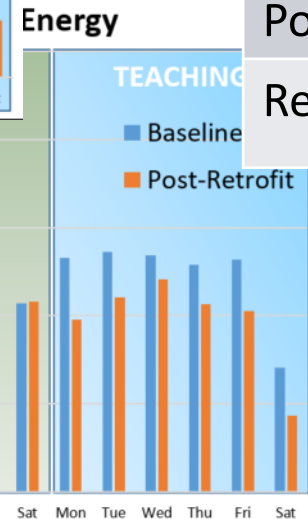
17%

Distributed Pumping System (DPS)

2ND DEPLOYMENT SITE @ BLK 22



Baseline (kwh)	2,300
Post-Retrofit (kWh)	1,131
Reduced	51%



Baseline (kwh)	240,597
Post-Retrofit (kWh)	202,276
Reduced	16%

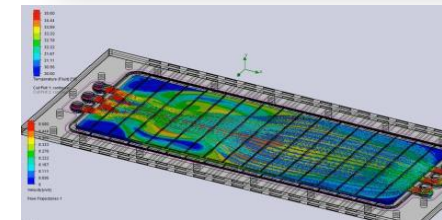
Annual Reduction of CO2 Emission = 62,569 kg

Membrane Evaporative Cooler (MEC)

E201801160153R (Provisional License) - Membrane based evaporative cooler for replacement of cooling tower and producing the same

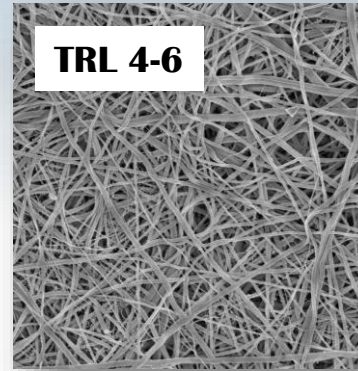


SCALE UP TESTING



Airborne Decontamination

**WO2013158028 -
Filtration Medium
With Electrospun
Metal Oxide
Nanofiber Layer**



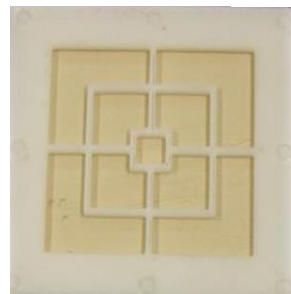
- Bacterial disinfection
- Detoxification of biological and chemical agents
- Tested with paraxon, a nerve agent
- 99% filtration efficiency
- Good breathability

APPLICATIONS

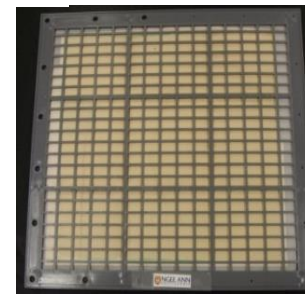
TRL 6-7



Face mask



Car filter



Aircon filter



Cartridge filter

Services

Tier 1

- Facility-use

Tier 2

- Fixed service package

Tier 3

- Consultancy project

Tier 4

- Contract research

Our Partners



NKH BUILDING SERVICES PTE LTD



ANXON ECO HOLDINGS PTE. LTD.

LINOVA WATER SOLUTIONS PTE. LTD.



ANXON ENVIRONMENTAL PTE. LTD.



SMITECH (ASIA) PTE LTD

GLW Oil Purifier Pte. Ltd.



ANXON ENVIROTECH PTE. LTD.



PISCAN TECHNOLOGIES PTE LTD

ING-ENERGY EPC PTE. LTD.

Circuits-Base Chemicals Pte Ltd



Pioneer Environmental Technology Pte Ltd
—Pioneering Environmental Solutions



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Environmental & Water Technology Centre Of Innov...

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About us

The Environmental & Water Technology Centre of Innovation (EWTCOI) was set up in October 2006 as a strategic collaboration between SPRING Singapore (SPRING) (now known as Enterprise Singapore) and Ngee Ann Polytechnic (NP). Its mission is to partner strategic industry sectors in applied R&D and consultancy projects to translate ideas into practical solutions or innovations for a sustainable environment.

Recent update

 **TechForum 2**
Catalysing Business Through Par



Developing Super Hydrophilic Water Filtration Membrane with EWTCOI



Mr Pung Choong Theng

Firmbase Pte Ltd

Founder

Mr Pung Choong Theng (CT) is the founder of Firmbase Pte Ltd which was started in 2011. Firmbase focuses on development opportunities in advanced polymeric materials to meet the growing needs on water, energy, and infrastructure and has been advancing on new generation of hydrophilic additives for polymeric water filtration membranes. Prior to his venture, CT has worked for a Global Fortune 500 Company in the Specialty Chemical industry for over 20 years with extensive senior management experiences in Asia Pacific Business Leadership and Operations Management.

Developing Super Hydrophilic Water Filtration Membranes with EWTCOI

Presented by CT Pung

Email: cpung@firmbase-group.com

Agenda

1. Introduction to Firmbase Pte Ltd
2. Examples of Collaboration
3. Share Learning

Introduction to Firmbase Pte Ltd

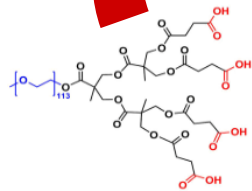
FIRMBASE Private Limited

- **FIRMBASE** was established 2011 in Singapore
- **Mission:**
 - to explore development opportunities in advanced materials to meet the growing needs on water, energy, and infrastructure.

Collaborations With EWTCOI

Challenges from Technology Concept to Product Scale-up

Application of
new Highly Hydrophilic
Polymer to Membranes



- ✓ Energy-saving
- ✓ Higher water flux
- ✓ Lower downtime

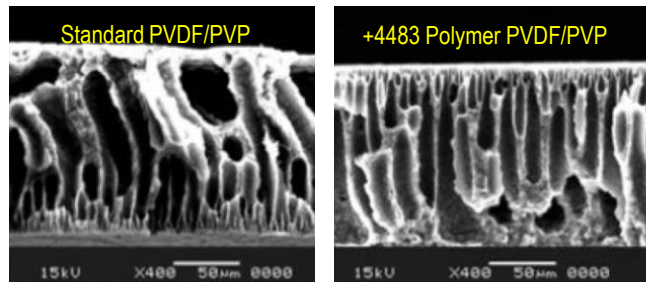


- Many market unknown
- Lack technical expertise
- Lack resources
- Lack IP protection coverage
- Relatively long journey
- High investment

ONE Dendritic Hydrophilic Polymer Enhanced Membrane

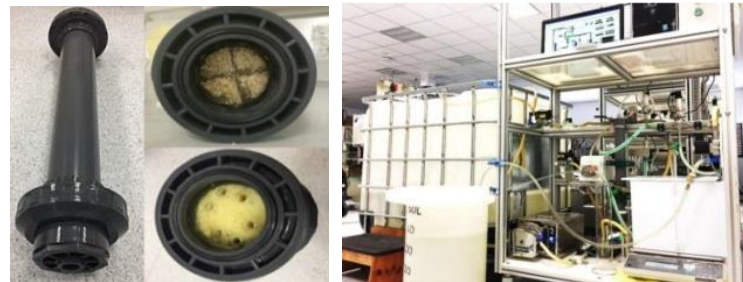
Developed a proprietary polymer based PVDF UF membrane with **improved anti-fouling and >25% lower operating pressure**, reducing operating energy costs.

Proof of Concept



- Good anti-fouling
- No leaching
- Lower Surface Contact Angle
- Even Pore Size

Validation in Pilot Environment



- Lower TMP – lower operating pressure
- Higher filtration efficiency
- Lesser backwash requirements
- Reduced membrane downtime

Scale-up



- **In progress**
 - Modules for customer trials
 - Production Parameters
 - Training and Education

TWO

Licensed Oil-Water Separation Membrane

License Technology

- Licensed super hydrophilic polymer and membrane technology that handles **10X higher concentration (100ppm)** of oil for oil-water separation.

Scale up polymer technology

- **Near completion**
 - Develop production-scale polymer process with support from EWT COI.

Trial on membrane

- **Starting soon**
 - Complete polymer production process.
 - Customer trial on membrane application.

Share Learning

Share Learning

- Collaborative power – Institution, Industry, Government
- Clear and Agreed Goals that the collaboration aim to deliver
- Know what you are in for: Expertise, Resources, Time
- Adjust to Market, new finding or dynamic change
- Commitment, no hands-off and make the calls

Overcoming the Technology Valley of Death

Our Journey with EWTCOI In Summary

YOU HAVE MADE CLEAN WATER,
WHAT'S NEXT?

SUPER HYDROPHILIC MEMBRANES

Improve Anti-fouling.
Lower Operating Pressure.
Higher Clean Water Flux.



At FIRMBASE, we enable you

- With EWTCOI, pursues Technology Breakthroughs in **energy-saving and highly efficient** water membranes with advanced polymer technology.
- Collaborate for success through **synergy and commitment**.
- Firmbase **seeks strategic partners globally** that it will collaborate on technology, manufacturing, and marketing.
- **Special thanks to Enterprise Singapore** for the support and assistance.

THANK YOU

**WELCOME YOUR
QUESTIONS AND POINTERS**

Contact: Mr. CT Pung

Email: cpung@firmbase-group.com

Q & A

Fostering WATER Technology Partnership

27 August 2020, Thursday
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Upcoming Webinars

Unlocking the Potential of Wastewater

(The Royal Danish Embassy)

22 September 2020, Tuesday
10:00am – 11:30am

PUB BIM e-Checker Initiative

6 October 2020, Tuesday
10:00am – 11:00am

EWTCOI

NGEE ANN POLYTECHNIC

 **swa**

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Fostering WATER Technology Partnership

27 August 2020, Thursday, 4:00pm – 5:00pm

Thank You

