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A Word from the Prof…

Dear Colleagues and Friends of NEWRI,

2016 is fast coming to a close and what a year we have had.

With December closing in, it would be good to have a review of 2016 and all its glorious happenings. Throughout the year, NEWRI saw many MoUs being signed and potential partnerships forged. One significant collaboration saw the Chongqing Hualong Group – STSE Engineering Services and NEWRI coming together for an MoU opening doors to Western China. NEWRI also saw a milestone carved in R&D efforts with NTU and Hyundai Engineering & Construction officially opening the NTU-Hyundai Urban System Centre in NEWRI.

Mid-year was another very exciting time for us as the Minister for Environment and Water Resources Mr Masagos Zulkifli paid NEWRI and its laboratories a visit, coupled with the officially opening of the ST-ART centre set up to test and scale-up “separation technologies” such as large scale advanced membranes. It was as exciting as our participation in this year’s 7th Singapore International Water Week 2016 at the Sands Expo and Convention Centre (Marina Bay Sands) which saw the Waste-to-Energy Research Facility (expected to be commissioned soon) launched at CESS 2016. NEWRI at SIWW saw several MoUs and collaborations agreed with new partners, like Kiat Lee Landscape & Building, Ceraflo (Singapore) and Ramboll Environ Singapore, signalling the beginnings of our spinoffs.

Over the course of the year, NEWRI had news appearances, a bevy of official visits from various organisations, universities and agencies globally, as well as our seminars a staple for staff and students. But our heartiest congratulation to Prof Wang Rong and Prof Anthony G. Fane on receiving the Alternative Water Resources Prize at the 7th Award of the Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW) at the UN Secretary-General Mr Ban Ki Moon and Prince Khaled Bin Sultan Bin Abdulaziz (Far left) and the Minister of Water, Environment and Agriculture, Mr Abdul Rahman Al-Fadli (far right) (Page 2)

Our work continues as we enter Tranche 3 with renewed vigour, renewed direction and purpose. Speaking of revamps, we do hope you drop by our refreshed NEWRI webpage. Comments welcomed.

Last but not least, we wish you season’s greetings and have a great festive holiday! We will see you again in 2017!

Prof Ng Wun Jern  
Executive Director, NEWRI

NEWRI Update 2016

Stay Connected with NEWRI – Your Global Research & Technology Partner

SMTC’S PROF WANG RONG SCORES ANOTHER WIN

Prof Wang Rong, Chair of CEE, Director of NEWRI’s SMTC, and Prof Anthony G. Fane (absent) were presented the Alternative Water Resources Prize at the 7th Award of the Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW) by the UN Secretary-General Mr Ban Ki Moon and Prince Khaled Bin Sultan Bin Abdulaziz (Far left) and the Minister of Water, Environment and Agriculture, Mr Abdul Rahman Al-Fadli (far right) (Page 2)

WELCOMING GLOBAL VISITORS

NEWRI is no stranger to global visitors, as we hosted the Islamic Republic of Iran’s Public Relations Office who sent a delegation from various representatives. More inside (Pg 4)

NEWRI’S WEBSITE GETS A FRESH LOOK

NEWRI’s website is given a new breath! Do stop by and have a look around. NEWRI @ NTU

NEWRI ECO SYSTEM

Nanyang Environment & Water Research Institute
We caught up with Professor Wang Rong, Chair of CEE and Director of NEWRI’s Singapore Membrane Technology Centre (NEWRI-SMTC) recently, after beating 31 nominations from more than 20 countries (195 nominations from 65 countries in total). Prof Wang Rong attained the Alternative Water Resources Prize at the 7th Award of the Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW). This is the first team from Singapore to win the Prize. NEWRI congratulates Prof Wang Rong on this achievement.

Interviewer: Congratulations on your recent Alternative Water Resources Prize at the 7th Award of the Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW).

Prof Wang Rong: Thank you.

It’s understood that there were 32 nominations from more than 20 countries and this is the first time a team from Singapore to win the prize? How was that accomplished and how does it feel to be recognised as the first?

The PSIPW is a leading global scientific award for innovative and pioneering research in water-related fields. I am excited and am truly honoured to have been selected as the award recipient amongst other competitive nominees.

What were the factors that contributed to this award?

This award is accorded to our work on novel forward osmosis membrane done at NEWRI-SMTC, NTU. Forward osmosis is an emerging technology that can lead to water reclamation and recycling at lower energy intensity. Our research is driven by the need for solutions so as to reduce reliance on inadequate conventional water resources.

Could you tell us the developments so far of the novel forward osmosis hollow fibre membrane?

My colleagues and I developed the first thin film composite FO hollow fibre membrane, and thereafter improved it with anti-scaling and anti-internal concentration polarization capacity to provide enhanced FO performance. This development has made it possible to combine FO with existing technologies such as reverse osmosis (RO), membrane bioreactor and membrane distillation, to create novel hybrid membrane systems which allow for the wide-ranging applications of the technology. Recently, a novel PRO membrane developed by my team has been identified by PUB as one of the projects seeking translation partners and funding in a request-for-proposal to accelerate the implementation of the PRO technology into a real-world solution for salinity-gradient energy recovery, minimizing RO brine disposal impact and making use of NEWater brine.

Can you share with us some of its recent applications in the industry?

FO/PRO is a new industrial technology with numerous potential applications. For example, a company has worked with us to demonstrate that our FO membranes can be used to reduce produced water injection volumes in the gas fields. One company is exploring to use our FO membrane for beverage application.

Could you tell us about NEWRI-SMTC and its role in the membrane development?

SMTC is a research centre NEWRI to spearhead Singapore’s R&D efforts in fundamental and applied membranes technology. The NEWRI-SMTC research activities are mainly directed towards membrane technology for Sustainable Water and Environment.

Recently it was reported that De.Mem (NEWRI Spin-off) in collaboration with NEWRI-SMTC, plans to test new membranes modules in real world usage in its plants. Are there plans to commercialize or scale-up to full industrial production?

Recently De.Mem licensed our novel low pressure nanofiltration (NF) membrane technology, and intended to scale up for mass production. NEWRI-SMTC is happy to provide support to De.Mem for this effort.

Are there other new types of novel membranes in development from NEWRI-SMTC?

In addition to novel FO PRO and low pressure NF hollow fiber membranes, NEWRI-SMTC has developed high performance aquaporin based biomimetic membrane for water reuse and desalination, and superhydrophobic membrane for oil/water separations. We are in the process of discussing with industrial partners to scale up the production for practical applications.

What does winning this award mean to NEWRI-SMTC?

We have both worked very hard to build up the NEWRI-SMTC to be a global leader in membranes and sustainable water. This prize is great recognition of these efforts.

Thank you Prof Wang for your insight.

( Interview on 31 October 2016)

Professor Wang has over 20 patents for novel membrane fabrication. She is the Editor of the Journal of Membrane Science, a top journal on membranes. She is also the founding President of the Membrane Society in Singapore.
At NEWRI, innovation and enterprise are achieved through collaboration and partnerships. Seeking opportunities for commercial and research alliances, NEWRI continues to push into valued-added solutions, defining our journey towards our goals of enterprise and contributing to global sustainable economic values.

Earlier in July, Prof Ng and Dr Shi Lei of NEWRI visit the Foshan Industrial Technology Research Institute, Chinese Academy of Sciences and were introduced to their research (31 July 2016).

NEWRI recently played host to several delegates from various sectors in the Guangdong Province. The Chinese delegates were briefed about the work NEWRI is capable of by Prof Liu Yu. (20 Oct 2016)

In the session, Prof Ng spoke about changes which have been investigated and are beginning to be implemented in wastewater, sludge, and agro-industrial wastes management which are more environmentally benign, such as improved anaerobic digestion. He drew on examples from the historical development of wastewater treatment to illustrate the premise that pollution control itself may not be entirely free from adverse impact on the environment if considered from a more holistic perspective, such as large energy requirement for aeration and excess biosludge which require safe disposal so as not to pose environmental and health hazard.

Prof Ng Wun Jern giving the opening plenary session of the Indonesian Science & Technology Festival at the new Indonesia Convention Exhibition (ICE), Serpong, Indonesia. (3 – 5 October 2016)
Environment Technology Office (ETO) of NEA (National Environment Agency) held a proposal sharing session at NEWRI (22 Aug 2016)

Visit by Cranfield University’s Prof Sir Peter Gregson (Vice Chancellor and Chief Executive), Prof Simon Pollard (Pro-Vice Chancellor, School of Water, Energy and Environment), Prof Philip John (Pro-Vice Chancellor, School of Aerospace, Transport and Manufacturing), Prof Iain Gray (Director of Aerospace, School of Aerospace, Transport and Manufacturing) to NEWRI (30 September 2016)

Visit to NEWRI by Prof. Arthur Mol (Rector Magnificus) of Wageningen University and guest (15 Aug 2016)


Visit by Hiroshima University’s Yasuhiro Isobe-san at NEWRI (19 Sept 2016)

Visit to NEWRI by Ms Juliet Bell, Executive Manager, International, CSIRO and Ms Carolyn Atkinson, Innovation Counsellor, Australian High Commission (10 Oct 2016)

Fresenius Medical Care R&D Team meets with NEWRI (10 Aug 2016)

Meeting with Hiroshima University’s Yasuhiro Isobe-san at NEWRI (19 Sept 2016)

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Islamic Republic of Iran’s Public Relations Office sent a delegation from various representatives: (Tehran Water and Wastewater Company, South Khorasan Province, Ardebil Province Water and Wastewater Company, Alborz Province Water and Wastewater Company, Ghazvin Province Water and Wastewater Company, Lorestan Province Water and Wastewater Company, Hameyan Province Water and Wastewater Company, Kashan Province Water and Wastewater Company and UNESCO Regional Centre on Urban Water Management) to visit NEWRI (30 Sept 2016)
Prime Minister Lee Hsien Loong, speaking at an event to promote environmental awareness, highlighted the challenges that come with climate change. Prof Ng Wun Jern (NEWRI) said the “save water” message has filtered through to the public. But added that there is a need to continue with ongoing efforts in education and increasing water efficiency.

“Water companies should invest in new technologies to venture into brownfield projects instead…” quoted Prof Ng Wun Jern in an article released in The Edge Singapore (Article by Trinity Chua, The Edge Singapore, Aug 2016)

Mooncakes, lanterns and mirth, as NEWRI staff and students celebrated the Mid-Autumn Festival complete with games and feasting. (15 September 2016)

Congratulations to Prof Wang Rong, Chair of CEE and Prof Anthony G. Fane, (NEWRI) for winning the Alternative Water Resources Prize at the 7th Award of the Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW) for their development and application of novel forward osmosis hollow fibre membranes. Their work combines forward osmosis with a reverse osmosis (RO)-like inner selective layer and a novel and previously undiscovered positively charged nanofiltration (NF)-like outer selective layer. This novel structure provides enhanced performance by reducing the effects of scaling and flux losses caused by internal concentration polarization. These membranes promise to be a key factor for the reduction of the energy required for water treatment by membrane processes.

There were 32 nominations for the Alternative Water Resources Prize from more than 20 countries, 195 nominations for all prizes together from 65 different countries. This is the first team from Singapore to win the Prize.
NEWRI constantly seeks to enhance staff knowledge and experiences. Regular in-house workshops and seminars by fellow researchers and visiting professors, scientists and institutes allows knowledge to diffuse throughout the organisation. Here are some highlights:

### Upcoming Seminars / Conference

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<thead>
<tr>
<th>Upcoming Seminars / Conference</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Engineering With Membranes (EWM2017) Recent Advances in Membrane Science and Technology (International Conference)</td>
<td>26 – 28 April 2017</td>
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<tr>
<td>Systems Thinking for Sustainable Homes</td>
<td>17 November 2016</td>
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### Past Seminars

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<th>Past Seminars</th>
<th>Dates</th>
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<tr>
<td>NEWRI Water Works Design Workshop</td>
<td>October</td>
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<td>PUB’S grant call and technology information sharing session</td>
<td>August</td>
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<tr>
<td>NEWRI Researcher and Senior PhDs Seminar Series</td>
<td>September</td>
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<td>Safe, Robust and Rapid Construction Method of Underpass for Roads and Railways in Operation &amp; Hyundai E&amp;C Newly Developed Technologies for the Optimization of TBM Excavation and Operation</td>
<td>August</td>
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<tr>
<td>NEWRI Best-Sharing Workshop and NEWRI Design Workshop</td>
<td>August</td>
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<tr>
<td>Steam Gasification of Lignocellulosic Biomass and Catalytic Tar Reforming Seminar</td>
<td>August</td>
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<tr>
<td>INES workshop “Upscaling the Production of Innovative Membranes” in Singapore (NTU)</td>
<td>July</td>
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<tr>
<td>Fungal Biomes and Diversity and Human Health Implications (@ CEE)</td>
<td>June</td>
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<td>Prospective of denitrifying anaerobic methane oxidation (DAMO) process in wastewater treatment</td>
<td>May</td>
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<td>The Reinvention of Sanitation Services</td>
<td>May</td>
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<td>From Waste Treatment To Valuable Products Production</td>
<td>June</td>
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<tr>
<td>ZeeLung: A new membrane-aerated biofilm reactor for low energy wastewater treatment</td>
<td>May</td>
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<td>Microbial functional diversity predicts groundwater contamination and ecosystem functioning</td>
<td>April</td>
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<td>Microbial Feedbacks Mediates Vulnerability of Permafrost Carbon to Climate Warming</td>
<td>April</td>
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<td>DEWATS-Rising technical challenges &amp; Bridging the gap from Lab to field studies</td>
<td>March</td>
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<tr>
<td>Microstructure Optical Fibers, 3D Scaffold and Biofilm Engineering</td>
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<td>Conjugated Oligoelectrolytes for Biochemical applications</td>
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<td>Antibiotic Resistant Genes as an Emerging Environmental Contaminant</td>
<td>January</td>
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<tr>
<td>Biofilm Sloughing in Integrated Fixed-Film Activated Sludge (IFAS) Systems</td>
<td>January</td>
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<tr>
<td>Organic Pollutants in the Water Cycle Workshop</td>
<td>February</td>
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<tr>
<td>Some Recent Advances in Research of Dense Jets</td>
<td>January</td>
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<tr>
<td>Strategies for biosynthesis of polyhydroxyalkanoates (PHAs) using excess activated sludge</td>
<td>January</td>
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<tr>
<td>Art of Grantsmanship – Prof Wang Kuan (Taipei Medical University)</td>
<td>January</td>
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<tr>
<td>Stochastic Processes in microbial community assembly and Succession</td>
<td>January</td>
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28 August 2016 - NEWRI Best-Sharing Workshop and NEWRI Design Workshop by Dr Victor Sim

28 August 2016 - NEWRI Best-Sharing Workshop by Zhao Jie (PhD student of NEWRI-SMTC)
NEWRI has sporting talent! Our congratulations to the following for their achievements.

**AWARDS / ACCOLADES / ACHIEVEMENTS**

**NEWRI**

**AWARDS**

**Spotlight on Yuan Guoan, Zhang Jingbo, formed a joint team with School of Physics and Mathematics Sciences (SPMS) for the NTU Staff Table Tennis Tournament, and managed a 4th position.**

Zhang Jingbo secured a Second Runner-up position in the Women’s Singles tournament. This has not stopped the plucky Ms Zhang, as she went on to receive 3rd Runner Up position in the NTU women’s team (Out of 7 players, 3 are NEWRI staff) for the Singapore Public Service Staff Table Tennis tournament.

*(17th October 2016)*

**JOURNALS & PUBLICATIONS**

At NEWRI we do not forget our foundation which is good science. NEWRI’s researchers publish frequently in journals. You can log on to the following website for more information on articles. Please click on Journal link: [Click Here](http://newri.ntu.edu.sg)

We’ve given the NEWRI webpage a upgrade and hope you can stop by for a visit! NEWRI’s website has been updated to show more! Have a look! [http://newri.ntu.edu.sg](http://newri.ntu.edu.sg) (Click above)
Two of Dr Khin’s students who have graduated were also with the team to help out with translation of the training materials and to demonstrate results of quality tests of the water. One of them is an Inle native and was able to give his presentation in the local dialect which was more easily understood by the community.

In July 2016, NEWRIComm and Dr Khin Lay Swe conducted a training on slow sand filter for the Laethit community. It was a busy time for the farmers at Inle as it was planting time. Nevertheless, the community was supportive and 20-30 youths came to attend the session. The Laethit Monastery hosted the session.

The project team have also noticed that potable water (RO/UV/cross-treated) is now sold in nearby Nyaungshwe town. However, these are still considered expensive to many in Inle.

Certainly, over time the community’s expectation on “good water” would change, and so must solutions evolve along with that.
DOCTOR OF PHILOSOPHY SCHOLARSHIP
FOR RESEARCH IN SUSTAINABLE EARTH

Graduate. With cause.
Welcoming Final Year and Master’s Students to take up this challenge and experience in a vibrant environment.

Global Recognition? Check ✔
NEWRI is helmed by top global leaders in Environmental Engineering. NEWRI’s research innovations and collaborations with industry partners worldwide have led to several spin-off companies, technology licenses and corporate social responsibility projects.

Excellent Career Prospect? Check ✔
Within 6 months of graduation, more than 90% of our students have found work in established organisations in Singapore and around the world. Our students are highly sought after by the industry as they are prepared to meet the needs of our industry partners.

Eligibility Criteria
Bachelor’s degree from a reputable local/overseas university (2nd class upper and above or equivalent) in Engineering and Science (ie; Top 5% to 10% of your cohort)

Good graduate record examinations (GRE) & Test of English as a foreign language (TOEFL) or International English Language Testing System (IELTS)

For enquiries, please send your questions to POSTGRAD-NEWRI@NTU.EDU.SG
If you haven’t heard of NEWRI yet, then now is your chance. Tucked away in CleanTech One, at the edge of NTU’s green fence, sits a research institute that works in the water and environment domain, unique in its structure, versatile in its make-up, all set for the industry’s gain.

Ranked as one of the top research institutes with some of the finest brains in the industry, developing innovations and engineering solutions with guiding RED philosophy, not just research, but de-risking and monetizing IPs and bridging commercial entities. United with our units, NEWRI Tech, NEWRI Edu and NEWRI Comm (these are but only three).

What is RED, our guiding philosophy? You say? It is my pleasure to explain.

From Research, to Engineering and Deployment commercially, add to our contiguous value chain, AEBF, STMT and EPIC form the 5 Centres of Excellence, each a vertical of mastery. If you look at our brochure (pg 1), it will show you where they form the foundation of the NEWRI tree.

AEBF or Advanced Environmental Biotechnology Centre looks at environmental microbiology. Not to mention Biosolid management and energy/resource recovery.

STMT (Singapore Membrane Technology Centre) is collaborating with industry and universities; they are entrenched a cross-disciplinary specialty area of membrane technologies.

EPIC is our Environmental Process Modelling Centre (previously DHI-NTU repositioned) focusing on the development of high performance hydraulic system modelling and simulations.

R3C or Residues and Resource Reclamation Centre looks at Waste-to-Materials and Waste-to-Energy. Not to mention thermal upcycling and contaminated site remediation, solutions and technologies.

Lastly but not least, ECMC (Environment Chemistry and Materials Centre) with world class capabilities, from Environmental Chemistry to Environmental Materials to Water Chemistry and Technology. Not forgetting ST-ART, WW-ART and WIE-ART - Applied Research and Translation - the bridging three, coupled with NEWRI’s many spin-offs, such as DeMem, Aquaporin Asia, Hydrovision and Anaesys PD.

We thank you for the stopping by and reading our NEWRI page, gives us a fine opportunity to show you what we have and what we can stage. If you have more questions, queries and quotes, we are always ready to lend a listening ear, to answer your ponders, resolve your reservations, and respond to your questions all through the year.

A verse by Alvin Goh, 2016

Till the next update
Merry Christmas and Happy New 2017!