

President's Foreword



Recently many organisations both public and private wish to recruit more engineers. They are needed for normal operational works such as maintaining the running of the trains or construction of our infrastructure. There are also organisations who ask for engineers for their R & D work.

As we progress to the next technological revolution, science and technology play important roles in many aspect of human endeavour. They make significant breakthroughs and contributions to health, environmental, energy, food and human development. Good engineers will always be in great demand.

One of the roles of our Fellows is to showcase the diversity of successful careers. They need not be confined to straightforward engineering. This possibility can encourage more young students to study engineering.

There are many occasions I have been asked by parents to advise their children on the choice of university studies and careers. I am sure that is also the same experience of our Fellows.

My advice on "Why study engineering" and "what makes a good engineer" are based on my observations.

All engineers are involved directly or indirectly with creating new things and make things work. They derive satisfaction from their work by demonstrating their ability to confront the problem and solve it. Only a small part of

engineering work calls for the highest academic intellect but all potential engineers should have more than average ability in Mathematics, Physics and similar subjects.

Instead of expecting an engineer to be skilful in using his hands, what is really needed of an engineer is to have a practical mind. He must be able to foresee and overcome in advance any snags which may arise. Engineers must, in short, be what the name "engineer" implies – ingenious. A successful engineer also knows how to approach a difficult problem in a systematic manner, not being discouraged by its complications and dealing with one part of a problem at a time.

Engineers find themselves dealing with people as well as material things. They must be able to explain, convince and instruct others. They must be capable of defending their point of view and know when to give way. They must know how to give orders and ensure they are carried out. Communication skills in speech and writing are therefore most important.

As seen from my observations, the career of an engineer can be both exciting and challenging. I hope many of our young students will be attracted to the opportunity of a meaningful career.

Professor Cham Tao Soon

Project Initiatives

As part of the strategic plan, the Academy has established five project groups to address issues ranging from renewable energy alternatives for Singapore, enhancing the role of Science Centre Singapore on engineering innovation, study of policies and strategies to revive students' interest in engineering, revival of the prestige of engineering and engineers in Singapore, and an engineering doctorate programme to meet industry needs.

1. Renewable Energy Alternatives for Singapore

The project championed by Professor Chou Siaw Kiang proposes a multi-pronged approach to encourage young students to take an interest and develop solutions in energy efficiency and clean energy to address the adverse effects of climate change. The proposal involves the set-up of a Resource Centre for Clean Energy (RECCE), working with the various schools and institutions to incorporate environmental sustainability in the curriculum, and strategically locating kiosks across the country to facilitate information dissemination, encourage public debate and involvement in community projects, and promote sustainable living habits by the public. The proposal was adopted by the Academy and all Fellows are encouraged to comment and contribute their expertise for the project.

2. Enhancing the Role of Science Centre Singapore in Engineering Innovation

To capture the hearts and minds of young Singaporeans to pursue an engineering profession, the project led by Professor Hang Chang Chieh, Dr Raj Thampuran and Mr Quek Gim Pew, proposes a two-steps approach to raise greater awareness and interest in the profession. In the incremental step, more regular exhibits in engineering innovations and entrepreneurship which are appealing to secondary school students will be added in the Science Centre Singapore (SCS). In the radical step, the SCS will fully embrace the mission of stimulation and long-term inculcation of students' interests in engineering innovation with the possible adoption of the Japan's National Museum of Emerging Science and Innovation as a role model. The white paper was adopted by the Academy and sent to the SCS who had expressed appreciation of the Academy's efforts and as SCS had already received significant government support to expand its activities, the SCS was keen to seek the Academy's inputs for new ideas and assistance in implementing future plans inclusive of the engineering innovations proposed in the white paper. Professor Hang and his team will continue to serve as the Academy's link with SCS and they welcome any inputs and assistance from Fellows for the project.

3. Study of Policies and Strategies to Revive Students' Interest in Engineering

With the continuing decline in students' interests in taking up engineering programmes, the project led by Professor Kam Chan

Hin was timely to address the issues and strengthen the talent pipeline for the engineering profession. The study included a re-think in the teaching of sciences and mathematics, restore the mandatory teaching of physics in the school syllabus, inclusion of more hands-on modules to stimulate interest, revamp of the current engineering curriculum and inclusion of early industry exposure to entrench students within the engineering profession. The team will be working with the IES Task Force on Engineering Education who had been brainstorming on the same issues to recommend proposals for the project.

4. A Call for Action: Engineering a Renaissance and Revival

The proposal led by Professor Hang Chang Chieh and Dr Raj Thampuran calls for the public sector to offer competitive salaries for engineers, professional engineering bodies to work together to raise the profile and value of engineering and engineers, and collaborations between universities and industry to reinvent the curriculum and provide scholarships to attract top students to take up engineering programmes. The proposal was adopted by the Academy and circulated to all Fellows for comments and expression of interests. As this is an on-going effort, Professor Hang Chang Chieh and Dr Raj Thampuran will continue to engage the public sector agencies to find new ways to boost the image of engineering and publicise the bright career opportunities of engineers in Singapore to the students and their parents.

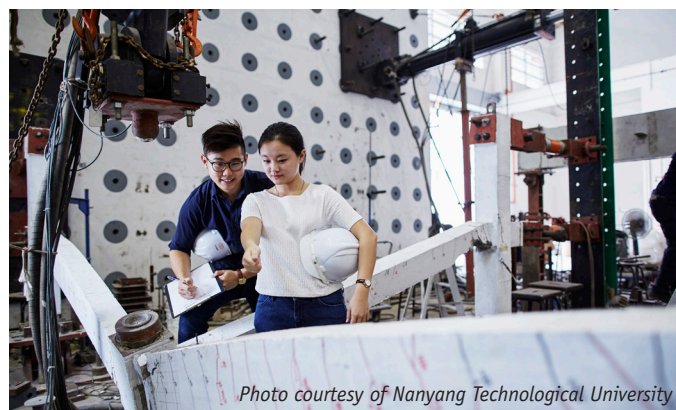


Photo courtesy of Nanyang Technological University

5. Engineering Doctorate Programme to Meet Industry Needs

The proposal calls for research-intensive Singapore universities to introduce the Engineering Doctorate degree programme that will produce industry-ready postgraduates at the doctoral level. Championed by Professor Hang Chang Chieh, the proposal is envisaged to improve the employability of engineers, enhance high quality collaboration between industry and academia and complement the existing PhD programmes to educate and train advanced engineering manpower for Singapore's industry, creating a competitive advantage for Singapore and attracting more bright Singaporeans into an engineering career. The proposal was adopted by the Academy and sent to the local engineering universities in July 2015 for comments and support to introduce the degree programme in their universities.

In addition to the above project groups, five expert groups have been established to provide advice on key issues currently faced by Singapore. The objectives of the expert groups are to deliberate and provide recommendations on national policies and issues pertaining to the engineering profession. The Academy has identified the following areas for the expert groups and invited prominent engineers to lead each group:

- 1) Water Resources - Professor Chan Eng Soon
- 2) Land Transportation - Professor Lee Der-Horng
- 3) Environmental Preservation - Professor Ng Wun Jern
- 4) Connected City - Professor Chua Kee Chaing
- 5) Cyber Security - Dr Lee Shiang Long

Singapore's Cybersecurity Landscape

by SAEng Expert Group on Cyber Security

With the advent of Smart Nation, Cybersecurity is a key technological component of the stack – it will protect the data, systems and communication platforms that will make Singapore smart. At the same time, Singapore as a sovereign nation needs protection from malicious cyberactors. Finally, there is global market demand for Cybersecurity solutions which Singapore can fulfil with homegrown IP. There are a few components required to achieve these goals related to the Cybersecurity domain – Operational Capabilities, R&D and Education.

The first is addressed by the Cyber Security Agency (CSA) setup at the national level to guide policy and make system-level recommendations for various important operational domains. CSA is closely coordinated with IDA, other relevant government agencies and the industry sector to realise the full value of its policies and recommendations across Singapore's ecosystem, both governmental and private. It will ensure that systems deployed in Singapore have the appropriate security built into them, and it will also manage any relevant incidents at the national level. CSA's Cyber Security Awareness and Outreach programme aims to augment existing outreach channels and explore new avenues that offer wider coverage and reach to users, such as broadcast media. In addition, the National Cyber Security Masterplan 2018 will also include initiatives to facilitate information sharing between the government and private sector, as well as collaborations with industry and trade associations to promote Cybersecurity.

Singapore's local Cybersecurity R&D ecosystem itself is growing and going from strength to strength. Singapore has invested increasingly in R&D over more than two decades and this is expected to continue. Under the Prime Minister's Office, NRF recently started the National Cybersecurity R&D Programme which aims to fund Singapore's research performers and develop expertise in Cybersecurity and improve cyberinfrastructure with an emphasis on security, reliability, resiliency and usability. There are research-performers in Cybersecurity across A*STAR, universities and polytechnics. NTU's Cyber Security

Laboratory was inaugurated in March 2013, and comprises faculty members from the School of Computer Engineering in NTU. The main research of the Cyber Security Laboratory is in the domains of Network Security, Software Security, Web Security and Forensics and Biometrics. Researchers in the Cyber Security Lab study collaborative security, security protocols, mobile security, collaborative intrusion detection networks, web application security, forensics and biometrics. Research is focused on integrating new knowledge and technology to provide law enforcement and security agencies with automatic devices and capabilities to improve prevention, detection and solution of crimes, and acts of terrorism. NUS research in this domain covers software security, systems security, cryptography and privacy. Research of their faculty members have had research impact on various emerging aspects of security including quantum and applied cryptography, systems security, network & web security, mobile security, language-based security, hardware security and distributed systems security. A*STAR-I2R has two departments researching this domain, strategically focused on Cyberphysical Security and Cyberforensics & Intelligence. It has setup joint-labs with Sopia Steria and ST Info-Security for Cybersecurity R&D. One aspect that could make Cybersecurity R&D in Singapore even more effective and impactful would be better access to real operational data. This would allow for local R&D to create solutions that can make commercial impact on the global stage.

With regards to Education, the relatively stretched local talent pool in the domain of Cybersecurity is a well-known challenge for Singapore's education ecosystem. One of the key prongs of the National Cyber Security Masterplan 2018 is to grow Singapore's expertise in Cybersecurity. Accordingly, IDA has been working with educational institutions to incorporate infocomm security courses and degree programmes into their curriculum and offer more scholarships to specialise in Cybersecurity. 30 post graduate scholarships have been introduced for those who wish to carry out research in Cybersecurity. The programme, co-developed by IDA and NRF, will help Singapore develop a pool of post-graduate researchers and technologists to meet the needs of a growing cybersecurity R&D community. Many institutes of higher learning have also stepped up to the plate to offer new infocomm security programmes. The Singapore Institute of Technology (SIT), for example, will launch Singapore's first undergraduate Information Security degree programme. Nanyang Technological University (NTU) has also introduced an Information Security specialisation as part of its undergraduate programme. NUS offers a specialisation in Information Security under its Computer Science and Information Systems programmes. AISP and ISS have launched the AISP Qualified Information Security Professional course. NEC and EDB have made a multi-year agreement to build strategic capabilities in cybersecurity through EDB's Strategic Attachment and Training (STRAT) Programme. Singapore Polytechnic's Cyber Security Academy and Singapore Technologies Electronics and Engineering's DigiSAFE Cyber Security Centre will provide training and skills-upgrading opportunities.

New Fellows

The Academy's fellowship currently stands at 86 strong with the election of five new Fellows in 2015. We are pleased to welcome the following new Fellows to the Academy.



Lee Shiang Long
Executive Director
A*STAR - Institute for Infocomm Research (I²R)

Dr Lee Shiang Long joined I²R on 1 July 2013 and assumed the role of Executive Director on 1 January 2014. In 2015, he received the Nanyang Alumni Achievement Award for his significant contributions to national R&D and the Infocomm Media industry. Dr Lee continues to lead the Infocomm ecosystem by positioning I²R as Singapore's key R&D entity which is closely integrated with its government, academia and industry partners and to create greater economic impact for the nation. Prior to joining I²R, Dr Lee spent 23 years with the Singapore Armed Forces and last held the appointment of SAF Chief Information Officer. In recognition of his contributions to the SAF, he was awarded the Public Administration Medal – Silver, Bronze and Commendatory (Military).



Lim Chwee Teck
Provost's Chair Professor
National University of Singapore (NUS)

Prof Lim Chwee Teck is a Provost's Chair Professor at the Department of Biomedical Engineering, a Principal Investigator at the Mechanobiology Institute and a Faculty Fellow of the Singapore-MIT Alliance for Research & Technology. He currently sits on the editorial boards of more than 12 international journals and co-founded one incubator and four startups. Prof Lim has authored more than 280 peer-reviewed papers and garnered over 50 research awards which include The Wall Street Journal's Asian Innovation Award (Gold), TIE50 Award (Silicon Valley), IES Prestigious Engineering Achievement Award and The President's Technology Award. He is an elected Fellow of the American Institute for Medical and Biological Engineering which puts him in the top 2% of the medical and biological engineering community.



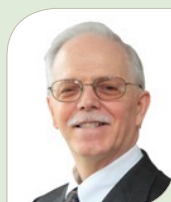
Lock Kai Sang
Principal
PQR Consultants

Dr Lock Kai Sang is Principal of PQR Consultants, Adjunct Professor at Singapore University of Technology and Design, and President Emeritus of the Institution of Engineers, Singapore (IES). Dr Lock was Founding Chairman of the Engineering Accreditation Board (2002-2009), leading IES to become a full signatory of Washington Accord. Internationally, he served as Washington Accord mentor and reviewer. He is IES Honorary Fellow and Honorary Fellow of the ASEAN Federation of Engineering Organisations. He is also a Founding Fellow of ASEAN Academy of Engineering and Technology and served as its Vice-President. He was Board Member of the Professional Engineers Board, Singapore (PEB) for 11 years and played an instrumental role in the implementation of the PEB examination system for qualifying professional engineers.



Seeram Ramakrishna
Professor
National University of Singapore (NUS)

Prof Seeram Ramakrishna is a Professor of Materials Engineering and Director of Center for Nanofibers and Nanotechnology at the Department of Mechanical Engineering, NUS. He is among the World's Most Influential Scientific Minds (Thomson Reuters) and founded the Global Engineering Dean's Council. Prof Seeram received numerous awards and recognitions which include IFEEES Presidents' Global Visionary Award for engineering education; ISTE International Fellow, Changjiang Scholar and Leading Talent, China; Nehru Fellowship, India; Lee Kuan Yew Fellowship and NUS Outstanding Researcher, Singapore. He is an elected fellow of major professional societies and academies of Singapore, India, UK and USA. He has served in a variety of leadership roles at NUS, including Vice President (Research Strategy), Director of NUS Enterprise, and Dean of Faculty of Engineering.



Thomas L. Magnanti
President
Singapore University of Technology and Design (SUTD)

Prof Thomas Magnanti is the founding President of SUTD, and Institute Professor and former Dean of Engineering at M.I.T. He has devoted much of his professional career to education that combines engineering and management, and to teaching and research in applied and theoretical aspects of large-scale optimization. At SUTD, he has led the development of a university whose mission is to advance knowledge and nurture technically-grounded leaders to serve societal needs, through a focus on Design and an integrated multi-disciplinary curriculum and research. He has led several centers and programs at M.I.T., was editor of the journal *Operations Research*, headed one third of the MIT Sloan School of Management and has also served on numerous boards and councils.

In Memory

The Academy honours the memory of the following Fellow who had passed on.

Miranda Yap (left us on 14 October 2015)

New Ex-Co Members

We are pleased to welcome the following four Fellows who are appointed as members of the Executive Committee. We thank Mr Ho Siong Hin for his invaluable contributions to the Academy.



Cheong Hee Kiat
President
SIM University (UniSIM)

Prof Cheong Hee Kiat is the founding President of UniSIM. He was Deputy President and Dean, School of Civil and Environmental Engineering in NTU, before joining UniSIM.

Prof Cheong served on various local and international university accreditation and academic audit panels, and is a member of the Engineering Accreditation Board of the Institution of Engineers Singapore. He is also serving on the ExCo of the SUTD, and on the boards of the NIE, Singapore Bible College and Grace Baptist Church. Prof Cheong is a registered Professional Engineer, a Fellow of the Institution of Engineers Singapore, Society of Project Managers and the Academy of Engineering, Singapore.



Tan Thiam Soon
President
Singapore Institute of Technology

Prof Tan Thiam Soon is President, Singapore Institute of Technology. He is a registered Specialist Professional Engineer (Geotechnical) in Singapore and has undertaken consulting jobs concerning his research interests – land reclamation, deep excavation and other geotechnical topics. He was the lead organiser and editor in two forums on Characterisation and Engineering Properties of Natural Soils in 2002 and 2006. He received the ASTM's C.A. Hogentogler Award (2007), Japanese Geotechnical Society Best Research Paper Award (2008), Public Administration Medal – Silver (2008) and Minister of Transport's Distinguished Innovation Award. He is a SkillsFuture Council member and sits on the Singapore Workforce Development Agency board.



Chong Tow Chong
Provost
Singapore University of Technology and Design (SUTD)

As SUTD's founding Provost, Prof Chong Tow Chong plays an instrumental role in steering the strategic development and operationalisation of SUTD. Prior to his current appointment, Prof Chong has a 15-year career in A*STAR as Executive Director of the Science and Engineering Research Council and Data Storage Institute. He also has a 30-year academic career with the National University Singapore as Professor of Electrical and Computer Engineering. Prof Chong received numerous awards such as the President's Science and Technology Medal, the Public Administration Medal (Silver), the IES/IEEE Joint Medal of Excellence Award 2013 and the ASME ISPS Division Leadership in Research and Development Award.



Seah Moon Ming
Group Chief Executive Officer
Pavilion Energy Pte Ltd

Mr Seah Moon Ming is Group Chief Executive Officer of Pavilion Energy. He is also Chairman of various public and private organisations including International Enterprise (IE) Singapore, Singapore Cooperation Enterprise, Trusted Board Ltd and SBF China & North Asia Business Group. He is recipient of the 2014 National Day Award, Public Service Star (BBM), IES/IEEE Joint Medal of Excellence Award 2008, 2011 Distinguished NUS Engineering Alumni Award and the 2014 APAC Executive of the Year by the Oil and Gas Council. He was conferred as Honorary Citizen of Guiyang, China in January 2008.

About the Editor

Prof Er Meng Hwa has been with Nanyang Technological University (NTU) for 30 years.

He currently assists the NTU President in managing the university's strategic alliance and network, global and China affairs, and provides oversight to NTU's global education and mobility programmes. His previous appointments include founding Director of NTU's Centre for Signal Processing, Dean of Electrical & Electronic Engineering, Dean of College of Engineering, Deputy President, Senior Associate Provost and Acting Provost, among others.

Prof Er's career has been underpinned by a very strong research track record. He has published over 250 papers in international journals and conference proceedings and holds five patents. In addition, he has been involved in editing technical journals and had been Chairs of several international conferences including the 15th World Conference on Cooperative Education (WACE) in June 2007 and the ASAIHL Conference on Education Innovation in December 2014.

Prof Er is the first Singaporean and the first academic in Asia to be conferred the prestigious title of Honorary Fellow by the London-based Institution of Electrical Engineers in 2005. He has received numerous awards and honours, including a Public Administration Medal (Gold) by the President of Singapore in 2006 for his significant contribution to the growth and international standing of NTU, and the IES/IEEE Joint Medal of Excellence Award 2015 for playing a pivotal role in innovating and revolutionising scientific research and education.



Er Meng Hwa
Vice President (International Affairs)
Professor of Electrical and Electronic Engineering
Nanyang Technological University

Fifth Annual General Meeting

The Academy of Engineering, Singapore (SAEng) held its fifth Annual General Meeting (AGM) in September 2015, at the Nanyang Executive Centre, Nanyang Technological University. Members of the Executive Committee were elected into positions which were due for review, and Prof Brian Lee was re-appointed as Honorary Auditor for a term of two years.

During the AGM, Academy President Cham Tao Soon reiterated that the Academy's mandate was to serve as a think tank to deliberate on national agenda and issues related to the engineering profession and SAEng Fellows are role models for the young engineers. He requested the meeting for new nominees to join as Fellows of the Academy.

Prof Yoon Soon Fatt presented the Secretary's report to the meeting for comments. He welcomed the new Fellows who joined the Academy during the past year, and requested the respective project champions for further comments and inputs, if any, on their projects for the meeting's information.

Prof Chou Siaw Kiang informed that the project group on Renewable Energy Alternatives for Singapore will be reviewing the proposal and requested Fellows for comments on the project.

Prof Hang Chang Chieh reported that the Science Centre Singapore was keen to seek the Academy's inputs for new ideas and assistance in implementing future plans inclusive of the engineering innovations proposed in the white paper.

It was noted that for the project on "A Call for Action: Engineering a Renaissance and Revival", the starting pay of engineers was one of the main issues to be addressed by the project group.

President Cham requested the meeting for comments and suggestions on the projects presented in the Secretary's report.

Prof Lui Pao Chuen updated that the New Science Centre would be an Experimentation Centre to excite and inspire young Singaporeans in science, technology, engineering and mathematics as they could experiment and test the research prototypes from industry and government agencies at the centre.

Prof Low Teck Seng informed that the government is currently looking into an engineering service scheme where salaries will be benchmarked with the other sectors so that engineers' salaries remain competitive and attractive for Singaporeans to take up the engineering profession.

Members noted that engineers are able to branch out to other sectors as the skills acquired from the broad-based curriculum are transferable to careers in other fields such as financial technology and risk management, and endorsed the Secretary's report without amendments.

With regard to next steps and future plans, President Cham Tao Soon informed that the Academy will be inviting younger Fellows for a tea session so that Executive Committee members could ascertain how they can contribute their expertise and time to the Academy.



Awards and Honours bestowed upon SAEng Fellows in 2015

Our heartiest congratulations to the following Fellows who had been bestowed with various prestigious honours and awards by the respective professional institutions and organisations.

Cham Tao Soon

- 2015 Engineer of the Year Award conferred by the Federation of Engineering Institutions of Asia and the Pacific (FEIAP) for his substantial contributions to the advancement of the engineering profession in the region.

Brian Chang

- AFEO Honorary Fellow conferred by the ASEAN Federation of Engineering Organisations (AFEO) in recognition of his outstanding services, greatness of spirit, integrity and devotion to the engineering profession, IES and Singapore.

Cheong Hee Kiat

- AFEO Honorary Fellow conferred by the ASEAN Federation of Engineering Organisations (AFEO) in recognition of his outstanding services, greatness of spirit, integrity and devotion to the engineering profession, IES and Singapore.

Neal Chung Tai-Shung

- President's Technology Award presented by the President of Singapore for his innovative research on membranes, which has set Singapore at the forefront of membrane research for clean water and energy applications.
- Outstanding Researcher Award accorded by the National University of Singapore (NUS) for his significant research contributions.
- Underwood Medal awarded by the Institution of Chemical Engineers (IChemE) for his exceptional research in the field of separations.
- Outstanding Researcher Award conferred by the American Institute of Chemical Engineers (AIChE) Singapore Local Section for his exceptional research contributions in membrane science and technology.

Er Meng Hwa

- IES/IEEE Joint Medal of Excellence awarded by the Institution of Engineers, Singapore (IES) and the Institute of Electrical and Electronics Engineers, Inc. (IEEE) for playing a pivotal role in innovating and revolutionising scientific research and education.

Lau Joo Ming

- MND Medallion presented by the Minister for National Development of Singapore for his outstanding contributions to Housing Development Board (HDB) and Professional Engineers Board (PEB).

Lee Bee Wah

- IES Honorary Fellow conferred by the Institution of Engineers, Singapore (IES) for her outstanding leadership and services to IES and her exemplary contribution to the profession of engineering and society.

Lim Chwee Teck

- Vladimir K. Zworykin Award accorded by the International Federation for Medical and Biological Engineering (IFMBE) in recognition of his outstanding research contributions in the field of medical and biological engineering.
- AIMBE Fellow conferred by the American Institute for Medical and Biological Engineering (AIMBE) College of Fellows for his long-lasting accomplishments in biomedical engineering and innovation.

Lock Kai Sang

- Public Service Medal conferred by the Government of Singapore for his commendable contribution to Professional Engineers Board (PEB) and the engineering communities.
- MND Medallion awarded by the Ministry for National Development for serving as Board Member of PEB for 11 years.

Seah Moon Ming

- APAC Executive of the Year Award accorded by the Oil & Gas Council for his leadership in growing Pavilion Energy in Asia and in positioning Singapore as an LNG hub.

Tan Gee Paw

- President's Science and Technology Medal presented by the President of Singapore for his pivotal role in harnessing science and technology to enable Singapore to achieve sustainable water supply, and to become a global water hub.

Tang Kin Fei

- AFEO Honorary Fellow conferred by the ASEAN Federation of Engineering Organisations (AFEO) in recognition of his outstanding services, greatness of spirit, integrity and devotion to the engineering profession, IES and Singapore.

Wang Chien Ming

- Monash Civil Engineering Alumnus Award of the Year 2015 accorded by the Monash University, Australia in recognition of his significant contribution to the engineering profession and community.

Making a Donation

The Academy of Engineering, Singapore (SAEng) is a not-for-profit entity registered in Singapore, funded by contributions from individuals and private organisations.

Your donations will enable the Academy to develop and sustain projects to attract aspiring engineers, encourage innovation and provide support to advance and promote excellence in engineering, and improve the public awareness and understanding of engineering in Singapore.

To make a contribution to the Academy, please contact saeng@ntu.edu.sg.

Our Donors

The Academy has received a total of \$101,070 from organisations and individual donors thus far.

We would like to express our sincere gratitude to all generous individuals and organisations that have supported the Academy over the past five years.

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