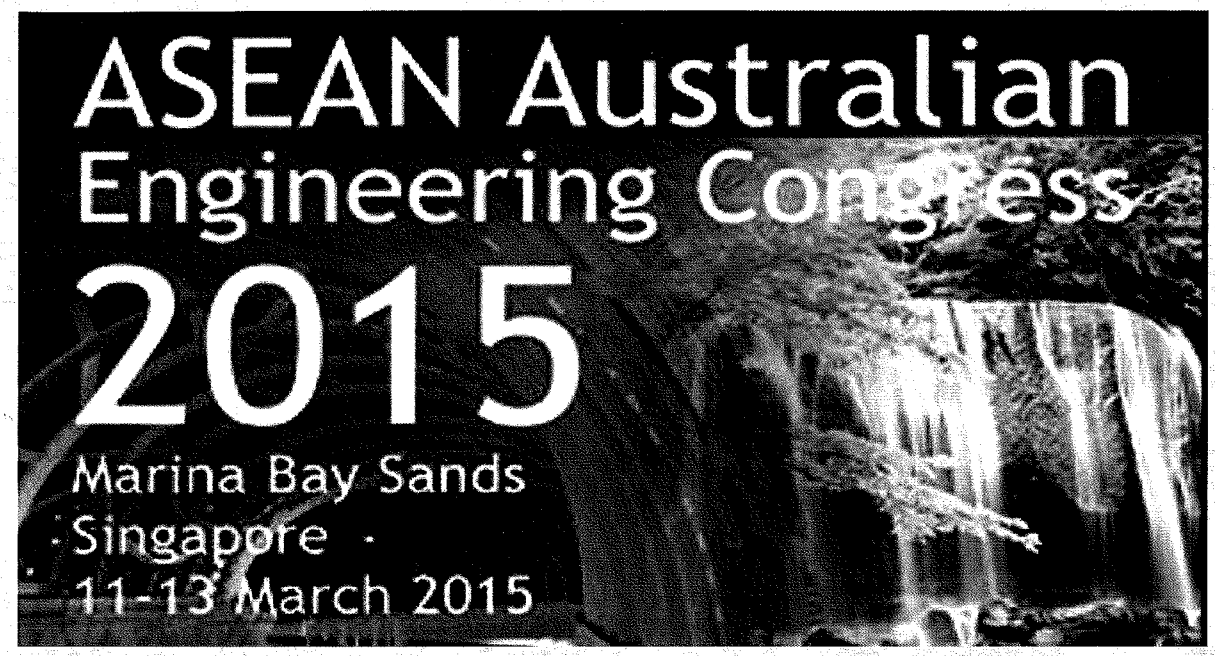
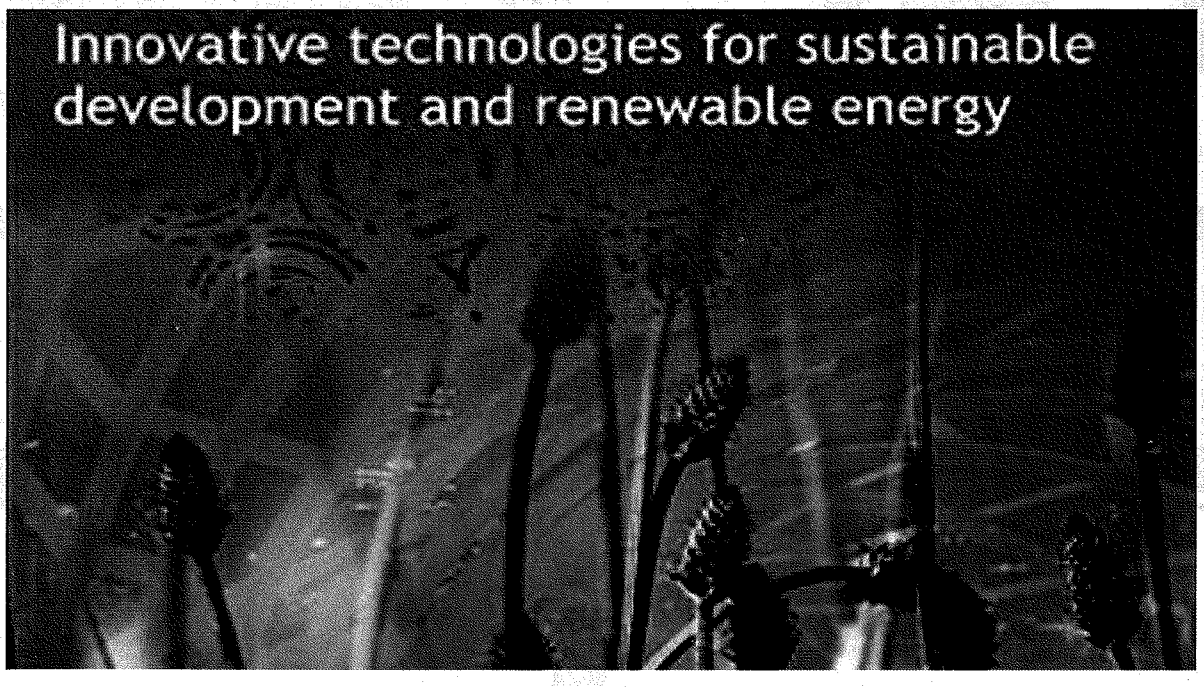




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SINGAPORE CHAPTER

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3rd ASEAN - Australian Engineering Congress 2015

On

"Innovative Technologies in Sustainability Development and Renewable Energy"



At

Marina Bay Sands, Singapore

11th – 13th March 2015

ACKNOWLEDGEMENT

We are thankful to the tremendous support we have received from the Following Organisation and personnel

University Of New Castle Australia

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Message from Australian High Commissioner to Singapore

Singapore and Australia have a strong and growing bond. Reinforcing that bond are a wide range of business-to-business, profession-to-profession and people-to-people links, connecting our two nations and forging stronger ties for a bright future together.

Not least of these links is the Singapore Chapter of the Institute of Engineers Australia, which celebrates its 20th anniversary this March. To mark this important anniversary, the Singapore Chapter is ***hosting the third ASEAN-Australia Engineers Conference,*** *held at the Marina Bay Sands in Singapore*

The 50th anniversary of Singapore's independence, and the 50th anniversary of Singapore-Australia diplomatic relations – it is indeed a celebratory year. Alongside other industries and professions, the Singapore Chapter of Engineers Australia is not just finding new ways to collaborate bilaterally, but to reach out across the region and globally, bringing experts together to strengthen the profession and uphold the standards, skills and innovation that define it.

I am delighted to support the Singapore Chapter, its leaders, its members and its many volunteers. I commend you all on your achievements these past two decades.

Philip Green OAM
Australian High Commissioner to Singapore



Organising Committee:

Engineers Australia Singapore Chapter

Percival Jeyapal,	Chair
Peter Toh,	Co-Chair
Tan Hee Wee,	Member
Stuart Manley,	Member
Lewis Chua,	Member
David Brown,	Member
Jugjit Singh,	Member
Lawrence Lim	Member
Philip Chan	Member

University of Newcastle, Australia (Singapore Campus)

Charles CC Lee,	Member
Hassan Ali,	Member

Technical Committee:

Chair: Prof Brett Ninness	University of Newcastle (UON), Australia
Assoc. Prof Steven Weller	University of Newcastle (UON), Australia
Prof Mark Jones	University of Newcastle (UON), Australia
Assoc. Prof Phil Clausen	University of Newcastle (UON), Australia
Dr Colin Coates	University of Newcastle (UON), Australia
Prof Rick Middleton	University of Newcastle (UON), Australia
Prof Wang Youyi	Technological University, Singapore
Dr. Charles Cc Lee	University of Newcastle, Australia (Singapore Campus)
Dr. Hassan Ali	University of Newcastle, Australia (Singapore Campus)
Dr.Aparna Viswanath	University of Newcastle, Australia (Singapore Campus)
Dr.Yit Yan Koh	University of Newcastle, Australia (Singapore Campus)
Dr.Gao Shang	University of Newcastle (Singapore Campus)
Er. Percival Jeyapal	Engineers Australia Singapore Chapter
Er. Peter Toh	Engineers Australia Singapore Chapter



Message from Organising Chairman

I am very pleased to welcome all delegates and speakers for the 3rd ASEAN – Australian Engineering Congress on ***"Innovative Technologies for Sustainable Development and Renewable Energy"*** *- March 11th to 13th March 2015*

ASEAN Australian Engineering Congress was first held in Kota Kinabalu, Sabah, Malaysia in 2004 and also in Kuching, Sarawak, Malaysia in 2011. Singapore is chosen as the venue for this congress and is well placed as an destinations for International Conferences and gateway for Asean Countries.
Sustainability is becoming of much importance and yet many consumers and practitioners are still struggling to address the competing forces of profitability and sustainability. It is inevitable that sustainability contributes to profitability with social responsibility and reduces the use of ever increasing cost of material & energy resources. Climate change is a reality and we need to recognize its impact both on global warming and subsequent melting of polar ice resulting in increase in sea level. Great Strides have been made towards reduction of energy use with better sustainability practices such as green building index and the use of energy efficient products for the consumers. New developments are under increasing pressure to optimize the use of resources including materials, man power and energy. Such demands places greater burden on engineers and practitioners to incorporate sustainable solutions in the early concept of the design process. This Congress will bring together Professionals, Practitioners from Industries, Researchers, Academics and Policy makers to share their expertise and experience in the Papers presented on the ever increasing trend to harness the forces of nature and to balance the complex equation of profitability, minimising the usage of materials & energy sustainability, protecting the ecosystem and increasing the usage of renewable energy.

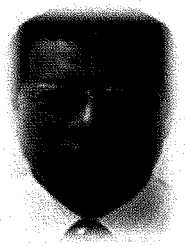
I must thank the many persons who have contributed to the success of this congress and to name a few my sincere thanks to Australian High Commission in Singapore, Engineers Australia National Office, University of Newcastle Australia and Committee Members of Engineers Australia Singapore Chapter and the many Sponsors.
I wish all participants fruitful and enjoyable time during this congress and to take pleasant memories of their stay in Singapore.

Percival Jeyapal P.E, CPeng, FIEAust, C.Eng(Civil/Mech)
President
Engineers Australia -Singapore Chapter

ASEAN AUSTRALIA ENGINEERING CONGRESS 2015
Organizing Committee

	**Chair** **Percival Jeyapal**
	**Co-Chair** **Peter Toh**

Committee Members

	**Tan Hee Wee**		**David Brown**
	**Stuart Manley**		**Lawrence Lim**
	**Philip Chan**		**Charles CC Lee**
	**Lewis Chua Ru Wei**		**Hassan Ali**



Message from Technical Programme Committee Chair

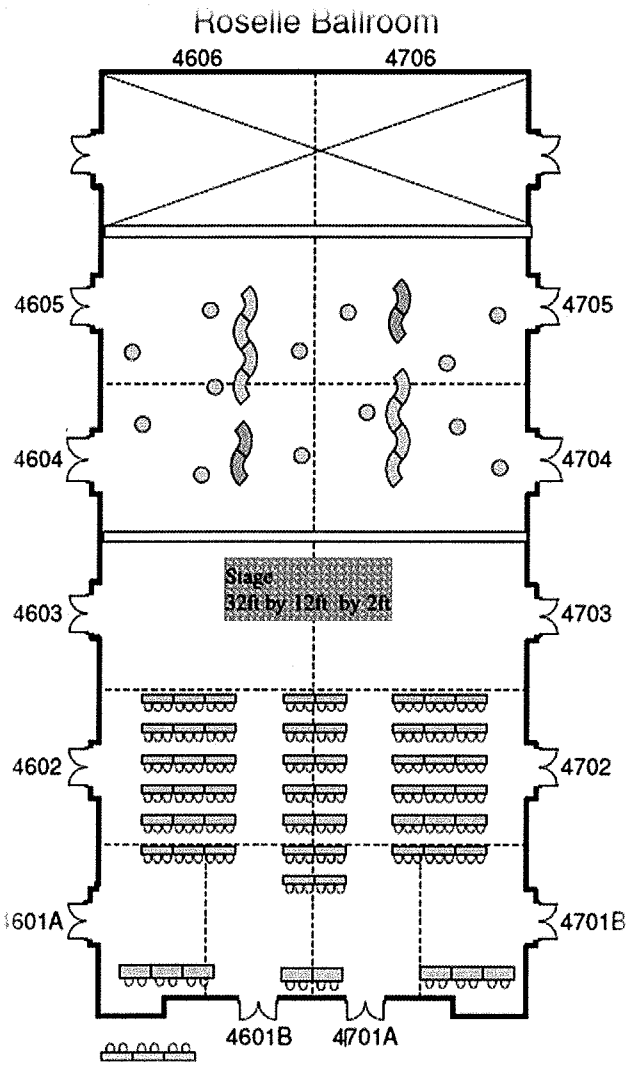
Welcome to the ASEAN – Australian Engineering Congress (AAEC2015) on Innovative Technologies for Sustainable Development and Renewable Energy. The AAEC2015 is aimed at providing opportunity for professionals, academicians, and students to bridge the knowledge gap and to share and promote research and development efforts towards a sustainable future in Australia and ASEAN countries.

The AAEC 2015 technical programme committee (TPC) accepted high quality papers and presentations after a two-step blind review process to evaluate each of the congress submissions. Please note that all accepted full paper papers will be included in RMIT Inform it Database.

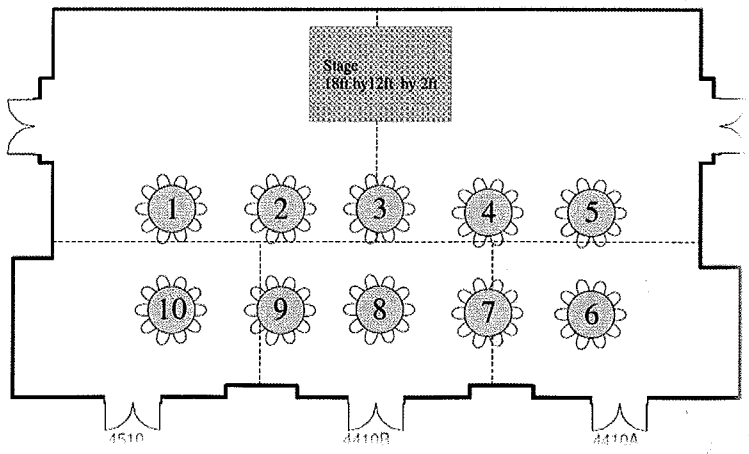
Many people have worked very hard to make this conference possible. I would like to thank all who have helped in making AAEC2015 a success. The Organizing Committee and TPC reviewers deserve credit for their tremendous efforts. I thank the authors who have contributed to the conference papers and all our Keynote Speakers.

I wish you a pleasant stay in the Finest City – Singapore.

Professor Brett Ninness
University of Newcastle (UON), Australia
AAEC 2015- Technical Programme Committee Chair



3rd Asean Australian Engineering Congress
Venue:
Roselle Ballroom
Level 4
Convention Centre,
Marina Bay Sands



AAEC 20th Anniversary Gala Dinner
Venue:
Peony Ballroom
Level 4
Convention Centre,
Marina Bay Sands

3rd ASEAN AUSTRALIAN ENGINEERING CONGRESS	
CONFERENCE PROGRAMME	
Time	**Wednesday**
	11/03/2015
8.00 am - 9.00 am	**Registration**
9.15 am	Arrival of **High Commissioner for Australia HE Phillip Green**
9.20am - 9.30 am	Welcome Address by **Mr. Percival Jeyapal, AAEC 2015 Organising Chairman & President EASC**
9.30am - 9.45 am	Welcome Address by **Mr. Stephen Durkin, CEO Engineers Austraila**
9.45am - 10.00 am	**High Commissioner for Australia HE Phillip Green's Address and opening of the Congress**
10.00 am-10.15 am	Address by **Prof. Amir Mahmood, Pro Vice-Chancellor and CEO UON Singapore -**
10.15 am - 10.30am	**Mr. Thomas Thomas** - Corporate Social Responsibility
10.30 am - 11.00 am	**TEA BREAK**
	Moderator - Dr. Marlene Kanga - Past President EA
11.00 am - 11.40am	**Key Note Speaker- Prof. Steven R. Weller** - Feedback Control and Climate Change: The Social Cost of Carbon, and Prospects for Climate Engineering
11.40 am - 12.20am	**Key Note Speaker-Mr. Jonathan Blesing** - Seawater Desalination - A Sustainable Solution to World Water Shortage - Adelaide Desalination Plant (44)
12.20 am - 12.30 pm	**Discussion**
12.30 pm - 1.30 pm	**LUNCH BREAK**
	Moderator - Dr. Charles Lee - UONS
1.30 pm - 1.55pm	**Mr. Thomas Pang** - Green Mark retrofitted buildings, update on green policies & regulation
1.55 pm - 2.20 pm	**Philip Chan**- The Asia Square Energy & Water Efficiency Tips
2.20 pm - 2.45 pm	**Dr. Sreedhar Kalavagunta** - Energy Performance Analysis of Buildings (37)
2.45 pm - 3.10 pm	**Mr. Liak Khiang Goh** - The Journey to Green Data Centres (39)
3:10pm - 3.35pm	**Ms. Rosaline Ganendra**- Municipal Solid Waste Management In Peninsular Malaysia-(67)
3:35pm-4:05pm	**TEA BREAK**
	Moderator - Dr Aparna Viswanath - UONS
4.05pm-4.30pm	**Dr. Tuck Wah Leong** - Sustainable Concrete Structures (65)
4.30 pm - 4.55 pm	**Mr. Jacob John Kuttisseril** - Development of a Low-Cost Image Processing Technique for Crack Detection for Structural Health Monitoring (48)
4.55 pm - 5.15 pm	**DISCUSSION**
5.15 pm	**Day 1 - Finish**
7.00 pm-7.30 pm	**Cocktail**
7.30 pm onwards	**Gala Dinner-Engineers Australia Singapore Chapter Anniversary at Marina Bay Sands**

3rd ASEAN AUSTRALIAN ENGINEERING CONGRESS	
CONFERENCE PROGRAMME	
Time	**Thursday**
	12/03/2015
	Moderator - Mr. Merv Lindsay - Director, Lindsay Dynan
9.15 am-9.40am	**Key Note Speaker-National President EA Dr. David Cruikshanks**
9.40am - 10.10 am	**Key Note Speaker-Dr. Marlene Kanga** - Smart Cities: Advanced Technology for Sustainable Urban Development
10.10am - 10.30 am	**Ms. Reine Essobmadje** - A Triptych of Community, City and Energy
10.30 am - 11.00 am	**TEA BREAK**
	Moderator - Dr. Hassan Ali - UONS
11.00 am - 11.25am	**Ms. Elizabeth Ratnam**-Assessing the Benefits of Net Metering with Residential Battery Storage(49)
11.25 am - 11.50pm	**Mr. Merv Lindsay** - The Building Information Modelling (BIM) Revolution (72)
11.50pm -12.15pm	**Mr. Geoffry A. Piggott** - Muncipal Solid Wastes to Energy: A Regional and Global Perspective
12.15 pm - 12.30 pm	**Discussion**
12.30 pm - 1.30 pm	**LUNCH BREAK**
	Moderator - Mr. Lee Keh Sai - EASC
1.30 pm - 1.55pm	**Dr. Norman Croker** - Social and Environmental Sustainability in the Hong Kong Construction Industry, An Empirical Study (62)
1.55 pm - 2.20 pm	**Prof. Steven R. Weller** - Estimates of the Social Cost of Carbon using Climate Models Derived from the CMIP3 Ensemble (43)
2.20 pm - 2.45 pm	**Ms. Rosaline Ganendra/ C.D. Ponnaiah** - The Prevalence and Suitability Of On-Site Decentralized Sewage Treatment Systems. - from Malaysia
2.45 pm - 3.10 pm	**Dr. Hassan Ali** - CCS Development and Demonstration for Coal-fired Power Plants in Australia (61)
3.10 pm - 3.35 pm	**Mr. Md Abdul Aziz** -Performance Testing of Comb Separator - A Novel Sewerage Overflow Screening Device (52)
3:35 pm-4:05 pm	**TEA BREAK**
	Moderator - Mr. Lawrence Lim - EASC
4.05pm-4.30pm	**Miss. Khadijeh Paymooni**- An Experimental Study on Perovskite Membrane Integration into a Chemical Looping Air Separation Unit for an Efficiency Improvement (57)
4.30 pm - 4.55 pm	**Mr. Mohammad Khairul Alam**-Application of Nanofluids to Enhance Heat Transfer in Renewable Energy Systems (59)
4.55 pm - 5.15pm	**DISCUSSION**
5.15 pm	**Day 2 - Finish**

3rd ASEAN AUSTRALIAN ENGINEERING CONGRESS	
CONFERENCE PROGRAMME	
Time	**FRIDAY**
	13/03/2015
	Moderator - Er. Percival JeyaPal - EASC
9.15 am-9.35am	**Mr.Havesh Nagarajan**-Gammon's Sustainability rney(74)
9.35 am-10.00am	**Ms. Lynn Dimayuga** - Technical Challenges of Developing Utility Scale Solar PV in the Philippines (61)
10.00am - 10.30 am	**Panel Session on:** International Perspectives on Sustainability **(Chair: Dr. Marlene Kanga, Speakers: Merv Lindsay, Charles Lee, Issi Gueye)**
10.30 am - 11.00 am	**TEA BREAK**
	Moderator - Dr Koh Yit Yan - UONS
11.00 am - 11.25am	**Mr. Md Abdul Aziz** - Parameter Sensitivity Using Sampling Technique For A Proposed "Comb Separator", A Sewer Overflow Screening Device (51)
11.25 am - 11.50pm	**Mr.Qinghao Cao**-Development of a Low-cost, Wireless, Self-sustaining Sensor based on Chemiluminescence for Soil Movement Monitoring (41)
11.50pm -12.00pm	**Discussion**
12.00 pm - 1.00 pm	**LUNCH BREAK- 3/13/2015**
1.00 pm - 5.30 pm	**FIELD TRIP to Tuas South Incineration Plant, 20 Tuas Avenue 20, Singapore 638831.**

KEYNOTE SPEAKERS



Dr. David Cruickshanks-Boyd

Dr. David Cruickshanks-Boyd,
National President Engineers Australia

David Is A Fellow Of Engineers Australia And A Member Of The Civil College. He Is Currently The National Director Sustainability For Parsons Brinckerhoff (PB), A Global Infrastructure Professional Services Firm, And Chairman Of Scope Global Pty Ltd.

David Was Deputy Chair Of The National Board Of The Centre For Engineering Leadership And Management, And Was Very Active In The Proposal Which Has Led To The Establishment Of The New College Of Leadership And Management. David Was The President Of Engineers Australia In South Australia In 2011, And Has Been A Member Of Several National Committees For Engineers Australia (Code Of Ethics Committee, Reconciliation Action Plan Steering Committee, Audit And Risk Committee, Council Governance Committee And Congress Governance Committee).

David Has Had A Number Of Non-Executive Board, Or Advisory Council Positions Including Board Member With The South Australian Chamber Of Mines And Energy; Member Of The SA Ministerial Resources And Energy Strategic Infrastructure Council; And Member Of The SA Ministerial Advisory Council For The Mining Industry Participation Office.



Prof. Steven Weller

Steven R. Weller (S'88–M'94)
Received The B.E. (Hons.I.) Degree In Computer Engineering In 1988, The M.E. Degree In Electrical Engineering In 1992, And The Ph.D. Degree In Electrical Engineering In 1994, All From The University Of Newcastle, Australia. During 1994–1997, He Was A Lecturer In The Department Of Electrical And Electronic Engineering, University Of Melbourne, Australia. In 1997, He Joined The University Of Newcastle, Where He Is Currently An Associate Professor. He Served As Head Of School Of Electrical Engineering And Computer Science (2007–2009), And Assistant Dean Research (2011–2013) For The Faculty Of Engineering And Built Environment, Where He Is Currently Deputy Head Of Faculty. His Research Interests Are In The Areas Of Control Theory And Its Application To Energy Systems And Climate.



Dr. Marlene Kanga

Dr Marlene Kanga

Is A Chemical Engineer With A Special Interest In Risk Engineering Especially As It Relates To Natural Hazards. She Will Discuss Technologies Being Developed Around The World For The Sustainable Development And Management Of Cities And To Mitigate Natural Disaster Risks.
Dr. Kanga Was National President Of Engineers Australia In 2013 And Is Deputy Chair Of The World Federation Of Engineering Organisations Committee For Natural Disaster Risk Management. She Is Currently Is Acting Chair Of Innovation Australia And Chair Of The R&D Incentives Committee At Australia's Department Of Industry. She Is A Board Member Of Sydney Water And A Founding Director Of Omniscient Pty Ltd. Which Has Developed Technologies For Smart City Management.

Dr. Kanga Was The FEIAP Professional Engineer Of The Year In 2014 And Was Listed Among Australia's Top 100 Engineers In 2013 And 2014 And Among The Westpac Top 100 Women Of Influence In 2013.

KEYNOTE SPEAKERS



Mr Jonathon Blesing

Mr Jonathon Blesing

Jonathon (Joe) Blesing is a Technical Director of Aurecon Australasia Pty Ltd and has over 40 years consulting engineering experience in Australia and South East Asia. Joe is a mechanical engineer by profession, a Chartered Professional Engineer and a Fellow of the Institution of Engineers Australia. He has a wide range of experience in industrial and infrastructure projects and commercial and institutional buildings, including the College of Technology, a 20 building tertiary institution in Doha, Qatar, the Seletar Waste Water Treatment Plant here in Singapore, and the recent Adelaide Desalination Plant where Joe was Team Leader of the SA Water Technical Support Team over the 4 year design and construction period. Whilst stationed in Singapore 1991 to 1996, Joe was a registered Professional Engineer (Singapore), and was a co-founder and inaugural Chairman of Engineers Australia (Singapore Group) which will celebrate it 20 year anniversary during this conference.

SPECIAL SPEAKERS



Mr Stephen Durkin

Mr Stephen Durkin, CEO Engineers Australia

Stephen Durkin is CEO of Engineers Australia, the peak professional body for the engineering profession in Australia.

Stephen graduated with an Honours Degree in Civil Engineering from Monash University in 1986. In his early career, Stephen worked as a consulting engineer across Australia, Canada and Asia and in 1993, was named EA's Victorian Young Engineer of the Year.

Upon completing an MBA in 1995, Stephen moved to the financial services industry where he worked for the next sixteen years for NAB in corporate strategy, change management, marketing and people leadership.

Working with a diverse range of people and being exposed to a range of leadership styles has driven Stephen's career interests in cultural change, creating high performing teams and running innovative and customer focused businesses.

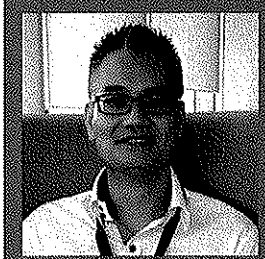
Since being appointed as CEO in January, 2012, Stephen Durkin has been leading a major transformation across Engineers Australia. This change program has been focused on building a more contemporary culture to support Engineers Australia in being a more member-focused organisation with a greater external orientation.



Prof Amir Mahmood

Prof Amir Mahmood, Pro Vice Chancellor, University of New Castle, Singapore

Professor Amir Mahmood is the Pro Vice-Chancellor University of Newcastle (Singapore). He holds an M.A. and Ph.D. in Economics from the University of Manitoba, Canada. Since joining the University of Newcastle, Australia, in 1992, he has significantly contributed to the areas of research, teaching, internationalisation and academic leadership. During this period, Professor Mahmood has also held a number of senior leadership positions with the University. A recipient of the Australian Governments Endeavour Malaysia Research Fellowship, Professor Mahmood has a strong research track record in the field of economics, business and management.



Mr Thomas Pang

Mr Thomas Pang,

Thomas Pang has joined BCA Green Mark Department since 2007. His current main work area is green mark developmental works such as development of assessment scheme for existing non-residential buildings. In early 2008, he also involved in the development of the green building evaluation system for the Sino-Singapore Tianjin Eco-city.

Another portfolio is the green mark operation such as green mark assessment in Singapore and in the regions. As of now, he has assessed over 200 green mark existing and new developments in Singapore & overseas (residential buildings, office buildings, institutional building, retail malls and industrial buildings). He also involved in legislation developmental works for existing buildings which was implemented in Jan 2014.

SPECIAL SPEAKERS



Ms Reine Essobmadje

Ms Reine Essobmadje

Reine Essobmadje holds a Global Executive MBA from IE business school Spain with an additional program in Ethics & Corporate Governance from SMU Singapore. She is also an Engineer by training (Master of sciences), graduated in 2004, from ECE Paris including an additional program in Management from Stafford University in UK.

With a double culture (African and European) Reine advocate for the added value of ICT4Dev in various sectors (finance, education, agronomy...), while in parallel being involved in scientist and women organizations as reflected below:

Member of:

WFEO – WIE & CIC committee (World Federation of Engineering Organizations)

EPWN – European Professional Women Network

INWES International Network of Women Engineers and Scientists

With the intent of using ICT to achieve the MDGs (Millenary Goal for Development) Reine is also the promoter of ICT days (annual free conference and training) under the brand name "ICT days of Evolving Consulting" launched in Cameroon in 2010. She is also co-organizer of the African Digital Woman Award patron by Dr HamadounTouré ITU SG.

As an Entrepreneur, she is the founder of Evolving Consulting in France and Cameroon.

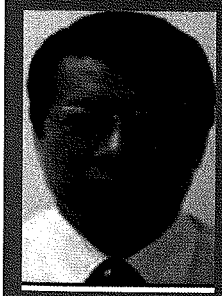
The company covers ICT and telecommunications projects in Europe and Africa with the vision to adapt international best practices to each local context for prestigious customers like World Bank, ITU, ICT Ministries, Regulatory Board and private sector in France, Cameroon, Congo, Burundi, ...

As an international consultant she has conducted some studies on ICT:

World Bank consultant for Central African Backbone (CAB) Projects in Congo and Cameroon (PPP, Cyberstrategy, ICT legal framework, Fiscal& Tariffs on Telecom sector, ...)

ITU (UN agency for Telecommunications & ICT) Expert in Burundi for ICT Ministry (Telecommunication Tariffs analysis)

Managed services for Alcatel-Lucent XXL Accounts

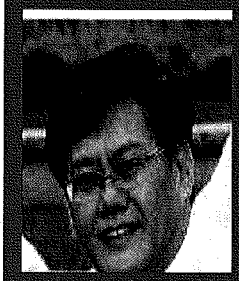


Dr Charles Lee

Dr Charles Lee

Dr. Charles CC Lee, is an Acting Program Convenor and senior lecturer at the University of Newcastle (Australia), UoN, Singapore. Dr. Lee obtained his BSc from the University of Guelph, Canada, and his MSc and PhD from the University of Hawaii, USA. He has more than 25 years experience in environmental research, teaching and consulting in USA, Canada, Singapore, China, Taiwan, Japan, Malaysia, India, Brunei and Indonesia. His experience encompasses consulting at one of the top environmental consulting firms

SPECIAL SPEAKERS



Mr Phillip Chan

Mr Phillip Chan

Beng(Hons) Mech RMIT, ASMKT,Dip.Mech,MIES,MIEAust, BCA-Registered Energy Auditor,SCEM, Certified GMM, Certified GMFM

He has help many buildings to achieve optimum design in water and energy efficiency through his 29 years of experiences in handling commercial and Industrial MEP Plants. He is a BCA-registered Energy Auditor and has helped several new buildings to achieve the design and operates the Plant Efficiency at0.6 Kw/ton or better. Currently, he is nominated for the Watermark Award for 2015 under the Individual category.

He has spearheaded Asia Square to clinch the 1st private commercial building to win the Water Efficiency Building Gold Award. He is overseeing and meeting the energy saving for Asia Square Tower 1 to complete the 2nd phase and renewal of Green Mark Platinum Award.

He has demonstrated beyond his innovative ways to sustain the optimal in operating the building in the most efficient ways such as;



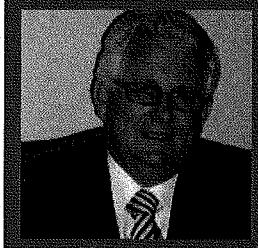
Mr Merv Lindsay

Mr Merv Lindsay

Merv Lindsay is a graduate of Newcastle University. He has operated his own Consulting Practice for 35 years. The practice, Lindsay Dynan Consulting Pty Limited has offices in Sydney, Newcastle, Perth and the Central Coast (NSW).Merv has also been a member of the governing board (Council) of Engineers Australia for 8 years until 2012 and in 2011 served as National President.

Freed from his leadership role in Engineers Australia and no longer in the role of CEO of his company, he operates in mentoring roles, focused on up skilling his company to meet industry and society expectations in project delivery in BIM, and promoting the benefits of BIM to the wider community.

Merv's other engineering interests include supporting and promoting the humanitarian relevance of engineering in all areas of society and throughout the world. He also retains an active interest in Heritage Engineering and preserving engineering heritage



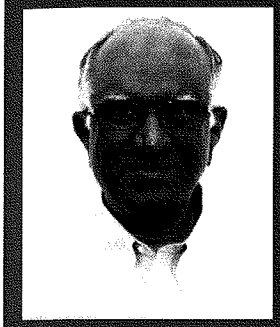
Mr.Geoffrey Piggott

Mr Geoffrey Piggott

Geoffrey Piggott is a Civil/Environmental Engineering graduate from the University of New South Wales in Australia with some 40+ years of experience in the planning, design, construction and operation of large scale infrastructure in Asia Pacific, the Middle East and Europe. He has specialized in water and wastewater infrastructure and solid wastes management and has worked in senior technical, operational and business management roles in the consulting, contracting and utility sectors. Geoff is a Fellow of the Institution of Engineers Australia and a Chartered Professional Engineer. He is also former Confederation of British Industry Scholar.

Geoff returned to Singapore in June 2014, after a 7.5 year stint in Qatar where he was the Project Director for the Middle East's First Integrated Waste Management Facility and subsequently the Middle East and North Africa Regional Manager for Keppel Infrastructure. He is currently the Project Director for one of the largest and most technically advanced capital works projects in Singapore for the Singapore Public Utilities Board and the National Environment Agency and leads an integrated Joint Venture team from Black & Veatch and AECOM in delivering this project.

SPECIAL SPEAKERS



Thomas Thomas

Thomas Thomas
is the CEO of the ASEAN CSR Network, a network of CSR networks in ASEANto achieve sustainable socio economic development as the ASEAN Community 2015 is formed.
He is an Honorary Professor of Corporate Social Responsibility with the Nottingham University Business School in the United Kingdom.

He serves on the UN Economic and Social Council for Asia Pacific (ESCAP)'s Business Advisory Council, an initiative to consult the private sector and other relevant stakeholders on business related policy issues of importance to Asia and the Pacific. He was also the lead of a study team doing a base line study on CSR in ASEAN Member States for the ASEAN Intergovernmental Commission on Human Rights. He serves in the Eminent Persons' Group Developing the Reporting and Assurance Framework Initiative (RAFI) for the UN Guiding Principles on Business and Human Rights.

Thomas was the founding Executive Director of the Singapore Compact for Corporate Social Responsibility (CSR), the national CSR society in Singapore. He was the co-chair of the National Tripartite Initiative for CSR, formed in 2004 and initiated the formation of Singapore Compact for CSR. He was the Singapore focal point for UN Global Compact.

Thomas had been involved in the ISO26000 process from the beginning in 2004, as the convenor of the Singapore Mirror Working Group for ISO26000, a member of the Chair's Advisory Group for the development of this standard and after the publication of the standard, as a member of the ISO's Post Production Organisation responsible for monitoring and providing guidance on the implementation of the standard.
Thomas had been active with trade unions, co-operatives, the consumer movement and social enterprises and also served as a Nominated Member of Parliament in Singapore.

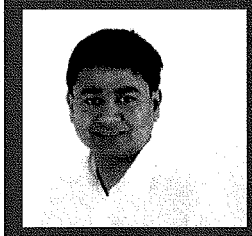
TECHNICAL PAPER PRESENTERS



Dr Hassan Ali

Dr Hassan Ali

I received the B.E (First Class First) in electrical engineering from Mehran University of Engineering and Technology, Pakistan, and Ph.D. degree in electrical engineering in 2003, from the University of Melbourne, Australia. During 2002–2003, I was a Lecturer, in the Dept. of Electrical and Computer Engineering, Curtin University of Technology, Western Australia. In 2004, I joined the University of Nottingham, Malaysia Campus as Assistant Professor in the Department of Electrical and Electronic Engineering. I served as Communications Strand Lead and was member of Faculty Research Committee. In 2008 , I joined the University of Newcastle, Australia (Singapore Campus) as Lecturer (Electrical Engineering) where I am currently Academic Coordinator (Engineering and Construction Management). My research interests are in the areas of Wireless Communications, Embedded Systems, Electronics Design, Emissions Monitoring and Energy Planning.



Mr Md Abdul Aziz

Mr Md Abdul Aziz

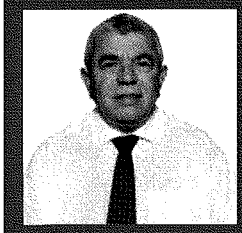
Md. Abdul Aziz is working as a floodplain officer at Wimmera Catchment Management Authority (Wimmera CMA) at Horsham in Victoria, Australia since 2011. Abdul have more than 12 years of experience in different civil engineers projects. He had received Swinburne University Post Graduate Research Award (SUPRA) at Melbourne, Australia for his doctoral study in 2009 and Japanese Government Monbukagakusho Scholarship in 2002 for his Master of Engineering at Tokyo Institute of Technology, Tokyo, Japan. His key research interest includes: Artificial Neural Network, Computational Fluid Dynamics and Floodplain Modelling



Mr Qinghao Cao

Mr Qinghao Cao

I am a final year undergraduate from National University of Singapore, majoring in civil engineering.



Dr NormCroker

Dr Norm Croker

Dr Norm Croker is a Civil Engineering practitioner residing in Hong Kong for the past 20 years. He is currently Vice-President of Engineers Australia, Hong Kong Chapter. He has authored several articles in international journals. His is professional interest is in the construction of major infrastructure projects and his current academic interest is in the sustainability of the construction industry through the application of socially responsible practices and provision of a safe and healthy working environment.

TECHNICAL PAPER PRESENTERS



MrLynn Dimayuga

Mr Lynn Dimayuga

I am a solar engineer with more than 9 years' experience in solar PV industry including cell manufacturing, system design, installation troubleshooting and operational improvement. Prior to joining GHD, I worked for more than 6 years for Sun Power's ROHQ in the Philippines where I provided technical advisory of system design and installation for the US and Australian markets. I have gained practical solar PV experience with up to date market technical knowledge.



Ms RosalineGanendra

Ms Rosaline Ganendra

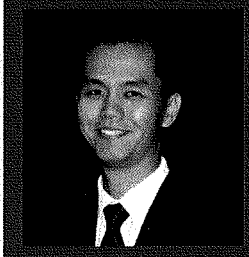
Rosaline is currently a Director of MinconsultSdn Bhd. She obtained her B.Sc degree in Civil Engineering from the Imperial College Science & Technology, London (1984). She has 30 years of technical experience in civil and structural engineering and 24 years of project management experience.

Datuk Ir. Rose was the Vice President of the Institution of Engineers Malaysia (IEM) Council, member of the Executive Committee and the Chairman of the Standing Committee on Welfare and Service Matter from 2009 to 2011. She was the first Chair of the Graduate & Student Section, IEM. She was also a committee member of BEM working groups on Road Safety Auditor Registration and on Integrated Building Systems. Datuk Ir. Rose was a member of the Executive Council and member of the World Federation of Engineering organization (WFEO).

Through her commitment in the Institution of Engineers Malaysia (IEM), Datuk Ir. Rose spearheaded the Women Engineers in organizing the first Women in Science Engineering and Technology International Conference (WiSET) in Malaysia in 2012. Datuk Ir Rose was also involved in the organizing the first Convention of Women in Construction (KUBINA), 2014 for women professional involved in the construction industry organised by The Malaysian Construction Industry (CIDB). Datuk Ir. Rose has published several papers in the engineering journals and given talks on women empowerment in local institutions such as the High Level International Roundtable for Women in Leadership in Roles in ScienceAnd Technology Conference jointly organized by International Science Technology & Innovation Centre(ISTIC), NAM Institute for the Empowerment of Women Malaysia (NIEW), etc.

As a member of the Standing Committee for Women in Engineering (WIE) Datuk Ir. Rose has also given talks and presented papers on women engineers at various International conferences such as "Policies & Activities on Gender, Science & Technology" at The 2013 International Conference on Women in Science and Technology (IConWiST) and 2013 Asia Pacific Nation Network (APNN) meeting in Taipei, "Women in Leadership Role in Technology Related Professions' at the World Engineers Summit in Singapore, 2013, The 2012 International Women's Day Celebration in UNESCO Paris, Panelist speaker on "Women Engineers in Malaysia at the 2012 Women Engineers Panel Chinese Society for Electrical Engineering (CSEE) Annual Meeting in Beijing and International Conference of Women Engineers and Scientists ICWES15 in Australia.

TECHNICAL PAPER PRESENTERS



Mr. Goh Liak Khiang

Mr. Goh Liak Khiang

Liak has a specific interest in deploying leading edge technology into buildings and data centre. He was a member of IDAï¿½ï¿½â„¢s Green Data Centre Standards Working Group and help established the Singapore Green Data Centre Standard.

Liak consolidated experience working with a consultant firm and equipment manufacturers in both Singapore and Australia. His responsibilities include managing projects, marketing, key account management, as well as providing technical support.

Liak holds an Honors Degree in Electrical & Electronics Engineering from the Nanyang Technological University in Singapore and a Master of Business Administration (MBA) from the University of New England in Australia. He is a Registered Communication Distribution Designer (RCDD) and Chartered Professional Engineer (CPEng).



Dr Sreedhar Kalavagunta

Dr Sreedhar Kalavagunta

Dr.Sreedhar PhD in Civil Engineering working as Sr Research Engineer for Bentley systems, Singapore

Published 20 over papers in Journals and international conferences. Pubilished a book on Axially Loaded Cold Formed Steel Columns Strengthened with CFRPâ€.Main areas of interest, Engineering software development, Structural analysis and design, Building information modeling , Training on engineering software applications



Mr Jacob John Kuttisseril

Mr Jacob John Kuttisseril

The author is pursuing his undergraduate degree in Electrical Engineering in the National University of Singapore. He is involved in a lot of work in the field of computer vision and Image processing.

TECHNICAL PAPER PRESENTERS



Dr Tuck Wah Leong

Dr Tuck Wah Leong

Dr. Leong Tuck Wah graduated with a Ph D in Structural Engineering from the University of New South Wales, Australia in 1971.
Appointed as a Lecturer in 1972 and later promoted as a Senior Lecturer then Associate Professor in the Department of Building, National University of Singapore until retirement in 2002. During this period he had committed himself not only in teaching and research but also in engineering practice. He was one of the first batches of accredited checkers appointed by the Building Control Authority, Singapore. He had published close to 100 technical articles in international, local journals and international as well as regional conferences. He have gained valuable experience through his practice as a Research, Professional Engineer and Accredited Checker from various civil and structural engineering projects completed all these years in Singapore and Malaysia before and after his retirement.



Mr Havesh Nagarajan

Mr Havesh Nagarajan

With an excellent, wide-ranging experience in multiple roles – in a multinational contractor, consulting firm and a government statutory board, I am an experienced Sustainability/Environmental professional working in Singapore. As a Sustainability manager, I have been closely working with the company's top management in setting and leading the organization's environment & sustainability strategy, preparing annual sustainability reports, leading ISO 9001,ISO 14001 certifications & audits and managing green building certification for large infrastructure and building projects in Singapore. I have excellent communication skills with an added ability to bring innovative solutions to problems.



Miss Khadijeh Paymooni

Miss Khadijeh Paymooni

I am a PhD student at the University of Newcastle. My prior education includes achieving Bachelor of Science and Master of Science in chemical engineering. I was awarded the University of Newcastle International Postgraduate Research Scholarships (UNIPRS) in 2011 to commence my research in the Newcastle Institute for Energy & Resources (NIER).
Since starting my PhD, I have been involved in a very interesting research project. In short, the main goal of my research is to integrate oxygen transport membranes into Chemical Looping Air Separation Unit to improve the energy efficiency.

TECHNICAL PAPER PRESENTERS



C.D. Ponnaiah

C.D. Ponnaiah

Ir. ChandranPonniah has been involved with the planning, design and construction supervision of environmental/public health engineering projects for the last thirty-two (32) years. In addition Ir. Ponniah has been involved in managing the conduct of over eighty Environmental Impact Assessment Studies over the last fifteen years.

After graduation from the University of Auckland with a Masters Degree in Chemical and Materials Engineering, Mr. Ponniah was employed by the Rubber Research Institute of Malaysia from 1973 to 1976. He was responsible for laboratory, pilot plant and commercial scale studies on treating latex concentrate and rubber factory effluents, and was a member of a Committee formed by the Department of Environment to review effluent discharge standards for the Rubber industry.

Mr. Ponniah joined MinconsultSdnBhd in 1976 and has since participated on numerous municipal water supply, sewerage and solid waste management projects both in Malaysia as well as in India, Nepal, Sri Lanka and the West Indies. Mr. Ponniah was a member of Sirim's Standards Committee on Sewerage and assisted in formulating MS1228. He has carried out conventional and turn-key water supply projects for both the private and public sectors.



Ms Elizabeth Ratnam

Ms Elizabeth Ratnam

Elizabeth received the B.E. (Hons I) degree in Electrical Engineering in 2006 from the University of Newcastle, Australia. During 2001-2012 she gained engineering experience at Ausgrid, one of the largest electricity distribution networks in Australia. She began her association with Ausgrid as an undergraduate, and subsequently on the graduate program. In 2007 she was appointed a distribution planning role, and in 2009 joined the group tasked with building an Australian government funded Smart Grid Smart City, led by Ausgrid and supported by a consortium of partners. She is currently studying towards her Ph.D. degree at the University of Newcastle, Australia.



Mr. Mohammad Khairul Alam

Mr Mohammad Khairul Alam

Mohammad Alam received his Bachelor in Mechanical Engineering from Dhaka University of Engineering & Technology, Bangladesh in 2012. Then he was working as a research assistant in the Department of Mechanical Engineering, University of Malaya, Malaysia. Afterward, he is currently undertaking his PhD in Chemical Engineering as an international student at The University of Newcastle, Australia in 2014 under the supervision of Professor Behdad Moghtaderi, Dr.Kalpit Shah, and Dr.Elham Doroodchi. He has been awarded niversity of Newcastle scholarships. Besides, he has been honoured merit scholarship during the BSc Engineering education for 4 years from Dhaka University of Engineering & Technology, Bangladesh

Application of nanofluids to enhance heat transfer in renewable energy systems

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Corresponding author: Professor Behdad Moghtaderi. Behdad.Moghtaderi@newcastle.edu.au

ABSTRACT:

Nanofluid is one of the potential fluids that provide range of properties to overcome energy recovery barriers from a low grade heat resource. A significant reduction in energy consumption is possible by improving the performance of heat exchanger circuit in renewable systems with the introduction of nanofluids. However, the stability of nanofluid still remains the unresolved because of the aggregates formation due to the associated van der Waals forces. Therefore, current work aims at investigating the stability of nanofluid with respect to viscosity and thermal conductivity. The water based Al_2O_3nanofluids with different concentrations of anionic surfactants were investigated under a wide range of the shear rates and nanoparticles concentrations. The results show that nanofluids stability has a strong relation with viscosity and thermal conductivity. The stability of nanofluid was found to improve with decrease in viscosity and increase in thermal conductivity. Consequently, the treatment with chemical surfactant was found to reduce pumping power and enhance the performance of heat transfer as well.

Carbon Capture and Storage (CCS) for Australian Coal-Fired Power Plants

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SUMMARY

The International Energy Agency (IEA) recognizes carbon capture and storage (CCS) as one of the essential technologies that can be used to reduce greenhouse gas (GHG) releases to the environment. Australia has undertaken initiatives to encourage the development of CCS as a way of limiting the country's GHG emissions while enabling it to make use of its abundant coal resources. This paper summarizes some of these initiatives, reviews the different types capture technologies, and the status of CCS deployment for coal-fired power plants.

KEYWORDS

Carbon capture and storage, coal fired, power plants, carbon dioxide, emissions

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TECHNICAL PAPER ABSTRACTS

PARAMETER SENSITIVITY USING SAMPLING TECHNIQUE FOR A PROPOSED 'COMB SEPARATOR', A SEWER OVERFLOW SCREENING DEVICE

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ABSTRACT

During wet weather conditions sewer overflow into creeks and rivers. Overflow sewer carries lots of aesthetic pollutants on water bodies. These sewer solids cause concern for the environment. To overcome such issue a self-cleansing 'Comb Separator' screening device was developed and tested. The device performance was compared with industry standard 'Hydro-JET™'. The comparisonhighlighted importance to understand parameter sensitivity at varying flow, effective comb spacing, device run time, weir opening and comb layers. Sensitivity analysis found weir opening and comb layers are responsible for only 3.6% of sewer solids capture efficiency. Other three input correlation coefficient suggest effective spacing is the most important parameter with correlation coefficient r= 0.684. Varying flow has a negative correlation with capture efficiency, r = -0.548 whereas runtime had a positive correlation, r = 0.476 and all these results are statistically significant. These results will be acted as guide for device operator.

Index Terms— *Sewer overflow, Sensitivity analysis, Effective Spacing, Capture Efficiency.*

PERFOMANCE TESTING OF 'COMB SEPERATOR'- A NEVEL SEWERAGE OVERFLOW SCREENING DEVICE

M. A. Aziz[1], M. Imteaz[1], H. M. Rasel[1], M. M. Hasan[2]

[1] Swinburne University of Technology, Faculty of Science, Engineering & Technology, VIC 3122, Australia.
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ABSTRACT

During wet weather conditions rivers and creeks receive a lot of sewer solids due to limited sewer volume in the urban sewer system. This overflow causes a serious concern for the environment. To overcome such overflow, different types of overflow screening device were developed. Some of the key limitations found in the existing screens include the initial expense, maintenance costs, poor sewer capture efficiency and blinding on the screener. Most of the screens have sophisticated switching systems which are expensive, and cause concern for possible malfunctions in remote unstaffed locations. Consequently, a novel sewerage overflow device 'Comb Separator' was developed and tested. Optimum design criteria were achieved for the device using trial and error method. Results showed there was minimal blockage on the screen and the novel device can produce higher capture efficiency than industry standard Hydro-JET™ model. This research recommends 'Comb Separator' can improve current practice of sewer solids capturing in the urban sewer system.

Index Terms— Capture efficiency, Sewer solids, Screening device, and experimental setup.

TECHNICAL PAPER ABSTRACTS

SEAWATER DESALINATION - A SUSTAINABLE SOLUTION TO WORLD WATER SHORTAGE ADELAIDE DESALINATION PLANT

Mr Jonathon Blesing

SUMMARY

As world population increases disproportionately in urban centres, stress on existing natural water supplies (with respect to quantity and quality) will continue to increase. Alternative sources of water are necessary for sustainable development. Seawater desalination can provide an almost limitless source of drinking water. However, this process requires relatively large amounts of energy and careful management of environmental impacts associated with abstraction and brine discharge is necessary.

This paper addresses the methodology adopted for the design, construction and operation of the Adelaide Desalination Plant (ADP) in South Australia. This plant represents the largest investment by South Australian Water Corporation, the public water utility providing water and wastewater services for more than 1.5 million people, in the history of the state. The plant was designed and constructed by Adelaide Aqua, a consortium consisting of Acciona Agua (process design) and McConnell Dowell and Lend Lease (civil, structural, mechanical and electrical design and construction). The ADP can produce up to 50% of metropolitan Adelaide's average daily water supply needs, providing a climate independent source of drinking quality water.

KEYWORDS

Sustainable engineering	Reverse osmosis	Seawater desalination
Ultra filtration	Energy recovery	Renewable energy

DEVELOPMENT OF A LOW-COST, SELF-SUSTAINING, WIRELESS, SOIL MOVEMENT SENSOR BASED ON CHEMILUMINESCENCE

Cao Qinghao [1] and K.S.C. Kuang[1,2]

[1] Engineering Design and Innovation Centre, Design Centric Programme, E1A #-03-03, Faculty of Engineering, National University of Singapore.
[2]Department of Civil and Environmental Engineering, E1A, #07-03, National University of Singapore, Singapore
Corresponding author: Cao Qinghao, 827918891qq@gmail.com

Theme: Sustainable sensor

SUMMARY

A novel sensor based on chemiluminescence is proposed in this paper and shown to be capable of monitoring horizontal soil movement typical in landslide situation and other applications where soil movement is a concern. Simulated experiments were carried out to verify the performance of the sensors system and design recommendation. The device is also made self-sustainable and shown to be capable of providing damage information wirelessly to the user as far as 300m from the position of the device.
Compared with other conventional monitoring instruments, the proposed sensor system has the advantages of being wireless, highly cost-effective and self-sustaining.

KEYWORDS

Wireless, sensors, soil movement, displacement, chemiluminescence, geotechnical health monitoring, self-sustaining

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TECHNICAL PAPER ABSTRACTS

SOCIAL AND ENVIRONMENTAL SUSTAINABILITY IN THE HONG KONG CONSTRUCTION INDUSTRY, AN EMPIRICAL STUDY'

Mr. N .C. Croker[1] L. R. Barnes[2],

[1] The University of Newcastle, Newcastle Business School, Faculty of Business and Law, North Loop, Ourimbah, NSW, 2258, Australia
[2] Consulting Engineer, Abundance Holdings Ltd., Unit 20H, 20/F Superluck Industrial Building, Tsuen Wan, Hong Kong.
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Dr. Lisa Barnes B Ec, MBA, DBA, FCPA, FTIA, GAICD, Lisa.barnes@newcastle.edu.au

Theme: Sustainable building & infrastructure

SUMMARY

The Hong Kong construction industry ("HKCI")comprises a small number of large local and overseas contractors dependent upon [primarily SME] sub-contractor firms (Rowlinson, 2007) for which the concepts of Social and Environmental Responsibility are still poorly understood. The aim of this research is to investigate the drivers of improvements in Social and Environmental Responsibility in the HKCI, The results of the study partially fill gaps in the Social and Environmental Responsibility literature relating to firms in the construction industry; and, confirm that the level of social and environmental maturity of HKCI firms is similar to their Australian counterparts.

KEYWORDS

Construction Industry, Social Responsibility of Business, Environmental Responsibility of Business, Sustainable Construction.

TECHNICAL CHALLENGES OF DEVELOPING UTILITY SCALE SOLAR PV IN THE PHILIPPINES

Ms. Lynn Dimayuga[1], Benoît Prim[1],Louis Lefevre[1]

[1] GHD Manila, 11/F Alphaland Southgate Tower 2258 Chino Roces Ave corner EDSA Makati City 1232 Philippines
Corresponding author: Lynn Dimayuga. lynn.dimayuga@ghd.com

Theme: With the booming Solar PV industry in the Philippines, developers and investors alike are clamoring to get "a piece of the pie" but what does it take to get to it? What are the roadblocks that one must overcome to succeed in this endeavor?

SUMMARY

Being located strategically near the equator, the Philippines is one we may call a privileged recipient of the suns benefits. Although all around the globe solar PV renewables have been a fad for quite some time, this is a technology that is fairly new to the Philippines. With the current shortage in electricity, the country has opened its doors to utilizing its resources to meet the increasing energy demand which is about to exceed electricity generation capacity.

To help in resolve this challenge, the government has launched programs to help attract investors and developers to pursue Solar PV projects. The current Feed-in-Tariff (FIT) capped at 50MW is to be extended to 500MW and a net-metering scheme is about to be officially announced.
But what does it take to be an investor or a developer for this technology in this country? What are the complexities that one needs to understand before plunging into the pool of opportunity? Is it worthwhile to take a risk?
This paper is intended to help investors and developers manage and understand the risks in pursuing a Solar PV project in the Philippines. It also aspires to provide guidance to a successful venture.

KEYWORDS

Solar PV Solar Photovoltaic's, the production of electricity via panels thru its exposure to the sun
FIT Feed-in Tariff, An economic policy created to promote active investment in and production of renewable energy sources. Feed-in tariffs typically make use of long-term agreements and pricing tied to costs of production for renewable energy producers.
Net-metering scheme a system in which solar panels or other renewable energy generators are connected to a public-utility power grid and surplus power is transferred onto the grid, allowing customers to offset the cost of power drawn from the utility.
Global Horizontal Irradiance The amount of solar radiation that can be consumed by the panels

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MUNICIPAL SOLID WASTE MANAGEMENT IN PENINSULAR MALAYSIA

Ms. R. Ganendra / Mr. C.D. Ponniah
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[2]Technical Director, Minconsult Sdn Bhd, Lot 6, Jalan 51A/223, Petaling Jaya, Selangor, Malaysia

SUMMARY

Municipal solid waste management in Malaysia is at a cross roads. Accelerated economic growth coupled with an expanding population base, increased intensity of rural to urban migration trends and increased level of consumerism in urban areas are factors that have contributed to the rapid increase in municipal solid waste (MSW) generation rates within Peninsular Malaysia. The annual geometric growth rate of MSW between the years 1996 to 2012 was of the order of 4 percent. Total wastes generated increased from about 13,000 tons/day to 30,000 tons/day during this period. Current average rates of MSW generation within urban areas, in terms of wastes produced per person per day, averages 1.1 kg/cap/day which is considered high.

Co-mingled municipal solid wastes, a combination of various types of organic and inorganic discards by households and by commercial, institutional and industrial establishments, harbour latent resources which can be tapped in an economical and profitable manner to remanufacture products, recover energy, forestall the depletion of natural resources and contribute towards environmental protection. In Malaysia efforts to recover and recycle latent resources in wastes are minimal and this factor has resulted in voluminous amounts of wastes that need to be finally disposed promoting adverse environmental impacts. Malaysia which aspires to become a developed industrial nation by year 2020 needs to enhance its MSW management capabilities to match-up to other developed Asian regions by maximizing the recovery of resources present in MSW, and in safety and hygienically disposing of residual wastes.

This paper reviews the historical management of MSW within Peninsular Malaysia, compares waste generation, recovery and disposal rates, and management efforts, to provide a satisfactory service to communities in comparison with other developed Asian nations; and recommends strategies and action plans to overcome current deficiencies and to promote an efficient sustainable municipal solid waste management programme befitting a developed nation status.

KEYWORDS: Municipal Solid Waste, Recycling, Resource Recovery, Environmental Impacts

TECHNICAL PAPER ABSTRACTS

THE PREVALENCE AND SUITABILITY OF ON-SITE DECENTRALISED SEWAGE TREATMENT SYSTEMS –

Ms. R. Ganendra / Mr. C.D. Ponniah

[1]Director, Minconsult Sdn Bhd, Lot 6, Jalan 51A/223, Petaling Jaya, Selangor, Malaysia
[2]Technical Director, Minconsult Sdn Bhd, Lot 6, Jalan 51A/223, Petaling Jaya, Selangor, Malaysia

SUMMARY

On-site latrines (OSL) were the sole Sewage Disposal System employed prior to the nineteen forties in Malaysia. Off-site piped sewerage systems were gradually introduced; initially on a regional scale in the 1940's, 1950's and 1960's, and thereafter more extensively on a local scale from the mid-nineteen seventies onwards. Even with the emphasis on implementing piped sewerage systems in urban areas since the nineteen eighties, on-site sewage disposal systems (OSDS), such as septic tanks and pour flush latrines (PFL), have continued to prevail in significantly large numbers in urban areas.

The current presence of STs and PFLs in urban areas throughout Peninsular Malaysia is significant numbering 1.3 million and 895,000 respectively. Collectively they serve a population equivalent of about 10 million (or 48% of the total population residing within Peninsular Malaysia and Labuan). They have contributed in no small measure towards upgrading the level of sewerage services in urban areas by displacing unsanitary on-site latrines (conservancy system, pit latrines, etc.) which were not able to cater for increasing amounts of sewage discharges induced by the adoption of flush toilets and multiple taps within occupied premises.

Currently the total organic loads and pathogens discharged to the environment by OSDS nearly match those released by mechanized sewage treatment plants throughout Peninsular Malaysia. It is a growing concern that OSDS are impacting adversely on the water quality of rivers and coastal waters; and are compromising the living ambience of socially advancing communities.

This Paper briefly reviews the historical development and prevalence of OSDS in Peninsular Malaysia; describes the basic functional characteristics and design features of STs and PFLs; explains their operational and maintenance requirements; and appraises their attributes and limitations. The case for elimination of OSDS is made taking due cognizance of the problems that will be encountered in phasing out these "outdated sewage disposal" systems.

KEYWORDS

Sewage Disposal System, Pour Flush Latrines, Sewerage Systems

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THE JOURNEY TO GREEN DATA CENTRES

Mr. Goh Liak Khiang

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SUMMARY

We live our modern lives in the digital world. Our digital lives are connected to processing and storage power in data centres. However data centres have been recognised as one of the top industrial source of energy consumption[1]. The previous focus by the industry was building bigger capacity and more robust data centres. However trends observed in recent years are seeing the focus shifting to designing and implementing more efficient data centres.

SS564 – Singapore Standard for Green Data Centres[2], Singapore's first energy efficient data centre standard was first published in 2010 and later revised in 2013[3],[4]. Green mark for data centre was also jointly introduced by BCA and IDA in 2013[5]. This demonstrates the determination and focus by the regulators in greening the industry.

The journey to green data centres is an interesting one. Firstly, the avail of new and more efficient technologies pulls data centre operators to adopt efficient technologies, sometime as the expense of higher cost. Secondly, raising energy cost, public awareness and changing best practices push data centre operators in that right direction. At the early stage of the transition period, the low hanging fruits were widely implemented. These include more efficient cooling technologies and power systems. However after these commercially available systems are being deployed, the PUE of typically data centres remains to be around 1.4. Is that the best result for the industry, or what's next?

Google presented their efforts in making data centres more efficient recently[6]. However every data centre is different. Their performance is a function of design, existing infrastructure, operation mode, and environment. Some are internal factors controllable by the data centre operator, while others like climate are external factors.

What is the future of data centres? Which way will demand go? How does the next generation data centre look like?

KEYWORDS
Data centres, Green data centres, Green mark,

ENERGY PERFORMANCE ANALYSIS OF BUILDINGS

Mr. Sreedhar Kalavagunta - Bentley Systems (Singapore) pvt Ltd,

A green building, also known as a sustainable building, is a structure that is designed, built, renovated, operated, or reused in an ecological and resource-efficient manner. Buildings use resources such as energy, water and raw materials, generate waste and emit potentially harmful atmospheric emissions. Building owners, designers and builders face a unique challenge to meet demands for new and renovated facilities that are accessible, secure, healthy, and productive while minimizing their impact on the environment. This paper describes a design, simulation, and analysis of building mechanical systems, environmental conditions, and energy performance calculations for buildings. A Typical building example considers using software tool to achieve better-performing, more sustainable buildings that consume less energy. The results are plotted with 2D/3D energy models and generate reports of peak loads, annual energy calculations, energy consumptions.
Keywords: Green building, Sustainable building, Energy analysis, BIM

DEVELOPMENT OF A LOW-COST IMAGE PROCESSING TECHNIQUE FOR CRACK DETECTION FOR STRUCTURAL HEALTH MONITORING

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[2]Department of Civil and Environmental Engineering, E1A, #07-03, National University of Singapore, Singapore
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Theme: Structural Health Monitoring

SUMMARY

Detection of cracks in any structure is a vital task to ensure structural health and reliability. Computer vision and image processing techniques can be used to automate the inspection of structures for cracks. This paper describes an algorithm that enables the detection of cracks in a variety of materials such as concrete, metal etc. by use of image processing techniques such as contour detection, edge detection and supervised machine learning classifier – support vector machine. The accuracy of the detection and classification has been verified experimentally.

KEYWORDS

Crack detection, contour detection, Sobel edge detection, canny edge detection, support vector machine, image processing.

SUSTAINABLE CONCRETE STRUCTURES

Dr. Leong Tuck Wah

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The unsatisfactory performance of concrete structures and the important causes are firstly emphasized .The seriousness of such causes affecting the life spans of structures are then established. A 3 prone approach to achieve sustainability is herewith proposed which involve more stringent control in the design and construction process, the early detection and diagnosis of defects for timely effective remedial actions as well as the requirement of efficient long term maintenance on the building structures. Keywords: Concrete Structures, Design and Construction, Life Span Resurrection, Performance, Remedial Actions and maintenance, Symptom and Cause Diagnostic.

THE BUILDING INFORMATION MODELLING (BIM) REVOLUTION

Mr. Mervyn Lindsay

- **Opportunity, challenge and social responsibility and how it is transforming the role of the Engineering Design Consultant**

I intend today to present my interpretation of how I believe Building Information Modelling is and will continue to transform, even revolutionise, what is possible when the full potential of BIM is integrated beyond project delivery. I will discuss what this revolution means to my industry, the consulting engineering design industry, but then what responsibilities will ultimately fallout from this revolution.

I want to touch on not just the enormous economic benefits that can be capitalised from the BIM potential, but also the environmental and social benefits that come from being able to graphically simulate the detail of every operation and every process and therefore to be able to comprehensively understand and communicate not just the operational issues but also the social and environmental interfaces to whatever operation or building is being planned then implemented.

Finally I want to issue some cautions. With this powerful capacity comes responsibility. When 'it' can be done, there comes an expectation that 'it' will be done. The social licence of our clients businesses inevitably depend on their demonstrating that they are doing their very best to operate within societies environmental and social boundaries. If BIM has the capacity to de-risk operations in a social and environmental context then not only are we obliged to do that but society will insist we do it. If we have the capacity to describe every detail of a venture then society will and should expect us to provide that insight.

TECHNICAL PAPER ABSTRACTS

GAMMON'S SUSTAINABILITY JOURNEY

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ABSTRACT
This paper aims to highlight Gammon's sustainability journey and its efforts in reducing greenhouse gas emissions in the construction industry. Gammon has built its sustainability framework based on four pillars - "Health and Safety", "Environment", "Economic and Business" and "Social Responsibility". Environmental issues are increasingly shaping the context of Gammon's business. The cost of materials, impacts from noise, energy use and waste, as well as rising concerns about climate change all have implications for the company's operations and value chain. Gammon applies the principle of 'Use Wisely, Waste Less' and looks at all of its businesses to identify how processes can be improved to improve energy, fuel efficiency and reduce wastes and other environmental impacts.

SEPARATION UNIT FOR AN EFFICIENCY IMPROVEMENT

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SUMMARY
A membrane integrated chemical looping air separation (MI-CLAS) process is proposed as an innovative energy efficient air separation unit with the potential to be tailored to oxy fuel power plants. The energy saving of a chemical looping air separation (CLAS) process is 12% of an equivalent cryogenic system however this is further increased by 36% with the integration of oxygen transport membranes into the CLAS process. In the MI-CLAS process, oxygen is separated from steam without condensing steam, saving a significant amount of thermal energy and ultimately reducing the overall energy footprint of the process. One of the incentives for a study on perovskite membranes is the unique characteristic they possess, which is an infinite selectivity for oxygen to other gas species. This is appealing for processes in which extremely high purity oxygen is required. In view of this, the main characteristic of the perovskite membranes namely oxygen permeation flux is considered as the decisive criterion for the selection of membranes. This study examines the practical feasibility of the integration of two oxygen transport membranes namely $La_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (LSCF5582) and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (BSCF5582) membranes into the CLAS process. Oxygen permeation experiments have been conducted under reacting and non-reacting environments. Under the non-reacting environment, BSCF5582 and LSCF5582 membranes are exposed to the atmospheric air and the permeated oxygen is analysed using a Varian CP 4900 micro GC. In the reacting environment, membranes are exposed to oxygen carriers (e.g., CuO) which are reduced into a lower oxidation state using nitrogen. The oxygen permeation fluxes of the LSCF5582 and BSCF5582 membranes were measured at different temperatures and oxygen partial pressures. This study provides an insight into the practical feasibility of the perovskite membrane integration into the CLAS process with increased energy efficiency.

KEYWORDS
Energy efficiency, Membrane, Chemical looping air separation, Oxygen permeation flux, LSCF, BSCF.

TECHNICAL PAPER ABSTRACTS

ASSESSING THE BENEFITS OF NET METERING WITH RESIDENTIAL BATTERY STORAGE

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Theme: Sustainable development: Energy Management

SUMMARY

We propose a linear programming (LP)-based algorithm to schedule battery storage co-located with residential solar photovoltaics (PV), when excess generation is compensated via net metering. While the objective of this LP-based approach is to maximize the operational savings that accrue to customers, an undesirable consequence to the utility is reverse power flow during the peak pricing period. Alternatively, using a quadratic programming (QP)-based algorithm for battery scheduling we show that it is possible to balance the objective of the utility in limiting reverse power flow, with the customer objective of increasing operational savings, in the context of net metering. Both the LP-based and QP-based scheduling algorithms are applied to measured load and generation data from 145 residential customers located in an Australian distribution network.

KEYWORDS
Photovoltaics, battery scheduling, net metering, peak-load reduction, reverse power flow.

ESTIMATES OF THE SOCIAL COST OF CARBON USING CLIMATE MODELS DERIVED FROM THE CMIP3 ENSEMBLE

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Theme: Sustainable development (energy policies & economics, or climate change & emissions control)

SUMMARY
In this paper, we consider estimates of the dollar value of carbon dioxide emissions due to anthropogenic climate damages, known as the social cost of carbon (SCC). Estimates of SCC in this paper are generated by DICE, the most prominent model combining climate processes, economic growth, and feedbacks between the climate and the global economy. Replacing the default DICE climate model with each of 12 models recently obtained from system identification experiments with the CMIP3 multimodel ensemble highlights substantial variability in estimates of the SCC arising from scientific uncertainty in the climatic response to net radiative forcing.

KEYWORDS
Climate change; emissions control; social cost of carbon; climate change economics; integrated assessment

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