NUS: 5 submissions

1. Der Horng Lee
2. PS Lee
3. Stephen Siu Yu LAU
4. Yuan Chao
5. WONG NYUK HIEN

Name: Der-Horng LEE
Title: Professor
Organization: National University of Singapore
E mail address: dhl@nus.edu.sg
Mailing address: Department of Civil and Environmental Engineering, National University of Singapore, 1 Engineering Drive 2, E1A 07-03, Singapore 117576
Contact number: (65) 6516 2131
Webpage link: http://www.eng.nus.edu.sg/cee/people/ceeleedh/

One-paragraph Bio:

Dr Lee Der-Horng Lee is a professor at the Department of Civil and Environmental Engineering, National University of Singapore (NUS). Professor Lee's research interests include Intelligent Transportation Systems (ITS), Smart and Sustainable Urban Mobility, Urban and Transportation Planning and Policy. At present, Professor Lee serves as the Director of NUS-LTA Transport Research Centre. Professor Lee is also a Chartered Engineer (Transportation Engineering) in Singapore and Fellow of Institution of Engineers Singapore (IES). A transportation planner and engineer by training, Professor Lee has not only been recognized by his international academic peers but also well-received by the government agencies and transportation industry as a thought leader. Professor Lee has been extensively consulted and quoted by local and international mass media (including CNN, BBC, NHK, ANN, KBS, Xin Hua, Channel News Asia, Singapore Press Holdings, etc.) with his views and proposals on policies and matters of urban transportation locally in Singapore and regionally in Asia.

Write up on the possible project (max half a page):

Development of suitable indices for sustainability in smart city and digital age context

Smart city programs are getting popular worldwide in the recent years. From developing to well-developed nations, there is an increased attention to build/re-build cities and towns leveraging an ever-growing IT (information technology) solutions, readily available and cost-effective sensors and better access to open-source mapping and related resources. Unprecedented amounts of money and resources are allocated from the government side with an aim of achieving sustainability and thereby provide its citizens with sustained happiness, safety and prosperous living. Researchers in the past focused on studying sustainability and came up with indices to measure it, primarily based on factors such as society, economics, energy and environment, among others. However, proposed project aims at finding how social media, sensor technologies, online purchases, and open and crowd sourced tracing and mapping tools can be effectively used to define a more practical set of metrics and indices for sustainability. This will help planners to better understand and approach sustainability in the smart city and digital age context.

Name: Poh Seng (PS) LEE
Title: Associate Professor
Organization: Department of Mechanical Engineering, National University of Singapore
E mail address: pohseng@nus.edu.sg
Mailing address: Department of Mechanical Engineering, National University of Singapore,
9 Engineering Drive 1, EA-07-08, Singapore 117576
Contact number: (65) 6516 4187
Webpage link: http://blog.nus.edu.sg/mtsgroup/

One-paragraph Bio:

Dr Poh Seng Lee is an Associate Professor with the Department of Mechanical Engineering at the National University of Singapore (NUS). Prof Lee's research interests include high performance cooling techniques (in particular single and two-phase microchannel cooling), high efficiency air cooling, energy efficient air conditioning & ventilation system, low grade waste heat recovery, high efficiency solar thermal collector and thermal storage system. A thermal engineer by training, Prof Lee is very active in engaging industry and agency and on R&D efforts related to building and industry energy efficiency and he has secured more than $6 Million dollar of research funding. He is also the recipient of numerous research and innovation awards including 2013 NUS Faculty of Engineering's Young Faculty Research Award, 2011 Institution of Engineers Singapore (IES) Prestigious Engineering Achievement Award, 2011 Asia Pacific Clean Energy Summit Top 10 Defense Energy Technology Solutions Award and 2009 Tan Kah Kee Young Inventors Award (TKKYIA) - Defense Science. At present, Prof Lee serves as the Assistant Dean of Research & Technology and Deputy Director of the Centre for Energy Research & Technology. Prof Lee is also a Council Member and Senior Member of Institution of Engineers Singapore.

Write up on the possible project (max half a page):

Development of low energy air-conditioning system for sustainable buildings in the tropics

Singapore, being a topical island country with high temperature and humidity, has been actively researching on more energy efficient air-conditioning and mechanical ventilation (ACMV) systems as part of the green buildings efforts. Conventional ACMV systems are typically mixing flow ventilation (MFV) type which tends to disturb the natural stratification formed in the room and supply cold air to mix the room air distribution. Their low efficiency also leads to high waste heat rejection to the ambient and exacerbating urban heat island (UHI) effect. This project will develop a highly efficient radiant cooling and passive displacement ventilation system to achieve indoor thermal comfort (handling both latent and sensible loads) with no draft or noise issue. The better efficiency will also lead to less waste heat rejection to the ambient thus helping to mitigate UHI effect.

Name: Stephen Siu Yu LAU
Title Professor
Organization: Department of Architecture, School of Design and Environment, National University of Singapore
E mail address akilssy@nus.edu.sg
Mailing address 03-03-10, Department of Architecture, School of Design and Environment, 4 Architecture Dr, Singapore 117566; **Contact number** +852 90471489
Webpage link https://www.arch.nus.edu.sg/people/cv/slau.html

One paragraph Bio

Stephen Lau is born in Hong Kong, studied at the University of Hong Kong (B.Arch., B.A. Architectural Study) and the London University (M.Sc. Architecture – Environmental Design & Engineering). He has taught at the University of Hong Kong in architectural design, environmental controls, and PhD study and been awarded the University Outstanding PhD Supervisor Award and a Star-researcher in the discipline of Humanities for three consecutive years. Administratively, he has served as the Chair of the Faculty; Associate Dean for three terms: human and financial resources; International and China collaborations; Acting Head of Architecture; Chair of the PhD Committee at the Faculty and Department levels; and Admission Tutor at the B.Arch./M.Arch level. In research, he is Principal Investigator of 60 internal and external funded projects. He is Primary Supervisor for more than 20 PhDs and 7 Postdoctoral Fellows. Since January 2015, he joined the Department of Architecture, National University of Singapore as a Professor, Deputy Head – Research, and heads the Design Technology and Sustainability research & teaching group, Chair of the Center of Advanced Study in Architecture, and Chair of the Architecture PhD program. He is a Registered Architect, Acoustician, Lighting Designer, LEED-AP, BREEAM-AP, Carbon Auditor, China GBL Assessor, and Vice Chair of the China GBC – Hong Kong and Macau Chapters.

Write up on the possible project (max half a page)

Research interests of Prof. Lau are mainly in the areas of environmental sustainability, including green building design, performance and rating, urban studies of low carbon and sustainable city, social sustainability (urban study) of adaptive reuse and cultural sustainability, urban regeneration. His main projects focus on architectural acoustics, urban heat island research, urban study, green building standard for green building evaluation, daylight analysis and post-occupancy evaluation (POE).

Currently, he is leading the Project: Tropical Technologies Laboratory on the campus, which shall serve as a full-scale test-bed for integrated study of technologies, materials and construction for various habitable spaces. Other current research includes urban noise mapping techniques, human-oriented and climatic responsive architecture, and is Co-P-I for a 4.75M SDG mega research on PV technology and BIPV (since July 2016).

He is active in the international front – a EU funded (1.36M Euro) project on Urban Knowledge Network Asia UKNA (2010-14); a EU funded (1M Euro) project on the study of Multiple Intensive Land Uses MILU (2005-2009); International Society of Habitat Engineering and Design ISHED (2011-14); International Initiatives on Sustainable Built Environment iiSBE (1999-2012); CIB Task Group TG39 - Mega-cities (2001-2004).

In recent years, he has contributed to the drafting of national standards, including the Standard for Architectural Acoustics (50118-2010); and is working on another two standards for green building certification: Eco-district and Green Campus (to be gazette in 2017). In 2012, he has completed a technical study on the validation of the national standard GB and ISO Standard for compliance assessment of these

standards for the Zhuhai-Guangzhou-Hong Kong-Macau Bridge. It was a HKU+Tianjin U +Guangzhou U mega research awarded by the Ministry of Technology. He is the leader of the HKU Team.

Name: Yuan Chao
Title: Assistant Professor
Organization: Department of Architecture, School of Design and Environment, NUS
E mail address: akiyuan@nus.edu.sg
Mailing address: SDE 1 04-03, 10 Kent Ridge Crescent, Singapore, 119260
Contact number: +65 84285890
Webpage link: https://www.arch.nus.edu.sg/people/cv/yuanc.html

One paragraph Bio:
Dr. Yuan Chao is an Assistant Professor in the Department of Architecture of National University of Singapore. Dr. Yuan's research interest is the climate-sensitive urban planning and design for livable and sustainable cities, with a focus on urban aerodynamic properties, which are one of the key components of urban climate but difficult to be evaluated. Dr. Yuan has participated in multiple important policy-level research projects commissioned by the Hong Kong Government, as well as contributed significantly in several Chinese projects (e.g., Wuhan and Macau) on relevant topics. He conducted Computational Fluid Dynamics simulation to provide quantitative understandings on the impact of building typologies on urban natural ventilation and air quality, which aided in the policy-making of what has now become the Hong Kong Sustainable Building Design Guidelines, APP 152. Dr. Yuan also developed the Frontal Area Density understanding that bridges the knowledge gap between urban morphology and the aerodynamic potentials of any particular city. This work has now been incorporated into Hong Kong and Wuhan's urban climatic research for city planners' references. In addition, Dr. Yuan has published numerous manuscripts in high impact peer-reviewed scientific journals.

Write up on the possible project (max half a page)
Title: Semi-Empirical Modelling and Mapping to Mitigate Impact of Regional and Local Air Pollution on Urban Air Quality
The proposed research aims to increase urban permeability and promote dispersion of both local traffic-related and regional cross-boundary air pollution, with the overarching goal of improving urban air quality. A new semi-empirical modeling-mapping method will be developed to bridge the gap between conventional modeling methods and planning practice. Corresponding Sustainable Urban Planning Guidelines are expected upon project completion. Singapore will be used as a case study to test the practicability of the new method in practical city planning and design.

The first part of the modeling-mapping approach in this research is the development of the multi-layer Urban Canopy Model (UCM). Given that the real urban morphologies are highly heterogeneous, the conventional single-layer UCM that assumes uniform building height is not practical. To address this limitation, in the proposed multi-layer UCM, the urban canopy layer will be classified into several sub-layers based on the building height distribution, and also be characterized by canopy drag force. Furthermore, while the conventional UCM assumes zero air pollution concentration above the building rooftop, our new proposed UCM will not make such assumption, but rather include such pollution as part of input boundary conditions in the modeling by mesoscale climate models, especially in the scenario of regional cross-boundary pollution. The second part of the research approach is the mapping of urban air pollution concentration. With the proposed modeling tool, city planners will be able to use their in-house GIS database to assess and map urban air quality, and develop the corresponding master and district planning strategies. In addition, a new database of air pollution concentration in the urban canopy layer, which is a better proxy for daily exposure than the concentration measured above the rooftop, will be established for the future research application (e.g., public health, wellness).

Name: WONG NYUK HIEN
Title: PROFESSOR
Organization: SCHOOL OF DESIGN AND ENVIRONMENT, NATIONAL UNIVERSITY OF SINGAPORE
E mail address: bdgwnh@nus.edu.sg
Mailing address: 4 Architecture Drive, Singapore 117566
Contact number: 65163423
Webpage link

One paragraph Bio: Professor Wong has been working on numerous research projects on Urban Heat Island effect in Singapore and also the associated mitigation measures.

Write up on the possible project (max half a page)
I am currently researching on how urban textures would impact the cooling energy consumption both at the urban level as well as at building level. The key objective is to develop a simulation tool that could consider the 3D model of an urban area (or extracted from Virtual Singapore) and study how the various urban morphology factors could impact the urban level cooling energy consumption. By linking the urban simulation model to Urban Canopy model as well as energy plus model, the impact of urban factors on the indoor environment as well as the cooling energy consumption of buildings could be studied.

NTU: 13 submissions

1. Alessandro Romagnoli
2. Wan Man Pun – project 1
3. Wan Man Pun – project 2
4. Yiyu Cai
5. Anshuman Tripathi – project 1
6. Anshuman Tripathi – project 2
7. Anshuman Tripathi – project 3
8. Kong Wai Kin Adams
9. Arvind Easwaran
10. Justin Dauwels
11. Cesare Soci
12. Nripan Mathews
13. Subodh Mhaisalkar
14. Josep Pou
15. Cheuk-Wai So
16. Cise Unluer

Name: Alessandro ROMAGNOLI
Title: Assistant Professor
Organization: Nanyang Technological University
E mail address: a.romagnoli@ntu.edu.sg
Mailing address: School of Mechanical and Aerospace Engineering, Nanyang Technological University, 50 Nanyang Avenue, 639798, Singapore
Contact number: (65) 6790 5941
Webpage link: http://www.mae.ntu.edu.sg/aboutus/FacultyandStaff/Faculty/Pages/ARomagnoli.aspx

One-paragraph Bio: Dr. Alessandro Romagnoli gained a First Degree cum laude in Mechanical Engineering in 2003 from the "University of Ancona" in Italy, after which he worked for two years at Lucci Collettori Spa (Ancona, Italy) where he supervised the design and production of commutators for electric motors. In 2006 he began a PhD at Imperial College London in the Thermo-Fluids Division focusing on aerodynamic study of single and twin-entry mixed flow turbines under unsteady conditions. As a part of his research, he also studied heat transfer effects occurring in turbochargers. In 2013, he joined Nanyang Technological University as an Assistant Professor. His responsibilities include teaching undergraduate courses, run lab-tutorial, supervising PhD students and FYPs. Alessandro's research activity in NTU encompasses several aspects related to propulsion, energy efficiency and thermal energy recovery and management. Examples of his current research include the study of waste heat recovery such as Thermoelectric Generators design and analysis, Organic Rankine Cycles optimization, Turbocharging and Thermal Energy Storage; Alessandro is also championing the effort on Cold Energy Recovery and Cold Economy in Singapore.

Project: **Thermochemical storage from cryogenic energy sources for sustainable cooling applications**

Thermal energy storage (TES) is an advanced technology for storing thermal energy that can mitigate environmental impacts and facilitate more efficient and clean energy systems. Thermochemical materials have higher energy densities relative to phase change materials and sensible storage media, hence they can provide a compact and efficient energy storage system which is particularly beneficial where space for the TES is limited or valuable.

Liquefied Natural Gas ("LNG") is shipped to Singapore LNG's ("SLNG") terminal at -161°C. Before it is piped in gaseous form at about 15-20°C to our power stations, it has to be regasified by heating it up. The cold energy lost during regasification is substantial, amounting to an estimated 735 GWh of cooling by 2020. This is equivalent to 0.25% of national electricity demand by 2020 and could translate into an economic savings of about S$18.4 million a year.

Based on the current scenario, it is apparent how there is a huge opportunity to investigate and advance research on thermochemical storage systems for waste cold energy applications. Current thermochemical storage research activity is limited to medium-high temperatures (above zero) but there is no reported literature and/or research activity in the sub-zero range. Hence the proposed project aims to move into a novel research domain which combines high efficient/compact thermal energy storage for cold energy applications. Indeed it is proposed to initiate fundamental research activity on novel thermochemical storage materials for cold energy storage; the research will mainly be based on lab-scale experiments and it would cover the formulation, characterization and design of the reactor to be used for testing.

On the long term, the impact for Singapore of the proposed research topic would be significant as it would allow moving, transporting and storing cold energy in a compact and efficient way for longer time periods; that means that the decoupling between cold energy demand and cold energy generation could be truly effective and it will contribute to provide cold & cooling in a more sustainable way.

Name WAN Man Pun
Title: Associate Professor
Organization
School of Mechanical & Aerospace Engineering, Nanyang Technological University
E mail address
mpwan@ntu.edu.sg
Mailing address
School of Mechanical & Aerospace Engineering, 50 Nanyang Avenue, Nanyang Technological University, Singapore 639798
Contact number
6790 5498
Webpage link
http://research.ntu.edu.sg/expertise/academicprofile/Pages/StaffProfile.aspx?ST_EMAILID=MPWAN

One paragraph Bio

Dr. Wan is currently an Associate Professor and the Assistant Chair (Research) in the School of Mechanical & Aerospace Engineering at Nanyang Technological University. Prior to joining NTU, he was an Assistant Professor of Mechanical Engineering at Kyungpook National University, Korea. His research interests cover aerosol sciences, building energy, indoor environmental quality, catalytic oxidation systems and numerical simulations. He has published over 80 international refereed journal and conference articles. Dr. Wan led numerous government and industry funded research projects including Cool Surface projects through which he developed new high-performance Cool materials and Meso-scale/Micro-scale modelling methods to analysis urban heat island (UHI) effect and the heat transfer characteristics of Cool materials. He served in the editorial board of Building Simulation: An International Journal and is a member of American Society of Mechanical Engineers (ASME), American Chemical Society (ACS) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

Project Description: Achieving Energy Sustainability from Urban Wind

With increased urbanisation and localisation of power generation, urban wind turbines and airborne systems have garnered momentum in recent years. Particularly, in urban and coastal cities, there is a multiplication factor of wind speeds due to the presence of buildings and large air movements. However, the accompanying higher turbulence intensity and multi-directionality increases flow complexity and loadings, which require an understanding of the fluid mechanics and unsteady aerodynamics. Airborne wind energy systems, on the other hand, generates power on ground through mechanical work done using tethers attached to a flying kite. In this project, the post-doctoral fellow will investigate the influence of city layouts and building orientations on flow dynamics, so as to identify optimal positions for the siting of micro-turbines and airborne systems for distributed and localized power generation. Additionally, the post-doctoral fellow will identify opportunities in future wind energy system designs, with specific focus on airborne and urban approaches.

Name WAN Man Pun
Title: Associate Professor
Organization
School of Mechanical & Aerospace Engineering, Nanyang Technological University
E mail address
mpwan@ntu.edu.sg
Mailing address
School of Mechanical & Aerospace Engineering, 50 Nanyang Avenue, Nanyang Technological University, Singapore 639798
Contact number
6790 5498
Webpage link
http://research.ntu.edu.sg/expertise/academicprofile/Pages/StaffProfile.aspx?ST_EMAILID=MPWAN

One paragraph Bio
Dr. Wan is currently an Associate Professor and the Assistant Chair (Research) in the School of Mechanical & Aerospace Engineering at Nanyang Technological University. Prior to joining NTU, he was an Assistant Professor of Mechanical Engineering at Kyungpook National University, Korea. His research interests cover aerosol sciences, building energy, indoor environmental quality, catalytic oxidation systems and numerical simulations. He has published over 80 international refereed journal and conference articles. Dr. Wan led numerous government and industry funded research projects including Cool Surface projects through which he developed new high-performance Cool materials and Meso-scale/Micro-scale modelling methods to analysis urban heat island (UHI) effect and the heat transfer characteristics of Cool materials. He served in the editorial board of Building Simulation: An International Journal and is a member of American Society of Mechanical Engineers (ASME), American Chemical Society (ACS) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

Project Description: Sustainable Cities through intelligent Weather-Prediction-Enhanced Energy Management Systems
The project aims to identify the application of weather parameters for effective energy management in the grid and building level. These include the consideration of demand-side management and building management systems that incorporates weather data in decision making processes. The postdoctoral fellow will be involved in both experimental and numerical investigations. He/she will demonstrate and develop technologies that incorporates the use of weather parameters to optimize demand-side resourse preparation and utilization so as to balance the supply of electricity on the network with the electrical load. Additionally, the postdoctoral fellow will investigate effective building energy management that incorporates external climatic influences, focusing on cities with large coastline that have significant sunshine. The development of such technologies and solutions will lead to intelligent power managements system in achieving sustainability in energy consumption.

Name: Yiyu Cai
Title: Associate Professor
Organization: Nanyang Technological University
E mail address: myycai@ntu.edu.sg
Mailing address: School of Mechanical & Aerospace Engineering, and Energy Research Institute @ NTU (ERI@N), 50 Nanyang Avenue, Singapore 639798
Contact number: (65) 67905777
Webpage link: http://www.ntu.edu.sg/home/myycai

One-paragraph Bio:
Yiyu is a tenured faculty with The School of Mechanical & Aerospace Engineering, NTU. He is in charge of the Computer-aided Engineering Labs and is also Cluster Director with The Energy Research Institute @ NTU. He held joint appointments with NTU's Institute for Media Innovation, and The Bio-informatics Research Center. He has been doing interdisciplinary research over the past two decades. His research interests include Virtual & Augmented Reality, Artificial Intelligence, High-performance Computing, Simulation and Serious Games. He is also actively doing industrial applications working closely with Construction, Building, Robotics, Petro-chemical, Medical, and Education sectors. His research has been published in leading journals like IEEE Transactions of Robotics, Automation in Construction, IEEE Transactions on Industrial Information, Magnetic Resonance Imaging in Medicine, etc. In collaboration with industrial partners in the oil and gas business under two Research Collaboration Agreements, he and his team have developed an innovative solution for intelligent lifting of heavy terrain cranes in industrial environments with a PCT approved patent successfully entered the national phase in Germany, USA, China and Singapore. His research has been widely publicized in local and international media including Straits Times and Lianhe Zaobao (Singapore), Wenhui Bao (China), La Republicca (Italy), MediaCorp (Singapore), etc. He has received funding supports for his interdisciplinary research from Temasek Trust Funded Singapore Millennium Foundation, Ministry of Education, Ministry of Information, Communication, and The Arts, National Health Group, etc.

Write up on the possible project (max half a page):

Research and Development on Intelligent Planning and Maintenance of Sustainable City

Sustainable city relies on good planning and maintenance. Traditional planning of city development is increasingly encountering the bottle neck problems when dealing with complex and dynamic urban and industrial facility. We have been doing interdisciplinary research aiming to develop innovative solution for intelligent planning and maintenance of sustainable city. In particular, we are keen to work in the intersection of artificial intelligence, virtual and augmented reality, and simulation for the purpose of optimal planning in construction, building and maintenance with both residential and industrial areas.

In this proposal, we will work on fundamental research and application development on Digitization using Building Information Modeling, Plant Design and Management System, and Laser Scanned Point Cloud Data Processing. By tapping on the latest artificial intelligence, virtual and augmented reality, and high-performance computing technology, we hope to push the boundary of intelligent planning for hybrid and highly complex environments. Path planning is crucial in many tasks such as auto driving, auto flying. We will continue our efforts in robotic and automatic path planning for optimal lifting of heavy industrial cranes in highly complex and dynamic industrial environments for the purpose to improve the productivity and safety with applications of turnarounds operation and maintenance in process plants and construction sites.

Name: Anshuman Tripathi
Title: Senior Scientist
Organization: Nanyang Technological University
E mail address: antri@ntu.edu.sg
Mailing address: Energy Research Institute @ NTU (ERI@N) | Nanyang Technological University, 1 Cleantech Loop, #06-04, CleanTech One, Singapore 637141
Contact number: (65) 9663 9575
Webpage link: http://erian.ntu.edu.sg/aboutus/organisation/PD/Pages/Anshuman-Tripathi.aspx

One-paragraph Bio:

Anshuman joined NTU in November-2012 and heads the Autonomous Vehicles, Electro-mobility and Grid connectivity areas of RD&D in the Energy Research Institute at NTU (ERI@N). There are two strategic areas of focus of this group (1) support the land transport authority and Ministry of Transport of Singapore to enable clean and autonomous transport solutions for various transport applications starting from first/last mile solutions to mass public transport. This is carried out through projects like design, certification and deployment of Electric & Autonomous Buses for Singapore and (2) Design, develop and deploy next generation power grids that will make the power distribution more resilient and adaptive with high network performance index. Before joining ERI@N he has spent close to 10 years in the industry. At General Electric, he formed electrical machine design competence in GE-global research delivering machine-converter solutions to GE transportation and GE healthcare systems. He also worked on wireless power transfer solutions for GE healthcare and GE-NBC. He then joined Vestas wind power systems where he was instrumental in creating a 2 MW and 3 MW converter design group comprising of hardware, software and control groups. This group delivered solutions for V-90, V-112 and V-164 turbine platforms of Vestas. Anshuman has research interests in grid connection of large and remote wind and solar farms, grid codes and compliance, power hardware in the loop simulations for power network designs, electrical drive train designs and hybrid Energy storage for stationary and mobile applications. He has 35 patents in the area of Energy storage, power systems, controls, electrical machines and over 24 journal publications.

Write up on the possible project (max half a page):

High frequency high voltage power converter design, for data center power supplies

This project will design and test a high efficiency, high power density and reliable power supply for a real world data-center load. Such diverse requirements can be catered to, by using new high frequency and medium voltage (> 1.7 kV) silicon carbide based power devices. The key challenges of configuring such power converters would be, to control them at very high frequencies (> 40 kHz) and package them in a footprint which is 50% of the conventional power supplies. Design, development and prototyping of a 380 V-DC power supply will be carried out, followed by testing for performance and reliability. Data center loads will be simulated in the lab for such tests.

Name: Anshuman Tripathi
Title: Senior Scientist
Organization: Nanyang Technological University
E mail address: antri@ntu.edu.sg
Mailing address: Energy Research Institute @ NTU (ERI@N) | Nanyang Technological University, 1 Cleantech Loop, #06-04, CleanTech One, Singapore 637141
Contact number: (65) 9663 9575
Webpage link: http://erian.ntu.edu.sg/aboutus/organisation/PD/Pages/Anshuman-Tripathi.aspx

One-paragraph Bio:

Anshuman joined NTU in November-2012 and heads the Autonomous Vehicles, Electro-mobility and Grid connectivity areas of RD&D in the Energy Research Institute at NTU (ERI@N). There are two strategic areas of focus of this group (1) support the land transport authority and Ministry of Transport of Singapore to enable clean and autonomous transport solutions for various transport applications starting from first/last mile solutions to mass public transport. This is carried out through projects like design, certification and deployment of Electric & Autonomous Buses for Singapore and (2) Design, develop and deploy next generation power grids that will make the power distribution more resilient and adaptive with high network performance index. Before joining ERI@N he has spent close to 10 years in the industry. At General Electric, he formed electrical machine design competence in GE-global research delivering machine-converter solutions to GE transportation and GE healthcare systems. He also worked on wireless power transfer solutions for GE healthcare and GE-NBC. He then joined Vestas wind power systems where he was instrumental in creating a 2 MW and 3 MW converter design group comprising of hardware, software and control groups. This group delivered solutions for V-90, V-112 and V-164 turbine platforms of Vestas. Anshuman has research interests in grid connection of large and remote wind and solar farms, grid codes and compliance, power hardware in the loop simulations for power network designs, electrical drive train designs and hybrid Energy storage for stationary and mobile applications. He has 35 patents in the area of Energy storage, power systems, controls, electrical machines and over 24 journal publications.

Write up on the possible project (max half a page):

Dynamic routing and sensor fusion for Autonomous Vehicle applications

Autonomous vehicles today face two serious challenges, (1) dependence on either the LIDARS or the GPS for routing and (2) inability to dynamically adjust the routes. As a result, these vehicles are unable to maneuver through routes which has segments of high density vegetation and high density buildings. This project will design mechanisms to switch controls from one sensor system to another to cater to the changes in routes. Dynamic route reprogramming will also be developed and tested on indigenously designed AV platforms.

Name: Anshuman Tripathi
Title: Senior Scientist
Organization: Nanyang Technological University
E mail address: antri@ntu.edu.sg
Mailing address: Energy Research Institute @ NTU (ERI@N) | Nanyang Technological University, 1 Cleantech Loop, #06-04, CleanTech One, Singapore 637141
Contact number: (65) 9663 9575
Webpage link: http://erian.ntu.edu.sg/aboutus/organisation/PD/Pages/Anshuman-Tripathi.aspx

One-paragraph Bio:

Anshuman joined NTU in November-2012 and heads the Autonomous Vehicles, Electro-mobility and Grid connectivity areas of RD&D in the Energy Research Institute at NTU (ERI@N). There are two strategic areas of focus of this group (1) support the land transport authority and Ministry of Transport of Singapore to enable clean and autonomous transport solutions for various transport applications starting from first/last mile solutions to mass public transport. This is carried out through projects like design, certification and deployment of Electric & Autonomous Buses for Singapore and (2) Design, develop and deploy next generation power grids that will make the power distribution more resilient and adaptive with high network performance index. Before joining ERI@N he has spent close to 10 years in the industry. At General Electric, he formed electrical machine design competence in GE-global research delivering machine-converter solutions to GE transportation and GE healthcare systems. He also worked on wireless power transfer solutions for GE healthcare and GE-NBC. He then joined Vestas wind power systems where he was instrumental in creating a 2 MW and 3 MW converter design group comprising of hardware, software and control groups. This group delivered solutions for V-90, V-112 and V-164 turbine platforms of Vestas. Anshuman has research interests in grid connection of large and remote wind and solar farms, grid codes and compliance, power hardware in the loop simulations for power network designs, electrical drive train designs and hybrid Energy storage for stationary and mobile applications. He has 35 patents in the area of Energy storage, power systems, controls, electrical machines and over 24 journal publications.

Write up on the possible project (max half a page):

Design of smart, efficient, clean & sustainable mobility solutions for a district and seamless integration of such transport solutions with urban living

Smart public transport is a key enabler for smart cities. For an urban setting like Singapore, smart mobility solutions must exist as an integrated segment of the society. The study conducted through this project aims to achieve this goal and will consist of two parts; the first part will develop a model that will be capable of simulating the transport requirements of a smart low carbon district with the key cost functions being zero emission, all-modal transport integrated with the requirements of the city planning and seamless connectivity. This model will not have any limitations with regard to the type of transport used and will focus entirely on efficiency in terms of connectivity of each distributed transport modalities with the mass public transport means like MRT and express way buses. The second part of the project would then optimize the transport network with regard to the minimum vehicles required for achieving the required connectivity. It will also look at optimizing the support structure (like charging, power management, cyber safe communication etc.). Such models will have the capability to grow beyond districts and can assess and improve the existing mechanisms of urban transport. They will also form a tool to seamlessly integrate transport with daily societal activities of the consumers.

Name: Kong Wai Kin Adams
Title: Associate Professor
Organization: Nanyang Technological University
E mail address: adamskong@ntu.edu.sg
Mailing address: School of Computer Science and Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore, 639798
Contact number: (65) 6513-8041
Webpage link: http://www.ntu.edu.sg/home/adamskong/Index.html

One-paragraph Bio:

Dr. Adams Wai Kin Kong received the Ph.D. degree from the University of Waterloo, Canada. Currently, he is an associate professor at the Nanyang Technological University, Singapore. His papers have been published in leading journals and conferences in his research areas, including TPAMI, TIP, TIFS, TSMC, TCSVT, CVPR, IJCAI, ICB, and Pattern Recognition. One of his papers was selected as a spotlight paper by TPAMI and another was selected as Honorable Mention by Pattern Recognition. With his students, he received best student paper awards in The IEEE Fifth International Conference on Biometrics: Theory, Applications and Systems, 2012 and IEEE International Conference on Bioinformatics and Bioengineering, 2013. He has developed seven patents; four of his patents have been approved, and the others have been filed. His research interests include pattern recognition, image processing, machine learning and data analytics.

Write up on the possible project (max half a page):

Development of Computational Models for Estimating Long-Term and Short-Term Energy Demand

Estimating long-term and short-term energy demand is important for energy allocation and urban planning. A simple approach which considers only historical energy consumption data to predict future demand is a time-series prediction problem with an input of single time series. However, energy consumption can be related to many factors such as population, technology development, global warming and economic development. In addition, development of some countries, e.g., China and U.S., may affect energy consumption of other countries. What are the factors affecting the energy consumption and how do we use these factors to accurately determine long-term and short-term energy demand? In addition, what data is publicly available related to energy demand? How can we use data from one country to improve the prediction accuracy for another country?

Name: Arvind Easwaran
Title: Assistant Professor
Organization: Nanyang Technological University
Mailing address: School of Computer Science and Engineering, Nanyang Technological University, 50 Nanyang Avenue, Block N4, # 02a-27a, Singapore 639798
E mail address: arvinde@ntu.edu.sg
Contact number: (65) 6790 4596
Webpage link: http://www.ntu.edu.sg/home/arvinde

One-paragraph Bio:
Arvind Easwaran is an Assistant Professor in the School of Computer Science and Engineering at Nanyang Technological University (NTU), Singapore. He received a PhD degree from the University of Pennsylvania, USA, in 2008. Prior to joining NTU in 2013, he has been a Scientist at the Polytechnic Institute of Porto, Portugal and at Honeywell Aerospace, USA. He is currently leading several research projects related to Cyber-Physical Systems (CPS) and Internet-of-Things (IoT) including, decentralized approach to electricity metering and load management for smart grids in collaboration with Technical University of Munich, real-time scheduling theory for mixed-criticality automotive systems, resilient cyber-infrastructure and cyber-twin modelling for smart manufacturing in collaboration with Delta Electronics Inc., and embedded platform design for autonomous driving in collaboration with Energy Research Institute @ NTU. He has published over 40 peer-reviewed articles in leading conferences and journals. His research interests are in the design and analysis of algorithms and optimization technologies for cyber-physical and real-time systems.

Write up on the possible project (max half a page):
Decentralized Optimization Algorithms for Load Management in Smart Grids
Internet-of-Things (IoT) technology has resulted in the large-scale adoption of *smart devices*, equipped with computation and communication capabilities, across application domains related to smart grids. For example, such devices could monitor and control electricity consumption of appliances in a household/building using demand-response management. They could also be used in Electric Vehicle (EV) charging stations to monitor and regulate the impact of EV demand using Vehicle-to-Grid (V2G) technology and integration with renewables. Developing such capabilities essentially requires the solving of multi-objective optimization problems. To enable a scalable deployment of these capabilities on the smart devices, it is then important to develop distributed consensus algorithms for solving such optimization problems. Further, it is also highly desirable that these algorithms are efficient in terms of computation and communication so that they are compatible with the low-power and resource-constrained smart devices. In this project, we will focus on the design, analysis and evaluation of such decentralized optimization algorithms for smart grid applications. Key challenge to address is the design of techniques to decompose the global optimization problem into a set of equivalent local problems.

Leveraging on the smart meter technology being developed at the Energy Research Institute @ NTU, we will also develop a prototype demand-response management system based on the proposed algorithms. This project will thus develop a core technology for load management in smart grids, with applicability to a variety of domains. As a consequence, it will be a key enabler for realizing the stringent energy goals of future smart cities.

Name: Justin Dauwels
Title: Associate Professor
Organization: Nanyang Technological University
E mail address: JDAUWELS@ntu.edu.sg
Mailing address: Building S2.2 B2-15, School of Electrical and Electronic Engineering, 50 Nanyang Avenue,Nanyang Technological University, Singapore 639798
Contact number: (65) 6790 5410
Webpage link: https://www.dauwelslab.com/

One-paragraph Bio:

Dr. Justin Dauwels is an Associate Professor with School of Electrical and Electronic Engineering at the Nanyang Technological University (NTU) in Singapore. He serves as Deputy Director of the ST Engineering – NTU corporate lab, which comprises 100+ PhD students, research staff and engineers, developing novel autonomous systems for airport operations and transportation. He is also involved as project PI in the Centre of Excellence for Testing and Research of Autonomous Vehicles - NTU (CETRAN), which will lead the development of testing requirements for such vehicles, and was launched by the Land Transport Authority (LTA) and JTC, in partnership with NTU. Moreover, he serves as project PI in the BMW-NTU lab on Future Mobility, and the NXP-NTU lab on vehicle-to-vehicle communications.

His research interests are in data analytics with applications to intelligent transportation systems, autonomous systems, and analysis of human behavior & physiology. He obtained the PhD degree in electrical engineering at the Swiss Polytechnical Institute of Technology (ETH) in Zurich in December 2005. He was a postdoctoral fellow at the RIKEN Brain Science Institute (2006-2007) and a research scientist at the Massachusetts Institute of Technology (2008-2010). He has been a JSPS postdoctoral fellow (2007), a BAEF fellow (2008), a Henri-Benedictus Fellow of the King Baudouin Foundation (2008), and a JSPS invited fellow (2010, 2011). His research on intelligent transportation systems has been featured by the BBC, Straits Times, Lianhe Zaobao, Channel 5, and numerous technology websites. His research team has won several best paper awards at international conferences. Besides his academic efforts, the team of Dr. Justin Dauwels also collaborates intensely with local start-ups, SMEs, and agencies, in addition to MNCs, in the field of data-driven transportation and logistics.

Write up on the possible project (max half a page):

Research on the Safety and Use Cases of Autonomous Vehicles

The introduction of Autonomous Vehicles to the general transportation infrastructure is predicted to bring about major disruption to the conventional transport paradigm. Mass-market penetration of this technology has the potential to bring about a wide range of improvements with regards to safety, travelling time and fuel efficiency/emissions. Furthermore, operating AVs in large fleets, such as a taxi service, is claimed to reduce the number of cars needed in urban areas by approximately 80%. However, most of the predictions that are being made, regarding the changes brought about by AVs are speculative in nature. A lot of it is based simply on factoring out the shortcomings of human driving, in addition to assuming that the AV technology performs completely error-free. Also what is missing is a case-by-cases analysis of the benefits offered by AVs at various levels of market penetration and the appropriate Autonomous to Human-driven, vehicle ratio. The proposed research project therefore aims to establish formal techniques and indices for evaluation of AV performance in urban areas, for different penetration rates and demand profiles, using a high-fidelity simulation model of an autonomous vehicle developed by the CETRAN project. The AV's performance analysis will be based on specific tasks that it may be required to perform and will be supplemented with a calibrated microscopic traffic model to evaluate its impacts on surrounding traffic and vice-versa. This approach allows a more in-depth visualization of the impacts of AV as it also takes the specific capabilities of the Autonomous Vehicle technology into consideration.

Name: Cesare Soci
Title: Associate Professor
Organization: Nanyang Technological University
E mail address: csoci@ntu.edu.sg
Mailing address: School of Physical & Mathematical Sciences, Nanyang Technological University, 50 Nanyang Avenue, Singapore, 639798
Contact number: (65) 6514 1045
Webpage link: http://www1.spms.ntu.edu.sg/~oson/people/cesare.html

One-paragraph Bio:

Dr. Soci received Laurea and Ph.D. degrees in Physics from the University of Pavia, in 2000 and 2005. He was a postdoctoral researcher from 2005 to 2006 at the Center for Polymers and Organic Solids of the University of California, Santa Barbara, and from 2006 to 2009 at the Electrical and Computer Engineering Department of the University of California, San Diego. He joined the Nanyang Technological University (NTU) in 2009, where he holds a joint appointment between the Schools of Physical and Mathematical Sciences (SPMS) and Electrical and Electronic Engineering (EEE).

Write up on the possible project (max half a page):

Perovskite-Silicon Tandem Solar Cells

The photovoltaic (PV) market is largely dominated by Silicon Solar cells (SCs), delivering high efficiency and long-term stability. However, the Si SCs are approaching their practical efficiency limits and new approaches are required to reach a significant improvement of the SC power conversion efficiency (PCE). Tandem Solar cells SCs are the most promising and viable option for drastically improving PCE of existing PV technologies keeping the Levelezed Cost of Electricity low. Unconstrained by the single-junction limit, tandem cells suggest a real possibility of true third-generation thin-film photovoltaics. Indeed, combining a Si SC with a low-cost wide-bandgap absorber material, as perovskite, it is possible to form a tandem SC that efficiently absorb light in complementary regions of the solar spectrum (Figure 1).By better utilising the energy of a wider range of the sunlight spectrum the PCE can be pushed well beyond 30%. 1 The recent extraordinary rise of perovskite solar cells to record efficiencies of over 22% 2 is the result of a unique combination of properties of these materials, as high optical absorption coefficient, 3 extra-long diffusion lengths, 4 low levels of parasitic absorption and low-cost solution-based synthesis. Beyond their intrinsic optical and electrical proprieties, another great advantage of the perovskites materials is that, their bandgap can be easily tuned by varying the chemical composition of the cation (A) and the halide (X). Therefore, it is possible to obtain a variety of perovskite absorbers whose energy gap can spectrally match properly the silicon bottom cell and so enhance the performance in tandem configurations.

Currently, in ERI@N we are developing high performing perovskite/silicon tandem cells in both 4-terminals and 2-terminals configurations. In collaboration with Si SCs specialists groups, we are optimizing the structure and optical properties of both top and bottom cells separately to match the tandem requirements, and jointly work on their integration. Different deposition methods are under testing combining both spin coating and thermal evaporation methodology to enhance the efficiency of the SCs.

Name: Nripan Mathews
Title: Assistant Professor
Organization: Nanyang Technological University
E mail address: nripan@ntu.edu.sg
Mailing address: School of Materials Science and Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore, 639798
Contact number: (65) 6513-4595
Webpage link: http://www.ntu.edu.sg/home/nripan/

One-paragraph Bio:

Dr. Nripan Mathews is an Assistant Professor at the School of Materials Science and Engineering and the Energy Research Institute@ NTU (ERIAN). He obtained his first degree in Materials Engineering (First Class Honors) from NTU (2003) and his MSc under the Singapore-MIT alliance on advanced materials for micro and nano systems (2004). He pursued his PhD at a joint Commissariat a l'energie atomique (CEA) - Centre national de la recherche scientifique (CNRS)- Universite de Pierre et Marie Curie (Paris VI University) laboratory in the area of molecular crystals, studying the signatures of optical excitations within them (2008). He was also a visiting scientist at Prof. Michael Graetzel's laboratory at Ecole Polytechnique Federale de Lausanne (EPFL), working on a pan-european project on photoelectrochemical hydrogen production.

Write up on the possible project (max half a page):

Perovskite Solar Cells for Building Integrated Photovoltaics (BIPV)

Within a tropical mega-city such as Singapore there is an increasing demand for renewable energy with little roof space for land or roof-based solar installations. One way to solve this problem is to integrate low-cost solar cells into the facades of buildings and convert the buildings themselves into power-plants. Printed carbon-based perovskite solar cells have been demonstrated to be the most scalable and environmentally stable varieties of perovskite solar cells. In order for perovskite solar cells to become commercially viable, it is necessary to devise a method to produce a high volume of large area solar cells with high efficiencies to achieve a cost-competitive product. To achieve this, we have demonstrated production of perovskite solar cells using a very scalable screen printing process and slot-diecoating infiltration method on glass substrates. Perovskite modules as large as 900 cm^2 and efficiencies of 11% for 100 cm^2 sizes with excellent long term stability under ambient conditions have been accomplished. One of the main challenges that our team faces is to apply our previously developed know-how of print 100 cm^2 and 900 cm^2 sized solar cells to much larger window-sized 2 m^2 and 6 m^2 modules for BIPV applications. With these challenges, we are also investigating how to increase the solar cell power conversion efficiency (PCE) and improve the stability of the solar cells through device architecture design, alternative printing and slot-diecoating techniques, and selection of appropriate perovskite formulations. We are also involved with selecting appropriate encapsulation technologies and development of commercial-ready prototypes to demonstrate this unique and potentially disruptive solar technology that adds value to building facades.

Name: Subodh Mhaisalkar
Title: Professor
Organization: Nanyang Technological University
E mail address: subodh@ntu.edu.sg
Mailing address: School of Materials Science and Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore, 639798
Contact number: (65) 6513-1096
Webpage link: http://www.mse.ntu.edu.sg/AboutUs/Organisation/Staff/Pages/subodh.aspx

One-paragraph Bio:
Subodh is a Professor in the School of Materials Science & Engineering at the Nanyang Technological University, Singapore. At NTU, he also holds the posts of Director, Advanced Materials Research Centre, Co-Director, Energy Research Institute @ NTU. Prior to joining NTU in 2001, Subodh has over 10 years of research and engineering experience in the Microelectronics industry where he held senior managerial positions in STATS Singapore, National Semiconductor, and SIMTech. Prof Subodh received his Bachelors' degree from IIT-Bombay and his MS/Ph.D. degrees from The Ohio State University.

Write up on the possible project (max half a page):
Metal Halide Perovskite Light Emitting Diodes
Organic inorganic halide perovskites – ABX_3 (A = $CH_3NH_3^+$, $HC(NH_2)_2^+$ or Cs^+; X = Cl^-, Br^-, or I^-) – have rapidly emerged as an extraordinary class of optoelectronic materials. Owing to their balanced electron-hole mobility, large carrier diffusion lengths, direct bandgap, and facile phase formation, record power conversion efficiencies >22% were achieved. In addition, the naturally abundant and inexpensive precursors used to form these materials allow for low-cost solution-processing and subsequent scale-up. More recently, bright and efficient light-emitting diodes (LEDs), lasers, and photodetectors were also demonstrated, in particular due to their near-unity photoluminescence quantum yields, narrow emission width, and color tunability across the spectral range by virtue of halide exchange or substitution. Although perovskite light-emitting devices have yet to become industrially relevant, in merely three years external quantum efficiencies (EQE) of ~12%, current efficiencies >40 cd A^{-1}, and maximum luminance in excess of 100k cd m^{-2} were achieved; accomplished by organic LEDs in two decades.

Researchers at NTU were the first to demonstrate light emission from halide perovskite materials, and have been at the forefront of new developments since. Our large research team focuses on the synthesis of novel light-emitting halide perovskite materials (ranging from nanocrystals to thin films), novel charge transport materials, and device processing with architectural innovations to move from lab curiosity to large scale fabrication (lab-to-fab). Efforts to further improve the inherent moisture instability include the use of multi-cation materials, core-shell formation, surface passivation, and improved LED packaging. In addition, a multitude of compositional and structural variants that enable the formation of lower dimensional layered are examined.

Name: Josep Pou
Title: Associate Professor
Organization: Nanyang Technological University
E mail address: j.pou@ntu.edu.sg
Mailing address: Building S2-B2a-06, School of Electrical and Electronic Engineering, 50 Nanyang Avenue, Nanyang Technological University, Singapore 639798
Contact number: +65 6790 4503
Webpage link:
http://research.ntu.edu.sg/expertise/academicprofile/Pages/StaffProfile.aspx?ST_EMAILID=j.pou

One-paragraph Bio:

Josep Pou received the B.S., M.S., and Ph.D. degrees in electrical engineering from the Technical University of Catalonia (UPC). He graduated first in the Bachelor graduating class, received the Master Degree with honours, and was awarded the outstanding Ph.D. Thesis Award at UPC. In 1990, he joined the faculty of UPC and from February 2013 to August 2016, he was a Full Professor with the University of New South Wales (UNSW), Sydney, Australia. In UNSW, he was technical research stream leader for the Solar Flagships Program Research Agenda, the result of AU$19-million investment from the Commonwealth Government of Australia. He is currently an Associate Professor with the Nanyang Technological University, Singapore, where he is Program Director of Renewables' Integration & Microgrids (Power Electronics) at the Energy Research Institute at NTU (ERI@N) and co-Director of the Electrical Power Systems Integration Lab at NTU (EPSIL@N), the electrical Rolls-Royce lab on NTU campus. He has authored over 230 published technical papers, is a co-inventor of 7 patents, and has been involved in several industrial projects and educational programs in the fields of power electronics and systems. He has received 6 scholarship and fellowship awards, including the prestigious Endeavour Research Fellowship Award, sponsored by the Australian Government. He is IEEE Fellow, and Associate Editor of the IEEE Transactions on Industrial Electronics and the IEEE Journal of Emerging and Selected Topics in Power Electronics.

Write up on the possible project (max half a page):

Modular Energy Storage Systems

Battery energy storage systems for grid level applications are currently based on connecting arrays of many batteries in series to reach a certain voltage level. Several arrays can also be connected in parallel to meet power and energy requirements. However, such a solution has many drawbacks which includes that when one battery unit fails the whole array needs to be disconnected. Also, since the current is the same within each array, the state of charge of the most charged/discharged battery units limits the use of the array. This project will focus on the integration of power electronic converters to battery units to create modules. Such modules will be suitable to be connected in series and parallel to reach the required voltage and current levels with perfect control of the state of charge of each battery unit. This will overcome the before mentioned problems, besides enabling the integration of different battery technologies in the same array, and even the use of second-life batteries. The proposed solution will also offer fault-tolerant features, since the battery modules that fail can be bypassed and the required voltage of the array can still be achieved by increasing the output voltage of the healthy modules. In this research project different power electronic solutions and control techniques will be studied, and the practical benefits of the proposed solution will be demonstrated.

Name: Cheuk-Wai So
Title: Associate Professor
Organization: Division of Chemistry and Biological Chemistry, School of Physical and Mathematical Sciences, Nanyang Technological University
E mail address: CWSo@ntu.edu.sg
Mailing address: Room 06-17, Division of Chemistry and Biological Chemistry, School of Physical and Mathematical Sciences, 21 Nanyang Link, Nanyang Technological University, 637371 Singapore
Contact number: +65 6513 2730
Webpage link**:** http://www3.ntu.edu.sg/home/cwso/

One paragraph Bio:

Cheuk-Wai So obtained his Ph.D. degree in 2003 under the guidance of Prof. W.-P. Leung at The Chinese University of Hong Kong. From 2005 to 2007, he was an Alexander von Humboldt research fellow at the University of Göttingen under the supervision of Prof. Herbert W. Roesky. Then, he was a JSPS research fellow at Nagoya University under the guidance of Prof. Shigehiro Yamaguchi. Since 2016, he has been an Associate Professor at Nanyang Technological University, Singapore. His research area focuses on the chemistry of very low oxidation state and coordination number *p*- and *d*-block complexes with emphasis on their unprecedented electronic structures and reactivities, which were thought to be inexistent and unstable at room temperature, leading to possible application in catalysis, materials chemistry, hydrogen storage, etc.. 61 articles in total regarding main-group and transition metal organometallic chemistry were reported in international renowned peer-reviewed journals.

Write up on the possible project

Designing Highly Phosphorescent Platinum Emitters for Single Dopant White Organic Light Emitting Diodes

White Light is indispensable in electronic displays and lighting devices. Currently, the state-of-the-art white organic light emitting diode (WOLED) technology (for example, WOLED in Samsung mobile displays) requires the use of multiple iridium emissive materials to generate white light. This will generate color instability and color aging issues, affecting the performance and operational lifetime of WOLEDs. Moreover, the manufacturing process of WOLED becomes more complicated with the incorporation of multiple emissive layers or a single emissive layer with multiple dopants. In order to prevent the color aging and enhance the color stability, the device structures will become inevitably more complexed. In this context, it is essential to develop a *single emitter* for an efficient and stable WOLED, which will lower the fabrication and energy cost of WOLEDs significantly by decreasing the complexity of device fabrication. This project focuses on the design and synthesize square planar platinum(II) complexes supported by novel ligands for the application of single emitters in WOLED devices. The novel ligands will exhibit extraordinary strong σ-donating abilities, along with π-conjugated and sterically undemanding, in comparison with the state-of-the-art ligand systems. The resulting platinum(II) emitters, when doped into a host material to construct a WOLED, will produce high-energy ^{3}LC, ^{3}LLCT, or/and ^{3}MLCT monomeric emissions and low-energy ^{3}MMLCT or ^{3}[σ*(π)–σ(π*)] excimeric emissions simultaneously, giving rise to a white-light emission. Such spectroscopic properties result in high performance WOLEDs with the cost, size and electricity consumption being 60% lesser than the stat-of-the-art WOLEDs using iridium complexes with three emission colors because only one single emitter is needed. This project will advance the OLED technology in “Chemical”, “Energy” and “Electronics” sectors of Singapore industry, which need further innovation in power-saving, manufacturing cost-reduction and high performance, leading to sustainable competitiveness.

Name: Cise Unluer
Title: Dr
Organization: NTU
E mail address: ucise@ntu.edu.sg
Mailing address: School of Civil & Environmental Engineering, 50 Nanyang Avenue, Block N1, Singapore 639798
Contact number: 9196 4970
Webpage link**:** http://www.cee.ntu.edu.sg/aboutus/FacultyDir/Pages/ccunluer.aspx

One paragraph Bio

Dr Cise Unluer, is a lecturer at the NTU School of Civil & Environmental Engineering. She completed her Bachelor's degree (BEng) in Civil Engineering with a minor in Mathematics from Vanderbilt University in May 2006, with a Fulbright and an Engineering Academic Achievement Scholarship. She obtained her MSc degree in Concrete Structures and Business Management from Imperial College London in September 2007. Upon the completion of her MSc degree, Dr Unluer worked for a design consultancy in London, Ramboll UK Ltd, as a structural engineer for 1.5 years, during which she was involved in the design of several concrete and steel structures in the UK and overseas. Following her industry experience, she joined the Engineering Department at the University of Cambridge in April 2009 as a PhD student with a Cambridge European Trust Bursary to carry out her research work focusing on the enhancement of carbonation of MgO-cement porous blocks, a novel product that gains strength by sequestering CO_2. Through her work, Dr Unluer recognized the innovative nature of MgO-cements and identified the very high potential of resulting formulations. Her work shed light to the significant impact of MgO cements through their abilities in lowering embodied energies, reducing wastes, and delivering massive sequestration in a wide range of applications. Because of her research accomplishments, Dr Unluer was awarded the 2010 Dow Sustainability Innovation Challenge Award, which recognizes and rewards researchers for their pioneering research on sustainable solutions to the world's most pressing social, economic, and environmental problems. After completing her PhD in July 2012, Dr Unluer joined the Concrete Sustainability Hub at MIT as a Postdoctoral Associate for a year, during which she worked on the alkali activation and nucleation seeding of supplementary cementitious materials. Her work at MIT concentrated on the use of waste materials with cement and examined the rate controlling step that led to a better understanding of how to use these materials to produce more sustainable mixes. Dr Unluer is currently supervising a research team including a Research Fellow and 4 PhD students. She has an extensive knowledge and several publications on concrete materials, especially on the development and use of novel cements; supplementary cementitious materials; recycled concrete and sustainability issues related to concrete materials.

Write up on the possible project

The proposed research aims to contribute to the maintenance of the marine ecosystems and biodiversity in Singapore through the prevention of increasing toxic threat to the marine environment, restructuring of present waste disposal techniques through efficient and affordable practices and the enhancement of productivity and performance. This will be achieved via the investigation of the production of valuable metals (i.e. Ca and Mg) from reject brine obtained from local desalination plants in Singapore and their use in various applications. Apart from their cementitious properties, these metals will be characterized and optimized for their purity and reactivity to enable their use in high value-added applications within other industries.

Similar to most of the widely used products in these industries that are imported to Singapore from other countries, the relatively low local availability of CaO and MgO has inspired their sustainable production

from waste brine obtained from local desalination plants, which have a strong presence in Singapore. The highly saline effluent brine from the desalination process not only has no economic value, but also has adverse effects on the marine ecosystem as it is currently discharged back into the sea. This process disturbs the local water and sediment by introducing a multi-component waste and increasing the temperature, also endangering the marine organisms due to the residual chemicals mixed into the brine from the pre-treatment process. Production of CaO and MgO from reject brine provides a new purpose for this otherwise harmful waste material and proposes a sustainable alternative for the current production of CaO and MgO within Singapore. This can reduce our dependence on external sources and define Singapore as a key player in sustainable materials research and production.

The locally available production routes of valuable metals such as calcium (Ca) and magnesium (Mg) present an advantage for the generation of technical advancements in line with the capabilities of local industries in Singapore. As most cement mixes are predominantly Ca-based, the production of calcium oxide (CaO) as well as the oxides of other metals, such as magnesium oxide (MgO) that possess the capacity to bind and gain strength within concrete mixes, from sustainable sources locally available in Singapore can enable the development of an innovation-based research community in Singapore. In addition to its use as a cement binder, MgO is largely in demand as a highly valued resource for the pharmaceutical and semiconductor industries within and outside Singapore.

Due to their ability to gain strength through carbonation (i.e. via the absorption of CO_2) and improved properties in many aspects, MgO-based cements have the potential to be utilized in a variety of applications, leading to the development of zero-carbon mortars, renders, grouts, pavements, bricks, blocks and pavers. In addition to their use in the pharmaceutical and semi-conductor industries, the produced MgO-based materials can be used in lightweight disposable high thermal capacity insulated packaging, soil stabilization and solidification, waste utilization, capture applications and other engineering applications where properties such as rheology and fire retarding are essential. In the longer term, as their engineering properties get quantified through research, MgO cements and future derivatives have the potential to target a wider range of applications. The use of MgO in other applications involving blocks such as the construction of road side paveways, garage and parking floorings, driveways, walls and floor coverings of residential and commercial buildings where carbonation can take place is greatly feasible.

The proposed reaction routes involve the sustainable production of CaO and MgO from waste brine followed by their use in the development of zero-carbon concrete products as well as other applications within the pharmaceutical and semiconductor industries. This will satisfy the goal of addressing the overall carbon footprint of the various promising production routes as well as the development of novel construction products, in which the materials produced from reject brine will be incorporated. The limited adoption of this production route thus far presents an opportunity for practical impact. The novel techniques to be used in this project will transform each material from its waste/by-product status to highly valuable materials with a range of applications within the construction, pharmaceutical and semiconductor industries. This project will facilitate the advancement of technological capabilities and creation of jobs that will contribute to Singapore's continued innovation-driven economic growth. A well-planned research agenda that is coordinated with industry needs has the potential to profoundly influence current practice. Such an outcome will not only place Singapore at a pioneering position for research in sustainable materials but also have global impact in terms of reduced energy usage and CO_2 emissions.

A*STAR: 6 submissions

1. Lim Chi Wan, Calvin
2. Bharathi Boppana and Daniel Wise
3. POH Hee Joo
4. George XU Xiangguo
5. Hu Wuhua
6. Emily Hao Jianzhong

Name: Lim Chi Wan, Calvin
Office Mailing Address: 1 Fusionopolis Way, #16-16 Connexis, Singapore 138632
Email: limcw@ihpc.a-star.edu.sg
Contact No: 64191507
Fax No: 64191230
Webpage Link: https://www.a-star.edu.sg/ihpc/People/tid/99/Lim-Chi-Wan-Calvin.aspx
Title: Capability Group Manager, Geometrical Modeling

Bio: Dr Calvin Lim Chi Wan is the capability group manager of the geometrical modeling group in Institute of High Performance Computing (IHPC). He has background experiences in the area of computational geometry, especially in the area of surface reconstruction from point clouds. He is also keenly involved with algorithmic development related to mesh generation/processing, both in industry related projects and academic grants. He has led industry projects which include automatic mesh generation for CFD simulation on aircraft mechanical parts and modelling of oil-well tunneling processes. He has a good understanding of mesh pre-processing, feature reduction, and geometrical-based reconstruction. He currently leads a capability group that has experiences working in domains related to computer graphics, CAD modelling and computer visualization

Potential Project: Automatic Repair and Conversion of Urban Digital Model into simulation-ready meshes.

The objective of this project is to design and develop an automatic 3D building model reconstruction methodology to convert CAD data (or other digital modeling formats) into data format which are compliant for finite element mesh generation. This will equip our simulation platform with a reliable and effective tool for the rapid reconstruction of geometrical models which satisfy computational requirements and simulation constraints. Specifically, the reconstruction algorithm will be able to automatically process building data format, resolve non-manifold topology, suppress unnecessarily detailed features, cluster and merge buildings that are close together, and export the 3D model into an exchange format suitable for the intended numerical simulation applications, along with the encoded semantics information.

The verification and correction routine parses the data to identify all regions of non-manifold topology and automatically rectifies the problem during the model reconstruction process. This will ensure that the final model is free of non-manifold topology, and is hence suitable for mesh generation algorithms.

In addition, a geometric model usually contains too many fine details that are unnecessary for simulation purposes and will cause the generated mesh to be unduly dense. Feature suppression is hence required to filter away excessive information based on a user-defined tolerance. The development of the automatic geometric feature suppression algorithm will replace the tedious and time-consuming task of manual modification of the model.

Name: Bharathi Boppana and Daniel Wise
Title: Uncertainty Quantification for Urban CFD applications
Organization: Institute of High Performance Computing
E mail address: boppanavbl@ihpc.a-star.edu.sg
Mailing address: 1 Fusionopolis Way, #16-16 Connexis, Singapore, 138632
Contact number: 64191575
Webpage link: https://www.a-star.edu.sg/ihpc/People/tid/264/Bharathi-Boppana.aspx

One paragraph Bio:
Bharathi Boppana is currently a Scientist at Institute of High Performance Computing, Singapore. Her main research interests are turbulent flows and uncertainty quantification, specific to environmental applications. As an NCAS research fellow at the University of Southampton, she worked extensively on the flow and passive scalar dispersion in urban flows using large-eddy simulation. She received her PhD from the Applied Mathematics department of The University of Manchester, UK and MSc from the Indian Institute of Science, India.

Write up on the possible project (max half a page)
Most CFD urban simulations used to assess wind and thermal comfort, pollutant dispersion etc. are conducted using RANS and LES. With both of these tools, the simulation output depends on the specified inputs and/or model coefficients that are usually steady and fixed. Such steady input-output simulations only provide a limited understanding of the complex underlying physics. Hence, it is necessary to obtain the probabilistic outputs for a range of uncertain inputs or model coefficients. The reliability and robustness of such simulations not only improves our understanding on the underlying physics, but also can be used for risk assessments and in the decision-making process. Very limited research has been done to quantify the uncertainties associated with inputs in CFD of urban flows. By using techniques such as generalized polynomial chaos (Sanchez et al, Atmospheric Environment, 2017) and hybrid anchored-ANOVA-POD/Kriging method (Margheri and Sagaut, Journal of Computational Physics, 2017), it is possible to evaluate the models, calibrate them, as well as quantify the uncertainties in the simulation output. For this, much work needs to be done in analyzing the existing uncertainty quantification tools and techniques, identifying the appropriate one according to the problem objective (i.e. wind comfort or gas dispersion, implementing, and integrating them with the CFD simulations. This will then provide a better framework and can be extended to many large-scale urban CFD applications.

Name: **Dr. POH Hee Joo**
Title: Wind Tree Modelling in Plant-Air-Soil Framework
Organization: Institute of High Performance Computing, A-STAR
E mail address: pohhj@ihpc.a-star.edu.sg
Mailing address: 1 Fusionopolis Way, #16-16 Connexis (North), Singapore 138632
Contact number: 64191536
Webpage link: http://www.ihpc.a-star.edu.sg

One paragraph Bio:

Dr Poh Hee Joo holds the position of Research Scientist and Manager (Environmental Flow) in Institute of High Performance Computing, A*STAR. He is also an Adjunct Assistant Professor to both the Mechanical Engineering Department and Building Department of National University of Singapore (NUS). He is the pioneer adjunct lecturer for BCA Green Mark Professional course module for Computational Fluid Dynamics (CFD) Airflow Modelling for Green Buildings. He has over 20 years of work experience in CFD research and consultancy jobs mainly focusing on Urban Physics; Environmental Health and Safety; and Building Performance and Sustainability. In 2014, he was nominated by the Ministry of National Development (MND) to be honoured as a World Cities Summit Young Leader in recognition of his contribution to the field of urban liveability and sustainability in Singapore. He has been invited as regular speaker at various agency events such as BCA International Green Building Conference (IGBC), MND Urban Sustainability R&D Congress and NEA Distinguished Speakers Forum to promote research focus on Urban Environmental Modelling and Sustainable Cities in Singapore.

Write up on the possible project (max half a page)

In this proposal, we aim to develop comprehensive Wind-Tree Modelling in Plant-Air-Soil Framework in order to better understand the physics of heat, mass and radiative exchange process and dynamic wind-tree interaction. They are three research capabilities to be developed:

1. Wind-tree modelling with convective heat and mass exchange from stomata via leaf boundary layer and subsequently to scale up with *Leaf Area Density (LAD)* formulation
2. Wind-tree modelling with atmospheric-vegetation and the influence of trees is considered as source terms, and radiation exchange & thermal conduction for unsteady RANS simulation
3. Wind-tree modelling with simplified root-plate model and subsequently to scale up for *the integrated branch-trunk-root-soil* model

The following four research work scopes are proposed:

1. Development on appropriate geometrical model representation for wind-tree modelling (e.g. explicit tree-branches, trunk, fractal and LAD)
2. Development on the physics of heat and mass exchange process (including drying kinetic) for wind-tree modelling
3. Development on the coupling of radiation for wind-tree modelling
4. Development on the dynamics wind-tree interaction model (with tree swaying and root-substrate model) for single tree and forest composition

Ultimately, we hope that the capabilities developed can be applied to the following future projects **for Urban Environment Modelling Research in IHPC**

1. Wind-tree interaction: Physical performance of solid models in wind tunnel tests – NParks/NUS
2. Wind load prediction on trees in virtual urban landscape for Greenery Management – NParks/NUS
3. Development of an Integrated Model for Tree Stability Assessment in Urban Landscape
4. Vegetation shadowing and evapo-transpiration effect – for outdoor thermal comfort study

Collaborator: Dr. Daniel Burcham, Senior Arboriculture Researcher, CUGE, NParks

Name: Dr. George XU Xiangguo

Title: Computer assisted CFD simulation to promote Positive Energy School (PES) Programme in Singapore

Organization: Institute of High Performance Computing, A-STAR
E mail address: xu_xiangguo@ihpc.a-star.edu.sg; Mailing address: 1 Fusionopolis Way, #16-16 Connexis (North), Singapore 138632; Contact number: 64191521; Webpage link: http://www.ihpc.a-star.edu.sg

One paragraph Bio:

George XU has enormous experiences in the experimental measurements and CFD simulations of engineering problems over the past twenty years. In particular, he has abundant endeavors about environmental sustainable design and CFD applications in building & construction industry for past six years. His comprehensive involvements cover the CFD modelings of thermal comforts, mechanical and natural ventilations, fire and smoking propagation and chemical dispersions in all types of buildings. He has life-long interest in CFD upstream researches with the focuses on the development of innovative all-speed fluid solver, fluid-structure interaction (FSI) approach, multi-physics electrohydrodynamic solution for high-precision jet printing problem, and opensource code development tailored for industrial applications in terms of performance-based and sustainable designs. Dr. George Xu is also a BCA Certified Green Mark Professional (GMP), for his remarkable experience and achievement in green and sustainable building designs in past years. George XU has published more than 30 technical papers on prestigious international conferences and journals. He is designated as the principal investigator for the proposed 3-year project that is going to be sponsored by Singapore Sustainability Blueprint (SSB) programme.

Write up on the possible project (max half a page):

In line with the Positive Energy School (PES) programme recently advocated by Building and Construction Authority (BCA), FD/ENV group from Institute of High Performance Computing (IHPC) proposes to employ advanced computational fluid dynamics (CFD) approach to optimize the school design features, with the primary efforts in maximizing the naturally ventilated occupational spaces and reducing energy consumption in air-conditioned spaces integrated with ceiling fans. For naturally ventilated classrooms, the integrated design solution, with the consideration of natural wind, solar heat and wind-driven rain (WDR), will be considered as a whole. In details, specific focus will be placed on utilizing CFD to deliver the following objectives in this project:

- To identify the optimized layout and strategies to harness natural ventilation, subject to the CFD methodology outlined in BCA Green Mark 2015 for Non-Residential Building (NRB), to improve the thermal comfort level at both classrooms and multi-purpose halls in school environments with the consideration of ceiling fans or HVLS fans;
- To investigate the effectiveness of the integration of ceiling fans into conventional air conditioning and mechanical ventilation (ACMV) spaces (e.g. general offices) in schools for the sake of enhanced thermal comfort and energy saving, and
- To numerically address the impacts of mitigate measures plausibly recommended for minimizing WDR impacts to the various areas of interest, including common corridor, classroom and staircases.

There will be opportunities to collaborate with university researchers who will perform experimental measurements in respective school environments. Besides, the candidate is anticipated to work closely with IHPC's research scientists to educate MOE students, BCA officers and industrial consultants about the simulation-based design technologies to be developed in this project. The brain-storming educational activities are deemed to enhance people's awareness of sustainability in both building design and operation.

Name: Dr Hu Wuhua

Title: Sustainable Cities - Bridging the Final Gap of Efficient Energy Consumption by Improving on Electric Vehicles
Organization: Institute for Infocomm Research (I^2R)
Email address: huwh@i2r.a-star.edu.sg
Mailing address: 1 Fusionopolis Way, #21-01 Connexis (South Tower), Singapore 138632
Contact number: 64082176
Webpage link: None

One paragraph Bio

Dr. Hu Wuhua received his BEng degree in Automation in 2005 and the MEng degree in Detecting Technique and Automation Device in 2007 from Tianjin University, China. He received his PhD degree in Communication Engineering from Nanyang Technological University (NTU), Singapore, in 2012. He is currently a Research Scientist with the Institute for Infocomm Research, Agency for Science, Technology and Research (A*STAR), Singapore. Before joining A*STAR, he worked as a Research Fellow first with the School of Mechanical and Aerospace Engineering and then the School of Electrical and Electronic Engineering, NTU, Singapore, from Aug 2011 to Mar 2016. His research interests are in modeling, estimation, control and optimization of dynamical systems, with applications for smart and greener power and energy systems.

Write up on the possible project (max half a page)

This proposal is for the design and development of an advanced battery management system (BMS) on top of existing BMS designed by automotive manufacturers. The primary goal is to improve the performance and lifetime of the vehicle's energy storages under regular workload as well as to monitor the health of the EV via the vehicle's energy profiling. The advanced BMS serves to optimize the usage of the energy storage cells against factors like usage behavior, road conditions and life expectancy of the energy storage. Novel concepts, such as distributed estimation, model-free control, real-time optimization and etc, will have to be utilized to bridge the remaining gap to optimality; taking into account the environmental factors of Singapore such as road conditions, weather and etc. Vehicle energy performance by the developed techniques will have to be validated through multi-agent simulation before deployment onto an actual electric vehicle. This is to ensure validation of developed technique is focused on the final tuning as opposed its workability.

Name: Dr Emily Hao Jianzhong
Title: An on-line process monitoring scheme to improve accuracy of boiler inspection process
Organization: Institute for Infocomm Research (I^2R)
Email address: haoemily@i2r.a-star.edu.sg
Mailing address: 1 Fusionopolis Way, #21-01 Connexis (South Tower), Singapore 138632
Contact number: 64082368
Webpage link: None

One paragraph Bio

Dr. Emily Hao Jianzhong obtained her B.Eng and M.Eng from Huazhong University of Science and Technology, PRC and Ph.D from Nanyang Technological University of Singapore in 1990, 1993 and 2001 respectively. She is currently the department head for her infrastructure department in the Institute for Infocomm Research (I^2R). Over her 15 years of research and work experience in I^2R and 6 years in the industry, she has secured more than S$5.47 million industry funding, published 2 book chapters and over 80 publications. She holds 7 international patents and the award-winning, "Perimeter Intrusion Detection System" technology. Her research interests are in fiber optics, photonics and bio-photonics.

Write up on the possible project (max half a page)

Defects caused by waterside corrosion (thinning of U-bend tubes), fireside corrosion, as well as a general failure of tube materials in tube boilers due are to stress or creep. The current maintenance policies for the U-bend tubes are scheduled preventive maintenance and unscheduled maintenance for an undetected failure which include randomly inspecting partial spot scanning, a full scan or incident detection of failure during some other repairs. The objective of this project is to develop online monitoring and assessment technologies to track the health status of the U-bend tubes in a tube boiler, which leads to more accurate and intelligent condition-based maintenance plus (CBM+). The on-line monitoring scheme not only automatically detects the defects but also increases the speed of inspection. The accuracy of the boiler inspection processes can be also improved by the on-line monitoring scheme. Further, it can allow immediate detection to prevent an undetected failure at a reasonable cost.