

Media Release

2 July 2013

\$10 million awarded in research grants to support Smart Grid innovation

The Energy Market Authority (EMA) announced today the award of research grants totalling about \$10 million to six research teams for projects on Smart Grid technologies under the auspices of the Energy Innovation Programme Office (EIPO). The six projects focus on ensuring the reliability and resilience of the electricity grid, and spans areas such as energy analytics, storage, condition monitoring and control systems.

2. The six projects are:

No.	Project Title	Host Institution	Industry Partners
1	Towards Green Datacentres as an Interruptible Load for Grid Stabilisation in Singapore	Nanyang Technological University	Toshiba Asia Pacific Pte Ltd SP PowerGrid Ltd
2	Dynamic Optimisation and Energy Management for Smart Grids	National University of Singapore	SP PowerGrid Ltd
3	Research on DC Micro-grid for Performance Enhancement of Smart Grid	Singapore Polytechnic	SP PowerGrid Ltd
4	Wattalyzer: An Integrated Solution for Smart Grid Condition Monitoring through Advanced Sensing and Real-Time Analytics	Institute for Infocomm Research, A*STAR	SP PowerGrid Ltd Power Automation Pte Ltd
5	Demand Focused Smart Energy Management in End-User Environments for Sustainable Cities	Singapore University of Technology and Design	Power Automation Pte Ltd

No.	Project Title	Host Institution	Industry Partners
6	Advanced Solar PV Communication and Control Device for Optimised Systems Performance, Reliable Metering and Enhanced Grid Stability	Solar Energy Research Institute of Singapore (SERIS), National University of Singapore	Power Automation Pte Ltd Solare Datensysteme Asia Pacific SP PowerGrid Ltd

(Further details of the six projects are in the Annex.)

Catalysing Energy Innovation through Research and Development

3. The Smart Grid grant call administered by EMA attracted 39 proposals from the industry and academia. The proposals were rigorously evaluated through a two-stage process involving both international technical experts and an evaluation panel.

4. Mr Chee Hong Tat, Chief Executive, EMA and co-Executive Director of EIPO said, “I am encouraged by the interest and support from the industry and academia. The selected projects will help strengthen the resilience and efficiency of Singapore’s electricity grid. EMA will continue to look for opportunities to work with our partners to build capabilities, catalyse innovation and prepare Singapore’s energy infrastructure for the future.”

5. With utilities companies and licensees as key partners in maintaining the high quality of electricity supply, Singapore Power (SP) is supporting the call for proposals by collaborating with several of the winning projects. Mr Chuah Kee Heng, SP’s Head of Strategic Development, said, “We are excited to partner leading researchers to develop innovative solutions that will address future energy challenges in our electricity network, improve grid reliability and benefit consumers in the long run.”

6. Managing Director of the Singapore Economic Development Board (EDB) and co-Executive Director of EIPO, Mr Yeoh Keat Chuan said, “The smart grids sector is experiencing robust growth globally due to the increasing need for grid stability, energy efficiency and management of intermittent renewable energy. This sector plays to the strengths of Singapore in system integration and is aligned with our focus on building energy management capabilities. With a strong base of industry collaborators, the projects selected for funding will support the growth of the smart grids sector in Singapore, spanning the value chain of research, innovation and commercialisation.”

7. Another grant call by EMA on enhancing the availability, reliability and overall system efficiency of the power generation sector is currently open. It will close on 18 July 2013.

8. Funding for the grant calls will be drawn from the \$140 million under the Energy Innovation Research Programme (EIRP) of EIPO. Formerly known as the Clean Energy Research Programme (CERP) since 2007, the EIRP is a competitive funding initiative aimed at supporting interdisciplinary and commercially-relevant research and development efforts.

-- End --

About the Energy Innovation Programme Office (EIPO)

Formerly known as the Clean Energy Programme Office (CEPO), EIPO is the interagency programme office responsible for developing and executing strategies and policies for the development of the energy sector. Led by the Economic Development Board (EDB) and the EMA, EIPO reports to the Energy Innovation Executive Committee co-chaired by Chairman EDB and Permanent Secretary, Trade and Industry.

About the Energy Market Authority

The Energy Market Authority (EMA) is a statutory board under the Ministry of Trade and Industry. Its main goals are to ensure a reliable and secure energy supply, promote effective competition in the energy market and develop a dynamic energy sector in Singapore. Through its work, the EMA seeks to forge a progressive energy landscape for sustained growth.

Smart Grid Technologies Proposals

1. Towards Green Datacentres as an Interruptible Load for Grid Stabilisation in Singapore

Host Institution: Nanyang Technological University (NTU)

Project Background:

As Singapore works towards facilitating the integration of distributed generation sources and renewable energy resources with the electricity network, the intermittent nature of such power generation, which could result in short-term fluctuations in power supply, must be adequately addressed. An effective approach is to identify suitable interruptible loads, or large-scale but non-critical consumers of electricity whose usage can be scaled down or disconnected from the grid when the electricity supply is stressed.

Outcomes and Benefits:

This project aims to develop advanced algorithms, coupled with an economic incentive model, to establish data centres as an interruptible load for power grid stabilisation in Singapore. If successful, this project could develop intelligent power analytics capabilities that will not only reduce the overall consumption of energy-intensive data centres, but also allow data centres to serve as interruptible loads for enhancing the overall stability of the grid.



Principal Investigator:

Dr Wen Yonggang has extensive experience in the field of information and communication technologies (ICT), including cloud computing, mobile computing, multimedia network, cyber security and green ICT. He obtained his PhD from the Massachusetts Institute of Technology and is currently an Assistant Professor with the School of Computer Engineering at NTU.

Co-Principal Investigators:

A/Prof Tseng King Jet, NTU
Prof Thambipillai Srikanthan, NTU
A/Prof Toh Kok Chuan, NTU
A/Prof Wong Yew Wah, NTU
Dr Fan Rui, NTU

Collaborators:

Mr Lee Kim Hoong, SP PowerGrid Ltd
Dr Li Hongqun, SP PowerGrid Ltd
Mr Kiyotaka Kaneko, Toshiba Asia Pacific Pte Ltd
Mr Valek Phang, Toshiba Asia Pacific Pte Ltd
A/Prof Michael Neely, University of Southern California
Prof Zheng Lizhong, Massachusetts Institute of Technology

2. Dynamic Optimisation and Energy Management for Smart Grids

Host Institution: National University of Singapore (NUS)

Project Background:

The future grid is expected to include a large number of distributed renewable generation sources, energy storage facilities and load control. It is also expected to be flexible and scalable, such that a large increase in load and installation of additional generators will not create any negative effect on the stability and reliability of the existing grid. However, expectations placed on today's grid significantly exceed the capabilities of today's systems, especially in terms of their ability to handle outages, sudden changes in load demand and intermittent generation. Hence, new control and management paradigms and technologies that are different from the traditional methodologies are necessary for the operation of modern power systems with smart grid functionalities.

Outcomes and Benefits:

This project aims to develop intelligent computational tools incorporating efficiency optimisation and decision making algorithms that will equip grid operators with enhanced capabilities to receive automated grid fault diagnosis, carry out highly accurate scenario planning and make optimised decisions in managing the smart grid.

Principal Investigator:



A/Prof Dipti Srinivasan possesses a breadth of experience in the field of advanced computational algorithms and learning methods, and their practical applications for large complex engineered systems, such as the electric power system and urban transportation system. Her recent research has focused on power system management and control, smart grid applications and development of multi-agent systems for micro-grid operation and control. She is currently an Associate Professor at the Electrical and

Computer Engineering Department of the NUS.

Co-Principal Investigators:

A/Prof Ashwin M. Khambadkone, NUS

A/Prof Sanjib Kumar Panda, NUS

Dr Akshay Rathore, NUS

Collaborators:

Mr Lee Kim Hoong, SP PowerGrid Ltd

Dr Li Hongqun, SP PowerGrid Ltd

3. Research on DC Micro-grid for Performance Enhancement of Smart Grid

Host Institution: Singapore Polytechnic

Project Background:

Today, renewable energy installations such as solar photovoltaic (PV) panels generate electricity in the form of Direct Current (DC) power. This is then converted into Alternating Current (AC) power for electricity distribution within the facility, before being re-converted again into DC power compatible with daily household and office appliances. This conversion circle of DC-AC-DC not only results in double-conversion losses which may reach as high as 50%, but the intermittent nature of renewable energy generation also poses challenges to the stability of the power grid. One way of addressing this problem is to develop DC micro-grids which allow for the transmission and usage of electricity from renewable generation sources without the need for any conversion.

Outcomes and Benefits:

Current research efforts in DC micro-grids are mainly focused on control and power management of the micro-grid itself. There is less focus on using DC micro-grids to enhance the reliability and stability of the power grid. This project aims to develop an intelligent, scalable DC micro-grid control system that will not only resolve the problem of double-conversion losses, but will also function as an intelligent building energy management system that will optimise the energy management of DC micro-grids to benefit both consumers and the grid operators.



Principal Investigator:

Dr Wang Huaqian is currently a Senior Lecturer at the School of Electrical & Electronic Engineering at Singapore Polytechnic. His broad range of expertise includes the areas of power electronics, motion control, battery management system, advanced digital control technologies and wireless control systems using Bluetooth and ZigBee technologies. In 2009, Dr Wang developed the world's first Bluetooth-controlled wheelchair which garnered much commercial interest from retailers in Singapore.

Co-Principal Investigators:

Dr Cai Zhi Qiang, Singapore Polytechnic
Dr Jiang Hao, Singapore Polytechnic

Collaborator:

Dr Li Hongqun, SP PowerGrid Ltd

4. Wattalyzer: An Integrated Solution for Smart Grid Condition Monitoring through Advanced Sensing and Real-Time Analytics

Host Institution: Institute for Infocomm Research (I2R), Agency for Science, Technology and Research (A*STAR)

Project Background:

A key challenge for the emerging smart grid is to leverage on state-of-the-art technology innovations to facilitate grid asset operation and maintenance through condition monitoring. Condition monitoring primarily focuses on using sensing technologies combined with advanced data analytics to monitor the health conditions of various grid infrastructure to prevent catastrophic outage; support network operation and improve asset management. The key benefits of condition monitoring are ultra-high reliability of power supply and condition based maintenance that results in significant cost savings and higher efficiency from the investment into power assets.

Outcomes and Benefits:

This project aims to develop and evaluate an end-to-end condition monitoring system that integrates innovative multi-modal sensing, data collation and real-time/predictive data analytics to enable grid operators to strengthen their on-line condition monitoring ability, by detecting and responding to faults in the transmission network more accurately and efficiently.

Principal Investigator:



Dr Shonali Krishnaswamy's expertise lies broadly in the area of mobile, ubiquitous and distributed data mining, and data stream mining. She is increasingly interested in applications such as utility analytics (smart energy management and smart water analytics), mobile user analytics and mobile activity recognition. Dr Krishnaswamy is currently the Head of the Data Analytics Department at the Institute for Infocomm Research (I2R) and also holds a tenured appointment as an Associate Professor at the Faculty of Information Technology, Monash University, Australia. Dr Krishnaswamy has received numerous research grants and awards, such as the IBM Innovation Award.

Co-Principal Investigators:

Dr Li Hongqun, SP PowerGrid Ltd
Dr Cao Hong, I2R
Dr Yixin Wang, I2R
Dr Yu Rongshan, I2R
Dr Dong Bo, I2R

Collaborators:

Mr Wang Aimin, SP PowerGrid Ltd
Mr Lee Kim Hoong, SP PowerGrid Ltd
Dr Yu Ming, Power Automation Pte Ltd

5. Demand Focused Smart Energy Management in End-User Environments for Sustainable Cities

Host Institution: Singapore University of Technology and Design (SUTD)

Project Background:

The current state of global smart grid development is generally focused on energy monitoring and control from a centralised administrative focus, with limited active involvement from individuals and communities who make up the end-users as well as beneficiaries of the smart grid. This approach typically results in weak support from grid end-users towards smart grid initiatives, and calls for a paradigm shift towards how such initiatives could be deployed to clearly express the potential smart grid benefits for the end-users. There is therefore a need to perform research into new market systems, algorithms, grid control and integration of different end-user environments that benefit the customers with new services and unprecedented modes of operation, while mitigating customer inconvenience.

Outcomes and Benefits:

This project aims to develop a novel and scalable smart grid system that manages demand-side electricity consumption. An integrated approach to end-user environment design will be adopted, including policy formulation, system modelling and implementation in a real-life testing environment within the SUTD campus so as to improve the system's overall design and scalability.



Principal Investigator:

Prof Kristin Wood is currently a Professor, Engineering and Product Development Pillar Head, and Co-Director of the International Design Centre at the Singapore University of Technology and Design (SUTD). His primary domains of expertise are mechanical engineering, product design and development, and pedagogy. With over 300 publications, Dr Wood has also won numerous accolades such as six Best Research Paper Awards, as well as the ASEE Fred

Merryfield Design Award and the NSPE AT&T Award for Excellence in Engineering Education.

Co-Principal Investigators:

Dr Selin Ahipasaoglu, SUTD
Prof Saif Benjaafar, SUTD
Dr Yu Gu, SUTD
A/Prof Katja Holtta-Otto, SUTD
A/Prof Kevin Otto, SUTD
Dr Chau Yuen, SUTD
Dr Shisheng Huang, SUTD
Mr Kerk See Gim, Power Automation Pte Ltd

Collaborator:

Dr Deokwoo Jung, Advanced Digital Sciences Center (ADSC)

6. Advanced Solar PV Communication and Control Device for Optimised Systems Performance, Reliable Metering and Enhanced Grid Stability

Host Institution: Solar Energy Research Institute of Singapore (SERIS), National University of Singapore (NUS)

Project Background:

Today, grid-integrated solar photovoltaic (PV) systems are increasingly prevalent. To facilitate the integration of such systems with the power grid, it is important to develop relevant and suitable devices that can leverage on leading-edge technologies and yet remain receptive towards future enhancements. This could be achieved by streamlining various monitoring and control devices in a highly reliable manner, so as to avoid the duplication of information and communication networks.

Outcomes and Benefits:

This project aims to effectively merge and simplify three distinct functionalities, namely, electricity metering, PV systems monitoring and grid control capabilities, into a single, bi-directional device that uses wireless communication technologies. This system would interact with the various stakeholders of the information at different time intervals, ranging from real-time (for power system operation), minutes (for performance monitoring) to daily/monthly (for metering). It will add the direct and "live" link between the power system control centre and the solar inverter for grid support measures and for obtaining valuable end-of-line information about power quality. This would then also allow for a higher degree of flexibility in network planning, while providing a future-oriented, "smart grid"-ready solution for reliable electric metering, optimised PV systems operations and enhanced grid stability.



Principal Investigator:

Dr Thomas Reindl is the Director of the Solar Energy Systems cluster at SERIS. His first venture into photovoltaics started at the solar division of SIEMENS' Corporate R&D in 1992 before he moved on to China to work as an expert with the largest solar cell and module manufacturer at that time there. He later held various management positions in SIEMENS and SIEMENS Solar, before heading ILIOTEC, one of the leading PV system integration companies in Germany, as Chief Operating Officer. Dr Reindl holds a Master degree and a PhD in Natural Sciences and an MBA from INSEAD, all awarded with highest honours. He is the official Singapore representative of the International Energy Agency (IEA) SHC Task 40 on Net Zero Energy Buildings.

Co-Principal Investigators:

Prof Gerd Heilscher, Ulm University of Applied Sciences
A/Prof Tseng King Jet, NTU

Collaborators:

Dr Li Hongqun, SP PowerGrid Ltd
Mr Kerk See Gim, Power Automation Pte Ltd
Mr Holger Morneweg, Solare Datensysteme Asia Pacific