MEDIA RELEASE

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Boosting Innovations and Building a Future-ready Workforce for the Energy Sector

Emerging trends in the energy sector, such as the greater integration of renewables into our system and digital technologies, require forward-looking measures to strengthen the resilience of Singapore's power system and energy markets. To do this, we will need to drive R&D initiatives to maximise renewables integration, optimise energy demand, while strengthening our system resilience. At the same time, there is a need to grow local capabilities at both the enterprise and manpower level to navigate these trends.

2. The Energy Market Authority (EMA) has thus announced the following:

- Inaugural EMA and Enterprise Singapore joint grant call for local enterprises to develop solutions in deploying solar energy and optimising energy consumption. This will help local enterprises build capabilities while creating opportunities for their businesses both here and in overseas energy markets;
- $15 million grant award for seven energy innovations to strengthen the resilience of our power system and energy markets. These will involve the use of technologies such as blockchain, data analytics, artificial intelligence and machine learning; and
- Support for Power Engineering Professionals in the Public Service to upskill and seize opportunities presented by new technologies.

Inaugural Joint Grant Call for Local Enterprises to Develop Energy Solutions

3. EMA and Enterprise Singapore have jointly launched a Grant Call for Small and Medium Enterprises (SMEs) to develop solutions in deploying solar energy and optimising energy demand. This is in line with EMA's efforts to catalyse R&D initiatives to keep Singapore's energy options open and to strengthen the resilience of the power system.

4. The inaugural joint grant call also seeks to build up SMEs' capabilities and intellectual properties in the energy industry, while supporting the growth and internationalisation of their businesses. More information on the Grant Call and application process can be found at https://goo.gl/V78LbR. All proposals must be submitted by 23 November 2018, 12pm (UTC+8).

(Details of the Grant Call are in ANNEX A below.)

$15 Million Awarded to Step Up Singapore's Energy Resilience

5. To strengthen the cyber, physical, and market resilience of Singapore's power systems and energy markets, EMA has awarded a total of $15 million in research grants to seven projects that are expected to be completed by 2021.

6. The projects, chosen after a grant call launched in May 2017, will use technologies such as blockchain, data analytics, artificial intelligence and the Internet of Things to address the following challenges:

i. Market resilience. Three projects will look into enhancing energy market operations and trading through distributed ledger technologies. Among them is a digital electricity retail model using blockchain technology. This will create a decentralised, secure and tamper-proof ledger of all transactions to facilitate peer-to-peer trading and payment. It is also expected to reduce customer costs by up to 20% by doing away with intermediaries. The Experimental Power Grid Centre, National University of Singapore (NUS), Nanyang Technological University, Beebryte Pte Ltd and PacificLight Energy Pte Ltd are collaborating on this.

ii. Physical resilience. Two projects will address the resilience, reliability and efficiency of power assets across the entire value chain. One of them involves the development of novel heat transfer materials for district cooling systems. If successful, the collaboration between NUS and Keppel District Heating and Cooling Systems (DHCS) Pte Ltd could result in energy efficiency improvements and space savings for district cooling systems by as much as five times.

iii. Cyber resilience. One of the two projects being awarded is the development of a state-of-the-art network intrusion detection system. The project will leverage artificial intelligence to significantly improve online detection and mitigation of active IT threats for industrial control systems. The Singapore University of Technology and Design will collaborate with ST Electronics (Info-Security) Pte Ltd to develop the technology. This will use machine learning and adaptation to respond rapidly to cyber threats.

(Details of all seven projects are in ANNEX B below.)

7. On the significance of these projects, EMA Chief Executive Ngiam Shih Chun said: "While Singapore has one of the world's most stable and reliable power systems, this cannot be taken for granted. Emerging trends such as distributed generation of energy and smart grids are transforming the energy sector. The Government is therefore supporting these projects which have the potential to enhance the efficiency and reliability of our electricity and gas systems, building upon emerging trends."

8. Speaking for Keppel DHCS, one of the grant recipients, Keppel Infrastructure Chief Executive Officer Dr Ong Tiong Guan said: "Our project will look at developing an innovative thermal energy storage system for our district and retail cooling applications, using novel heat transfer materials that can store heat at four to five times the capacity of water. This will strengthen the resilience of Singapore’s power system and enhance our suite of sustainable cooling solutions that will improve energy efficiency, cost effectiveness, and save space. Keppel DHCS looks forward to partnering with NUS to develop this innovative solution."

Initiative to Develop Power Engineering Professionals (PEPS) in the Public Service

9. Along with the push for energy innovation is the need for a future-ready competent workforce equipped with relevant skill sets. For the Public Service, power engineering has been identified as a critical skill set given that power systems form the backbone of critical public and commercial infrastructure, from transportation to utilities. EMA was tasked to undertake the expanded mandate to build up power engineering capabilities for the Public Service, leveraging EMA's sector-wide manpower development experience.

10. To build these professional capabilities, EMA, together with the Public Service Division and SkillsFuture Singapore, have collaborated to extend the SkillsFuture Earn-and-Learn Programme to Polytechnic and Institute of Technical Education (ITE) graduates pursuing power engineering-related roles in the Public Service. This signals the Government's strong commitment to build power engineering capabilities in the energy sector.

11. Under this collaboration, eligible[1] Polytechnic and ITE graduates will undergo a structured training programme. This will include facilitated learning, on-the-job training and work-based projects in the Public Service. Participants will receive a sign-on incentive of $5,000

(A Factsheet of the initiative can be found in ANNEX C below.)

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[1] For fresh graduates who are Singapore Citizens and within three years of graduation or Operationally Ready Date for male Singaporeans only.

About the Energy Market Authority

The Energy Market Authority is a statutory board under the Ministry of Trade and Industry. Our 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 our work, the EMA seeks to forge a progressive energy landscape for sustained growth. Visit www.ema.gov.sg for more information.

About Enterprise Singapore

Enterprise Singapore, formerly International Enterprise Singapore and SPRING Singapore, is the government agency championing enterprise development. We work with committed companies to build capabilities, innovate and internationalise. We also support the growth of Singapore as a hub for global trading and startups. As the national standards and accreditation body, we continue to build trust in Singapore's products and services through quality and standards. Visit www.enterprisesg.gov.sg for more information.

ANNEX A

EMA-ENTERPRISE SINGAPORE JOINT GRANT CALL

No.	Description
Solutions to Mitigate Solar Intermittency	
1.	Solar energy is presently the most viable form of renewable energy for Singapore. However, supply can be intermittent as power output fluctuates due to weather and environmental conditions, such as cloud cover and humidity. To promote greater solar take-up, the agencies seek innovative and cost-effective solutions that can i) mitigate solar intermittency; and ii) reduce the associated costs that this imposes on the power system. These could include but not be limited to solutions relating to smart inverter controls and distributed solar-storage controls.
Solutions to Optimise Energy Consumption Through Demand-Side Management	
2.	Electricity use is expected to grow with increasing digitalisation and electrification in everyday life. The agencies therefore seek innovative solutions to reduce energy demand through DSM initiatives and technologies. This can cover technologies in smart meters, Internet of Things, sensors and the use of artificial intelligence. Demand-side Management (DSM) refers to initiatives and technologies that encourage consumers to optimise their energy use. The benefits are potentially two-fold: Firstly, consumers can reduce their electricity bills by adjusting and using less electricity during peak hours when prices are high, and shifting their usage to non-peak hours when prices are lower. Secondly, this can reduce the overall load on the power system during peak hours, ensuring a reliable supply of power.
Grant Call Details	
3.	The Grant Call comes under Enterprise Singapore's Gov-PACT initiative. It aims to provide assistance to SMEs and startups to collaborate and undertake innovative projects initiated by government agencies. This enables companies to develop stronger capabilities and solutions that can potentially be scaled overseas. More information on the Grant Call and application process can be found at https://goo.gl/V78LbR . All proposals must be submitted by 23 November 2018, 12pm (UTC+8).

ANNEX B

ENERGY RESILIENCE PROJECTS

No.	Title	Description	Project Team
Market Resilience – Securing the competitiveness of Singapore's energy markets			
1.	Intelligent Demand Management for Resilient Power Market	**Current situation:** Emerging trends of demand-side management (DSM) initiatives, increased solar photovoltaic (PV) penetration and digitalisation will amplify the complexity of the grid. This would, in turn, cause fluctuations in the prices of wholesale electricity and ancillary services. **Aim:** To develop a DSM solution that can reduce market price spikes and provide distributed reserves to mitigate fluctuations in solar energy generation. This would be integrated into an electricity retail platform using blockchain technology, which could reduce customer costs by 10-20%.	**Principal Investigator:** Dr Zhao Qian, Experimental Power Grid Centre (EPGC) **Co-Investigators:** EPGC, National University of Singapore (NUS), Nanyang Technological University (NTU), Beebryte Pte Ltd, PacificLight Energy Pte Ltd
2.	FogGrid: Transforming Microgrid Operations via Blockchain and Fog Computing to Secure the Competitiveness of Singapore's Energy Market	**Current situation:** Distributed generation sources have become more widespread, sparking interest in how micro-grids can be deployed within the main power grid. Communications and connections between micro-grids and main power grid would need to be enhanced and automated to enable seamless energy and monetary transactions. **Aim:** To establish the world's first blockchain-based micro-grid for commercial buildings, including schools. This will help to standardise technical and market solutions for global adoption and commercialisation.	**Principal Investigator:** Assoc Prof Wen Yonggang, NTU **Co-Investigators:** NTU, Singapore Institute of Technology **Collaborators:** National Chiao Tung University, Guangdong Institute of Technology, Ethereum Foundation, Sembcorp Industries Ltd, SP Centre of Excellence, NVIDIA Technology Centre Asia Pacific

No.	Title	Description	Project Team
Market Resilience – Securing the competitiveness of Singapore's energy markets			
3.	Distributed, Scalable, and Transparent Data Management Framework for Energy Market: A Blockchain Approach	**Current situation:** With the rise of distributed generation, we can expect larger numbers of market participants, new business models and greater complexity to our electricity market. **Aim:** To demonstrate an open ledger technology based on blockchain, which can record transactions between two parties efficiently and in a verifiable and permanent way. This will improve the flexibility, efficiency and scalability of our electricity market operations.	**Principal Investigator:** Prof Dusit Niyato, NTU **Co-Investigators:** NTU, SP Group **Collaborators:** SolarGy Pte Ltd

No.	Title	Description	Project Team
Physical Resilience – Ensuring the resilience, reliability and efficiency of assets across the entire value chain			

4.	Smart Demand-Side Management (Smart-DSM) integration with Energy-efficient Thermal Storage System	**Current situation:** Cold energy from LNG regasification (estimated at about $180 million/year) is presently not being harnessed. **Aim:** To harness LNG's cold energy for district cooling. This will be done through developing novel heat transfer materials that can achieve energy efficiency improvements and space savings for district cooling systems.	**Principal Investigator:** Assoc Prof Chua Kian Jon Ernest, NUS **Co-Investigators:** NUS, Keppel District Heating and Cooling Systems Pte Ltd
5.	Enhancing the Resilience and Reliability of Singapore's LNG/Gas Assets: A Prescriptive Maintenance and Self-Configuring Control Framework using Big Data and Machine Learning	**Current situation:** There are currently limited automated tools for preventive maintenance of equipment and systems in Singapore's gas assets. **Aim:** To develop a digital twin of gas assets to enable better fault detection and diagnosis. If successful, the solution can also be commercialised for other sectors such as the process control and construction industries.	**Principal Investigator:** Prof Iftekhar Karimi, NUS **Co-Investigators:** NUS **Collaborators:** Singapore LNG Corporation Pte Ltd, SP PowerGrid Ltd, Indian Institute of Technology Madras

No.	Title	Description	Project Team
Cyber Resilience – Safeguarding Singapore's power system against external threats			

6.	Enhancing Power System Resilience through Distributed Intelligence and Adaptive Infrastructure	**Current situation:** Our power grid is experiencing greater interconnection with intelligent devices (eg smarter meters). This requires us to deter cybersecurity attacks and enhance the resilience of our infrastructure. **Aim:** To develop a device that can improve our grid's situational awareness and limit the potential impact of cyber-attacks.	**Principal Investigator:** Dr Chen Binbin, Advanced Digital Sciences Centre (ADSC) **Co-Investigators:** ADSC, Institute for Infocomm Research, Mirai Electronics Pte Ltd, Accenture Pte Ltd **Collaborators:** NUS, University of Illinois at Urbana Champaign, Michigan Technological University, Singapore Telecommunications Ltd
7.	AI enabled Cyber Resilience for Power Systems	**Current situation:** Advances in artificial intelligence and machine learning have increased the complexity of cyber-attacks. To better secure our existing power systems, we need to evolve our systems in line with these advances. **Aim:** To develop machine learning techniques and online assessment/ control models that can detect and mitigate active threats and intrusions.	**Principal Investigator:** Prof David Yau, Singapore University of Technology and Design (SUTD) **Co-Investigators:** SUTD **Collaborators:** ST Electronics (Info-Security) Pte Ltd

ANNEX C

FACTSHEET ON INITIATIVE TO DEVELOP POWER ENGINEERING PROFESSIONALS (PEPS) IN THE PUBLIC SERVICE

About the SkillsFuture Earn-And-Learn Programme

The SkillsFuture Earn-and-Learn Programme (ELP) is a work study programme that gives Polytechnic and Institute of Technical Education (ITE) graduates a headstart in careers related to their discipline of study. It provides them with more opportunities, after graduation, to build on the skills and knowledge they acquired in school. It also better supports their transition into the workforce through structured workplace learning, mentorship and facilitated learning.

About the ELP for PEPS

Under the collaboration between EMA, the Public Service Division and SkillsFuture Singapore, the ELP will be extended to Polytechnic and ITE graduates taking up power engineering-related roles in the Public Service. Eligible[2] Polytechnic and ITE graduates will undergo a structured training programme, This will include facilitated learning, on-the-job training and work-based projects in the Public Service. They will also receive a sign-on incentive of $5,000.

This initiative will help to expand the talent pipeline to support the Public Sector's power engineering needs and fill new jobs arising from upcoming development projects and natural attrition. It is part of EMA's expanded mandate to build power engineering capabilities for the Public Service.

What are the Supported ELPs for PEPS?

IHL	**Programme**	**Target Audience**
Institute of Technical Education	Work-Learn Technical Diploma in Mechanical & Electrical Services Supervision	For ITE graduates
Singapore Polytechnic	ELP leading to Part-time Diploma in Engineering (Electrical – Rapid Transit Technology)	
	ELP leading to Part-time Diploma in Engineering (Mechanical – Rapid Transit Technology)	
	ELP leading to Part-time Diploma in Engineering (Control and Automation)	
	ELP leading to Part-time Diploma in Engineering (Power Engineering)	
	Advanced Diploma in Power Engineering	For polytechnic graduates
Ngee Ann Polytechnic	Specialist Diploma in Electrical Design and Operation	
Temasek Polytechnic	Specialist Diploma in Sustainable Energy Management (SIT-TP joint ELP in Building Services)	

[2] For fresh graduates who are Singapore Citizens and within three years of graduation or Operationally Ready Date for male Singaporeans only.

This list is not exhaustive. Any course outside of this list should consist of modules related to the job function of PEPS and will be assessed on a case-by-case basis.

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