MANAGING THE ENERGY TRANSITION

Bernard Nee
Deputy Chief Executive

Energy Market Authority
Smart Energy, Sustainable Future

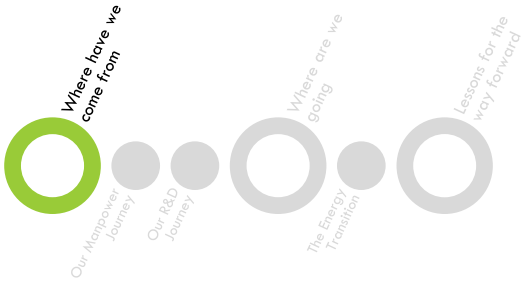
AGENDA

Where have we come from

Where are we going

Lessons for the way forward

WHERE HAVE WE COME FROM



PRE 2010

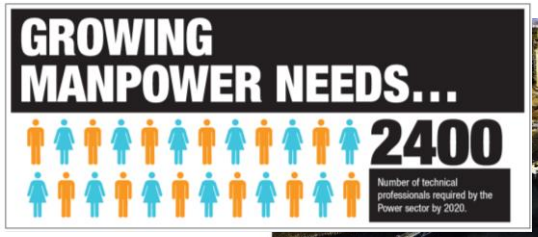
Challenges

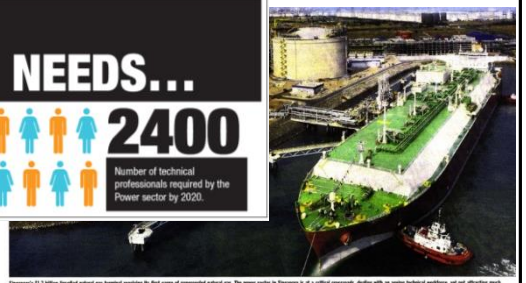
- Industry focus on operations with limited R&D interest
- Power engineering was not a priority in IHLs
- Workforce was aging with median age above 48

Opportunities

- Change was in the air
- Technology and climate change drivers

THE BEGINNING OF OUR MANPOWER JOURNEY…





Countering the age outage

Power sector on high-voltage drive to attract workers

By GRACE CHUA

吸引更多新血加入

电力人力资源工作小组提三建议

SPgroup

SIPG to lead sector wide training

*"I believe this degree will give my career a jumpstart because of **how specific and industry-focused it is.**"* – Ms. Asher Liao,, EPE degree programme graduate

SIT-Newcastle on Power Engineering

Singapore-Industry Scholarship SgIS

ENERGY INDUSTRY SCHOLARSHIP POWERING YOUR FUTURE

Scholarships for students at ITE, Polytechnics and University

Ministry of Education SINGAPORE

NGEE ANN POLYTECHNIC

Incorporating energy issues into the curriculum

Learning journeys to help students and educators

POWER SECTOR MANPOWER TASKFORCE

- EMA formed an industry-led Power Sector Manpower Taskforce in 2012 to recommend how to attract, retain and develop a strong Singaporean-core workforce for the Power Sector.

- Three key recommendations were submitted:
  - Establish an attraction, retention and development framework.
  - Launch a sector-wide branding exercise.
  - Adopt a coordinated approach to drive manpower efforts.

Panel addresses power sector's manpower woes

Task force makes 3 recommendations, with boost from LNG supplies coming soon

By **RONNIE LIM**

THE task force set up the Energy Market Authority (EMA) last March to address the power sector's manpower issues has come up with three key recommendations.

Designed to alleviate the shortage of technical professionals in an industry also hobbled by an ageing workforce, the recommendations call for:

◆ Setting up a comprehensive set of initiatives to attract, retain and develop skilled manpower;

◆ Launching a branding exercise to raise awareness of the career opportunities in the industry; and

◆ Taking a coordinated approach in driving manpower efforts, such as by setting up a centralised training institute.

Such moves will be needed to tackle the critical manpower crunch in the fast-growing power sector here, said Minister in the Prime Minister's Office S Iswaran yesterday.

The issue is urgent, he said, given that the liquefied natural gas (LNG) supplies coming in the second quarter have already triggered the building of new power stations; these will produce over 2,000 megawatts more power, or about 20 per cent more than the current installed capacity, which is slated to come on-stream in the next few years.

Good prospects: *The task force's recommended sector-wide branding exercise, said the minister, would raise awareness, especially among young Singaporeans, of career opportunities in the power sector.* PHOTO: BLOOMBERG

"There are also other growth opportunities arising from smart-energy technologies, energy efficiency and energy-demand management," added the minister, who is also Second Minister for Home Affairs and for Trade & Industry.

He was speaking at the launch of the 2012 Singapore edition of *The Oil & Gas Year*, a series of annual publications featuring country-by-country interviews with the key players of the international energy industry.

The Power Sector Manpower Taskforce (PSMT) – made up of representatives from the industry, unions, government and institutions of higher learning – had its work cut out for it.

Apart from the power sector workforce having more than four in 10 employees in technical areas nearing retirement in the coming decade, the industry will be needing 2,400 additional technical professionals.

Of the task force's call for a comprehensive set of initiatives to attract, retain and develop skilled manpower, Mr Iswaran said these could include mapping out career progress pathways and training programmes for workers, and offering scholarships and internships to students pursuing courses in the field.

"The PSMT has assessed that such initiatives are critical in encouraging workers to pursue and eventually carve out meaningful careers for themselves within the sector," he said.

The sector-wide branding exercise, he said, would raise awareness, especially among young Singaporeans, of the career opportunities in the power sector.

The task force had said that one way to achieve a better alignment of manpower development initiatives across the sector was to set up a Centralised Training Institute (CTI) as a one-stop centre.

Mr Iswaran said EMA will work with the industry and other stakeholders to implement the recommendations.

He added that the recommendations could be relevant also to other sectors, such as petrochemicals and oil & gas: "The challenges of a tighter labour market and a more mobile workforce are common (among these industries), and building greater skills and capacity in our workforce is the way forward."

At yesterday's launch of the inaugural *The Oil and Gas Year*, the minister was named "Man of the Year" by the publication.

SINGAPORE INSTITUTE OF POWER AND GAS

As a recommendation under the PSMT, Singapore Institute of Power and Gas (SIPG) was established in 2014 as a one-stop training and development centre for the power sector.

EMA supported SIPG for development of 5 power generation courses with Energy Training Fund, and facilitated SIPG's $3 million grant application for 36 courses to WDA in 2016.

SIT-NU ELECTRICAL POWER ENGINEERING PROGRAMME

SIT OFFERS S'PORE'S 1ST DEGREE IN ELECTRICAL POWER ENGINEERING

The Singapore Institute of Technology (SIT) and Newcastle University (NU), UK, signed an agreement to offer Singapore's first undergraduate degree in Electrical Power Engineering. NU was one of SIT's pioneer partner universities when the latter first

Since 2012, EMA has collaborated with SIT on manpower development and R&D.

SIT runs Singapore's only dedicated Electrical Power Engineering (EPE) Undergraduate EPE Degree programme, and differentiates from other IHLs with its focus on theoretically-grounded and practice-oriented skills that are relevant to the industry, giving its students strong operational experiences.

A workforce with such competencies will be strongly needed in the near future.

More recently, SIT started the EPE MEngTech programme, designed to equip graduates and professionals for a career in the power sector.

POWERING LIVES TRAILS

- Launched in 2016, the PLTs offers unprecedented access to secure sites allowing participants to experience real-world applications of science and engineering concepts.
- Benefited more than 800 students and educators since inception.
- The 5 learning sites represent different aspects at each segment of the Power sector value chain (i.e. Power System Operations Division, Pulau Ubin Micro-grid Test-bed, Sembcorp Cogen @ Banyan, SLNG Terminal and Singapore District Cooling).

ENERGY INDUSTRY SCHOLARSHIP AND SINGAPORE-INDUSTRY SCHOLARSHIP

- Scholarships help to build a pipeline of talent into the sector targeted at the various educational levels (from ITE, Polytechnic and University).
- In 2018, EMA worked with the industry to award 4 EIS and 5 SgIS to students pursuing energy-related courses at the polytechnics and universities.
- To-date, the industry has awarded a total of about 60 scholarships.

Four awarded new scholarship dedicated to energy industry

By CAROLYN KHEW

THE first government-industry scholarship dedicated to the power sector has been awarded to four tertiary students.

Mr S. Iswaran, Minister in the Prime Minister's Office, gave out the scholarship awards yesterday at the In Dialogue With Youth forum, which was part of the Singapore International Energy Week and attended by more than 300 students.

The Energy-Industry Scholarship was launched in January to help nurture talent for the sector, which was reported last year to have workers with a median age of 48. The industry would need 2,400 more technical professionals in the next decade, the Energy Market Authority (EMA) had said.

Open to Singaporeans and permanent residents, the scholarship covers hostel and tuition fees, and provides a monthly allowance.

This year's recipients will join Singapore LNG Corporation, Singapore Power and YTL PowerSeraya once they graduate.

To keep the energy sector competitive, there must be good people joining the sector at different levels, said Mr Iswaran, who is also Second Minister for Home Affairs and Trade and Industry.

Singapore Polytechnic student Noor Nashriyah Jalil, 19, is one of the scholarship winners and is studying for a diploma in electrical and electronic engineering.

"Engineering has always been a 'man's field'. I hope to prove to myself and society that woman can do the job just as well, if not better," she said.

The other recipients are National University of Singapore undergraduate Tay Wei Jia, 23, Institute of Technical Education College West student Muhammad Rafiuddin Samsudien, 17, and Singapore Polytechnic student Teo Wen Xuan, 18.

The next scholarship application period starts in December.

Seven companies in the sector, including Sembcorp Industries and Keppel Infrastructure Holdings, will come on board.

Yesterday, Singapore Power and EMA also unveiled initiatives, including a mobile exhibition and a short film contest, to reach out to 10,000 primary and secondary school students from next year.

✉ kcarolyn@sph.com.sg

Energy-Industry Scholarship recipients (from left) Tay Wei Jia, Teo Wen Xuan, Noor Nashriyah Jalil and Muhammad Rafiuddin Samsudien. The scholarship, which is open to Singaporeans and permanent residents, was launched in January to help nurture talent for the sector. ST PHOTO: DESMOND LIM

SINGAPORE ENERGY AWARD (SEA)

A biennial award that aims to recognise significant contributions to Singapore's energy sector in the areas of capabilities development and / or innovation.

Individual Category – Mr Quek Poh Huat, Senior Adviser, Singapore Power Ltd

Organisation Category – Senoko Energy Pte Ltd

Special Mention Award – Energy Carta

… AND MILESTONES OVER THE LAST 9 YEARS.

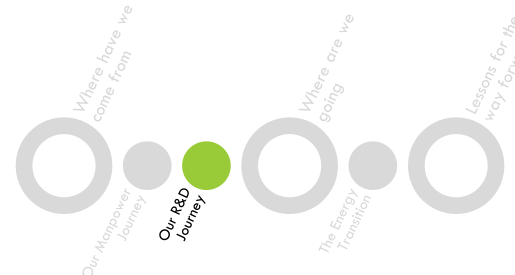
>50 ELP students, >60 scholarships, 40 PCPs, 38 Study Award recipients, 19 Energy Managers in Power engineering.

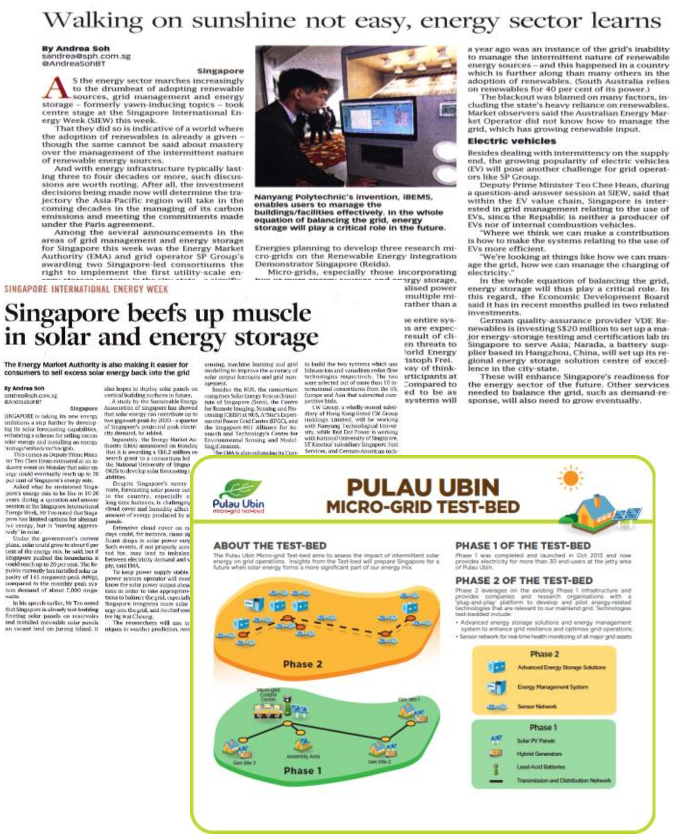
Supports power engineering demand within and beyond the power sector.

Median age of the sector is now at 40, below national median of 43.

Outreach and recognition efforts, such as Youth@SIEW, Singapore Energy Award and Sembcorp-EMA Energy Challenge.

THE BEGINNING OF OUR R&D JOURNEY…





Walking on sunshine not easy, energy sector learns

By Andrea Soh

Nanyang Polytechnic's invention, iBEMS, enables users to manage the buildings/facilities effectively. In the whole equation of balancing the grid, energy storage will play a critical role in the future.

Electric vehicles

SINGAPORE INTERNATIONAL ENERGY WEEK

Singapore beefs up muscle in solar and energy storage

The Energy Market Authority is also making it easier for consumers to sell excess solar energy back into the grid

PULAU UBIN MICRO-GRID TEST-BED

ABOUT THE TEST-BED

PHASE 1 OF THE TEST-BED

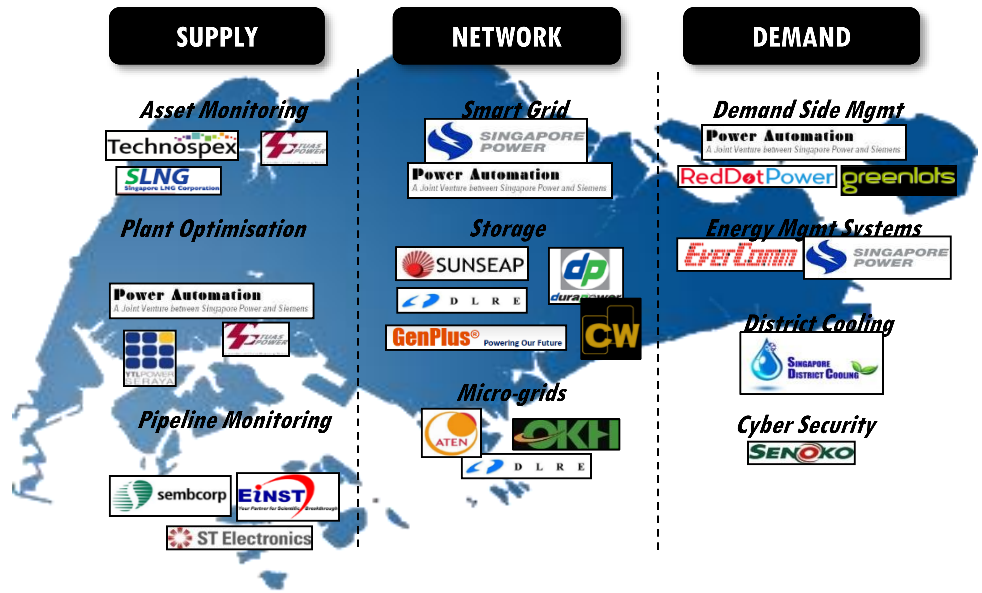
PHASE 2 OF THE TEST-BED

Phase 2

Phase 1

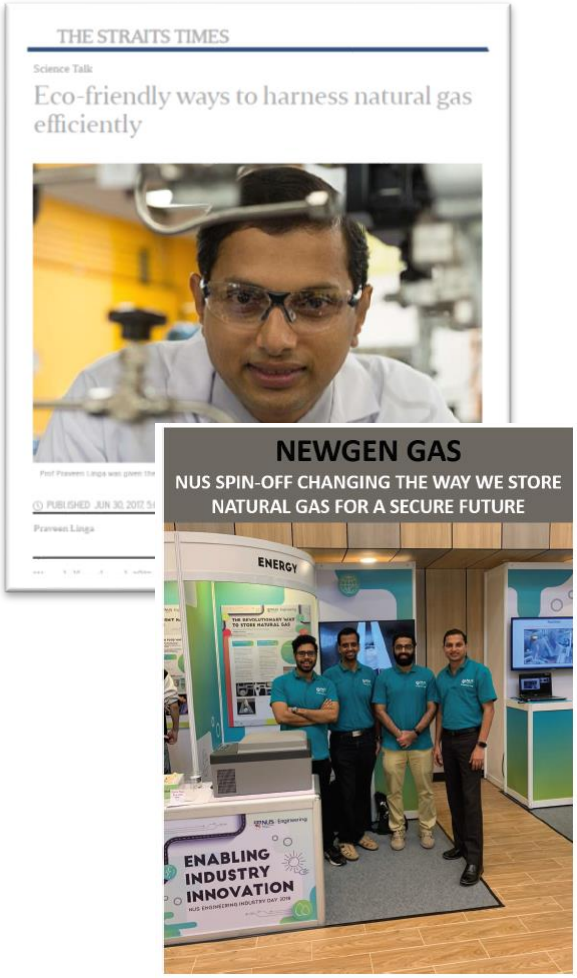
R&D to meet national needs and economic spin-offs for economy - Guided by make-or-buy decisions to meet unique local operating conditions.

Examples of R&D investments include Grant Calls aimed at strengthening power systems as well as test-bed for near-to-market energy technologies.



EMA has partnered with a few large and sophisticated users and supporting more energy start-ups and non-power companies in their commercialisation push.

A COST EFFECTIVE SOLIDIFIED NATURAL GAS (SNG) TECHNOLOGY FOR ENERGY STORAGE TO STRENGTHEN ENERGY RESILIENCE IN SINGAPORE



Prof Praveen Linga's project under the Energy Storage Grant Call aims to convert natural gas into a solidified form for ease of storage and transport could halve the cost of storing natural gas from current levels.

Newgen Gas is a spin-off company from the project. It incubated under NUS GRIP accelerator program and secured seed funding up to $100,000. Currently seeking strategic and industrial partners for pilot testing of the technology.

New Gen GAS

ULTRAFAST CHARGING, LONG LIFE AND COST-EFFECTIVE LITHIUM ION BATTERIES FOR STATIONARY ENERGY STORAGE


เบตาเอ็นเนอร์ยี โซลูชัน ซื้อเทคโนโลยี
ผลิตแหล่งกักเก็บพลังงานไฟฟ้าขั้นสูงจากสิงคโปร์

NEW RESOURCES TECHNOLOGY

durapower

A project under the Energy Storage Grant Call, NTU developed a class of batteries with cheaper anodes, faster charging capability, higher energy density and five-times improved cycle life vis-à-vis existing graphite-based lithium-ion batteries. Solution also factored in Singapore's hot and humid climate and dense urban population.

Durapower (subsidiary of New Resources Technology, a collaborator under the project) leveraged it as reference case and signed a Manufacturing License Agreement to be the first lithium ion battery manufacturer in Thailand.

TOWARDS GREEN DATA CENTRE AS AN INTERRUPTIBLE LOAD FOR GRID STABILIZATION IN SINGAPORE

Prof Wen Yonggang's project under the 1st Smart Grid Grant Call won the Gold Award (R&D category) at the ASEAN ICT Awards 2016, and licensed the technologies to two successful start-ups: EverComm and Red Dot Analytics (RDA). EverComm has helped its clients accumulate over US$4.3m in energy savings, while RDA has signed commercial deals with major local banks and global data centre operators (including Alibaba) to reduce their energy consumption.

EverComm's founder, Ted Chen, has also been named in a "30 under 30s" list of young tech entrepreneurs to watch.

EverComm

Red Dot Analytics

SELF-REGULATING INTEGRATED ELECTRICITY-COOLING NETWORKS

本地成功研发供冷系统 具有效发挥能源储存功能

卓彦薇 报道
tohyw@sph.com.sg

成本高昂的能源储存科技被视为发展再生能源的绊脚石，本地区域供冷系统企业利用现有设备结合锂离子电池"四两拨千金"，料可省下大笔能源储存建设费用，有望协助我国在2020年后达到一千兆瓦峰值太阳能用量的目标。

全世界其中一个最大的地底"冷库"，也就是区域供冷系统网络（District Cooling System）隐身在滨海湾，它利用大型制冷机冷却水后，输送给该区域内的大楼以降低室内温度，自2006年运转以来已达到40%的节能效率。

新加坡能源集团属下的新加坡供冷有限公司（Singapore District Cooling）负责设计、建造和营运这座地底"冷库"，也负责操作全球其中一个最大的蓄热系统。

区域供冷系统网络的制冷机在用电量的非尖峰时段如夜晚将水冷却后，会以冰块形态储存在蓄热系统的"冰窖"（ice tank）中，在需要用到时把冰块融化为冷水输送出去。

本报记者昨天深入地底，参观滨海湾地下五层楼的五个"冰窖"，每个冰窖的体积相等于五分之三个奥林匹克游泳池，可取代制冷机八个小时的冷却水作业，期间可省下1.5兆瓦用电量，其功能类似能源储存系统。

开始试验利用锂离子电池

不过，把蓄热系统转换为能源储存系统的挑战在于，完全关闭制冷机需要10至15分钟，但蓄热系统却无法快速产电，这会导致电流供应不稳定。新加坡供冷有限公司和新加坡科技研究局（A*Star）在2016年获得能源市场管理局的征集计划书活动资助，开始试验利用锂离子电池补足蓄热系统启动前的电流供应，以解决电力供应不稳定问题。

经过约两年的试验，两个机构成功利用锂离子电池证明这个概念，并于今年4月正式投入运作。

锂离子电池是其中一种能源储存方式，尽管近年来价格已不断下跌，但依旧不符合能源成本，若要为区域供冷等大型系统储存能源，成本多达千万元。彭博新能源财经数据显示，去年的锂离子电池价格为每千瓦时（kWh）美金176元，对比新能源本季的住家电费每千瓦时新元22.79分，差距可谓天渊之别。

尽管锂离子电池的价格高昂，但这个系统只在制冷机关闭和蓄热系统启动期间启用（也就是那10至15分钟），相信不会对成本造成太大影响。

新加坡供冷有限公司总裁邱秀金指出，解决问题的关键在于找到能够快速反应的能源系统，而团队离子电说："电池系化为能

A project under the 2nd Smart Grid Grant Call by I²R and Singapore District Cooling (SDC), a novel hybrid ESS by coupling a 400kW / 400kWh Lithium-ion battery with thermal energy storage (i.e. ice tanks), resulting integrated electricity-cooling network that is able to lower the electricity costs of producing chilled water by up to 38%, and provide grid ancillary services such as frequency regulation that contribute to grid stability.

It was recently awarded the Minister for National Development's R&D Awards 2019: Merit Award, and featured in Lianhe Zhaobao.

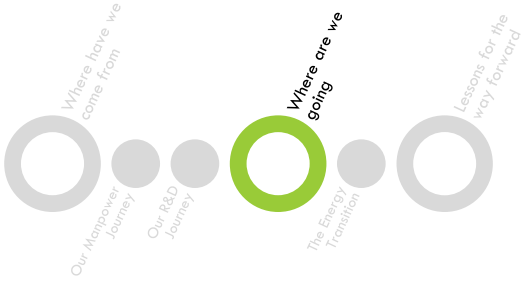
. . . AND MILESTONES OVER THE LAST 9 YEARS.

Partnered with a few large and sophisticated users.

Saw new, promising SMEs and spin-offs over the last five years.

Made significant pushes towards “enterprise development” to better capture value from our past efforts in R&D and test-beds.

Beyond R&D, leverage policies and regulations to innovate in areas such as regulatory sandboxes.



WHERE WE ARE GOING

SINGAPORE IS COMMITTED TO FIGHT CLIMATE CHANGE…

THE STRAITS TIMES

Singapore ratifies Paris Agreement

Singapore pours $10m into research of rising sea levels

Chang Ai-Lien
Science Editor

There is nowhere to run if Singapore is hit by a severe rise in sea levels, and this is among the most pressing issues facing the Republic, say climate scientists.

So, researchers across the island are banding together to figure out exactly how the country will be affected – based on sound science – to work out the best solutions.

"This is the future of the nation we are talking about," said Professor Benjamin Horton, chair of the Asian School of the Environment at Nanyang Technological University, pointing out that rising sea levels have widespread implications, ranging from flooding to salination of water resources.

He is among the experts who could be part of a $10 million National Sea Level Research Programme that will be launched to boost the understanding of sea levels around Singapore and develop more robust projections of rising sea levels.

To do so, scientists will have to delve into a complex, multi-disciplinary and rapidly evolving field involving many areas of expertise. These would range from storm surges and ice-sheet dynamics, to circulation and thermal expansion

PHOTO: MINISTRY OF THE ENVIRONMENT AND WATER RESOURCES

barrages to prevent flooding, to even floating parts of the city.

Minister for the Environment and Water Resources Masagos Zulkifli, who announced the programme yesterday, said: "Cli science, where it is devel specifically for the tropics, is a and complex area of research.

"Much more work needs t done. I am glad we are takin initiative to lead."

He also announced that a nev mate Science Research Progra

TAKING THE LEAD

Climate science, where it is developed specifically for the tropics, is a new and complex

The office will focus on five key areas: sea level rise, the impact of climate change on water resources and flood management, the impact of warming trends on human

35 scientists, is also expanding.

The urgency of the environmental challenges cannot be overstated, said Mr Masagos, speaking at the Partners for the Environment Forum at Marina Bay Sands.

Based on today's science, climate scientists here have projected that mean sea levels could rise by up to around 1m by 2100, he said. This could happen even earlier or sea levels could go even higher if ice sheets melted more rapidly and ice shelves in Antarctica collapsed.

And if high mean sea levels, high tide and high surge all happened at the same time, sea levels could reach almost 4m above current mean sea levels and overwhelm low-lying coastal areas.

Even worse, if a tropical storm happens at sea, sending surge waters to Singapore that it cannot keep out, while in tandem a heavy rainstorm occurs inland, bringing with it rainwater that cannot be drained away, these could be the ingredients of a perfect storm, said Mr Masagos.

DOING OUR PART

Singapore needs to do our part by further reducing our greenhouse gas emissions and embarking on a transition to a low-carbon future.

NATIONAL CLIMATE CHANGE SECRETARIAT, in a statement.

Feedback sought on how Singapore can move towards low-carbon future

Clara Chong

A public consultation exercise was launched by the National Climate Change Secretariat yesterday to seek feedback on measures that can be taken to contribute towards Singapore's long-term low carbon emissions strategy. The consultation ends on Aug 30.

These measures would be actions that the Government, businesses, households and individuals can take.

Some key areas the exercise is seeking views on include improving energy efficiency, encouraging responsible climate action through carbon pricing, reducing emissions from power generation, tapping alternative energy sources and using low-carbon technologies.

The long-term low emissions strategy builds on Singapore's ongoing efforts to achieve its pledge under the Paris Agreement.

Singapore has committed under the agreement to reduce its emissions intensity by 36 per cent from 2005 levels by 2030, and stabilise emissions with the aim of peaking around 2030.

As a small low-lying city, Singapore is especially vulnerable to the effects of climate change, such as rising sea levels, changing rainfall patterns and rising temperatures, said the National Climate Change Secretariat in a statement yesterday.

These effects can affect the health of people, Singapore's water supply and biodiversity, among other things.

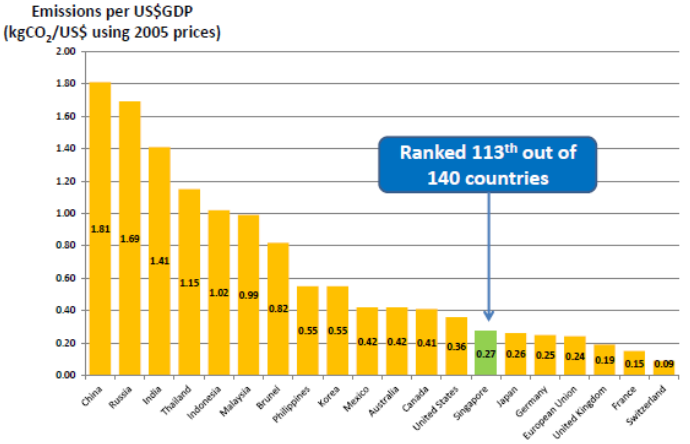
"Singapore needs to do our part by further reducing our greenhouse gas emissions and embarking on a transition to a low-carbon future", said the secretariat.

chongcjy@sph.com.sg

• The public can view the consultation papers at www.reach.gov.sg or www.nccs.gov.sg and submit any feedback or views to nccs_contact@pmo.gov.sg

International Comparison of Emissions Intensity

Singapore ranks favourably amongst the lowest 20% in the world



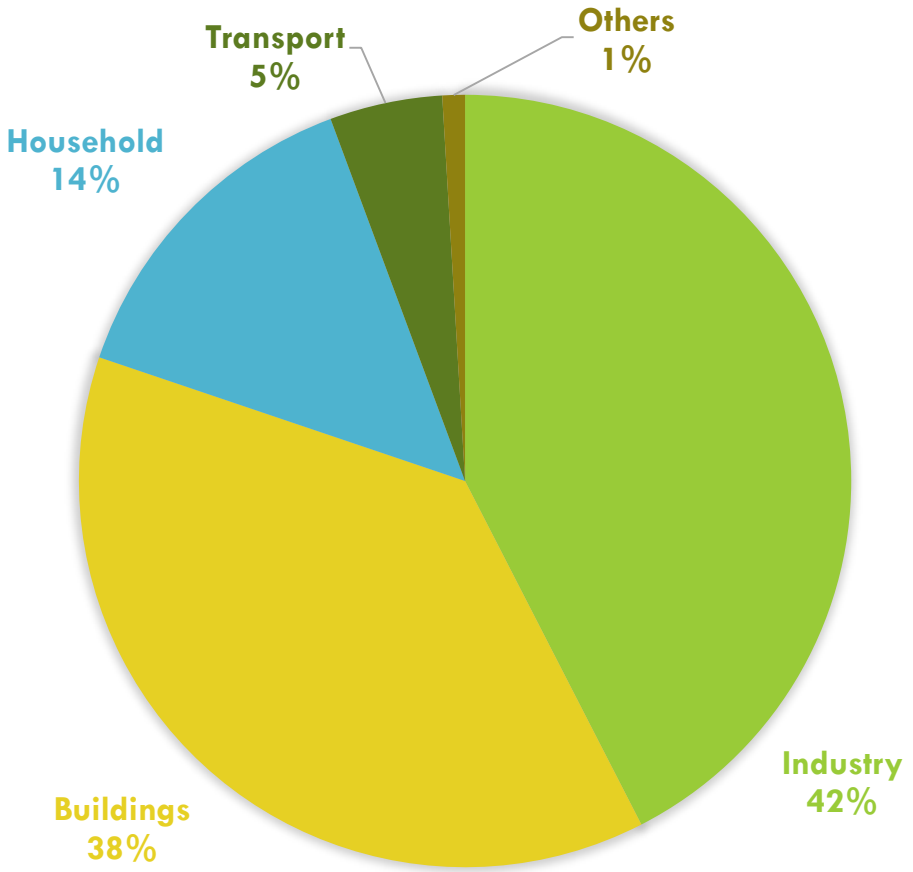
*Source: IEA Key World Energy Statistics, 2014. Comparisons based on available carbon emissions per US$GDP data.

… AND THE POWER SECTOR IS A KEY NEEDLE MOVER IN REDUCING EMISSIONS.

About 95% of Singapore's electricity is currently generated using natural gas, with about 3% from solar.

This is up from just 26% back in 2001, when oil was the dominant fuel.

Emissions arising from use of electricity is the greatest in industry sector, followed by buildings.



3 PRIORITIES

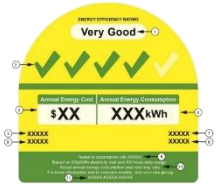
Minimise demand

Maximise clean energy supply

Maintain grid stability

Do this while keeping energy cost competitive and growing the sector.

MINIMISE DEMAND - DEMAND REDUCTION



Industry

- Mandatory energy management practices under Energy Conservation Act (ECA)
- Energy Efficiency Fund (E2F)

Buildings

- Zero/ Super low energy buildings
- Green Mark Incentive Schemes

Households

- Mandatory Energy Labelling Scheme
- Smart metering

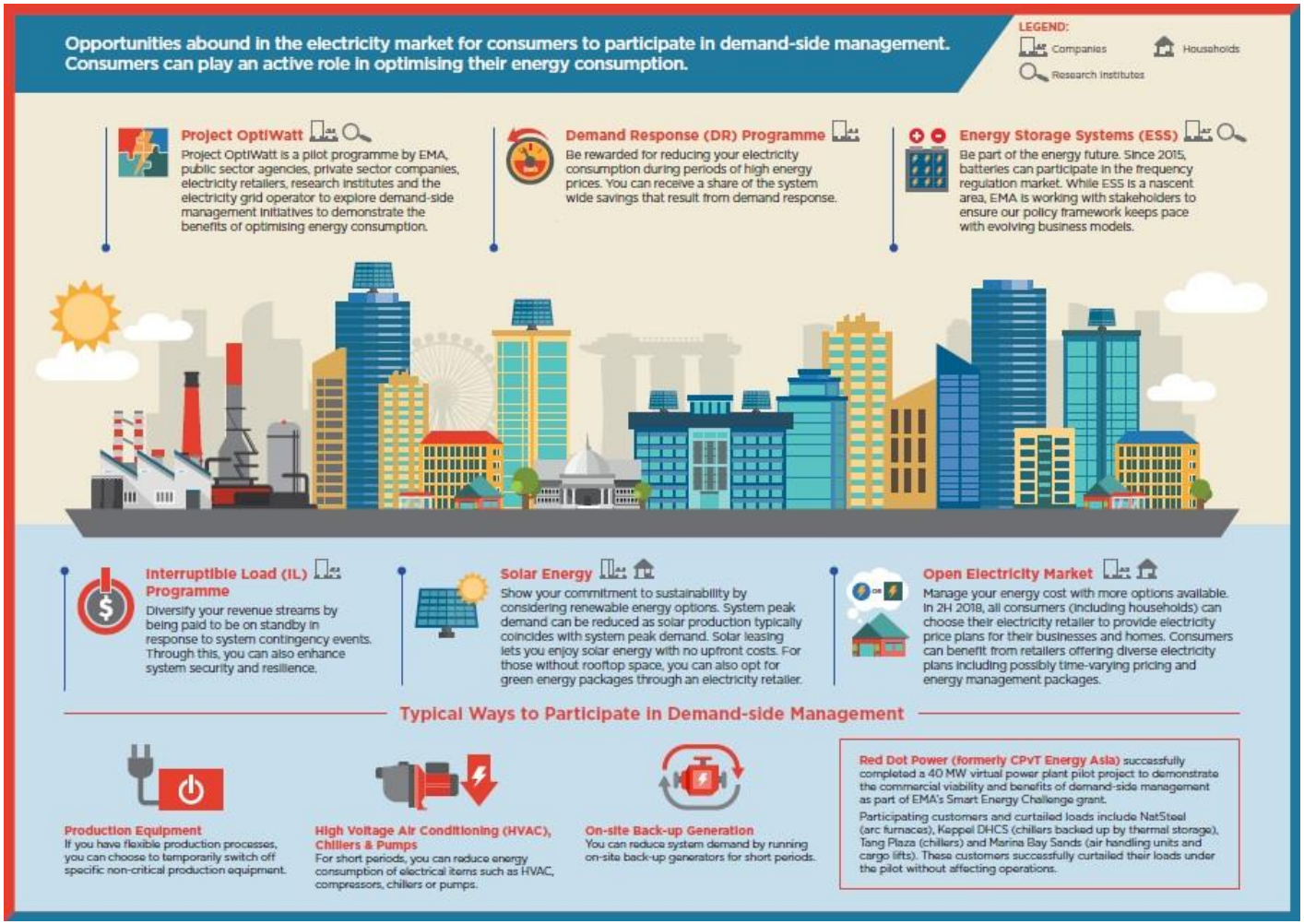
Power Sector

- Power plants digitise for higher operational efficiency
- Genco EE Grant calls

Government Sector

- Public Sector Taking the Lead in Environmental Sustainability (PSTLES)

MINIMISE DEMAND - DEMAND SIDE MANAGEMENT

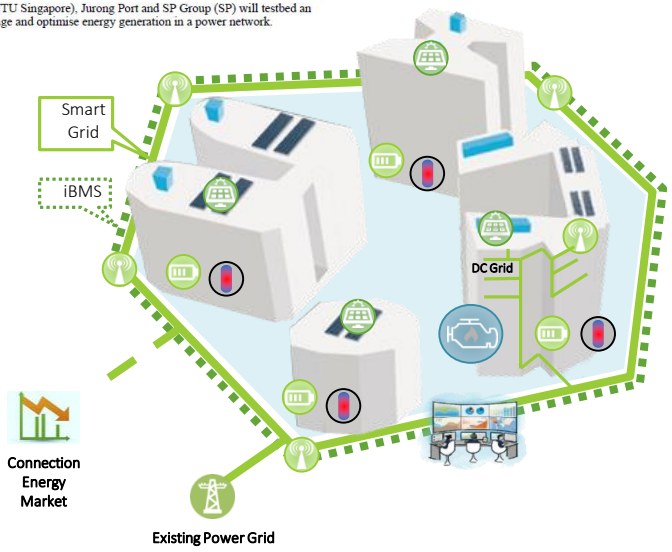


MINIMISE DEMAND - SMART, MULTI-ENERGY DISTRICTS

NTU, Jurong Port and SP Group to testbed AI-powered energy management system

Published on: 28-Sep-2018

Nanyang Technological University, Singapore (NTU Singapore), Jurong Port and SP Group (SP) will testbed an artificial intelligence (AI) software that can manage and optimise energy generation in a power network.



MAXIMISE CLEAN ENERGY SUPPLY - SHORT TERM

Maximise Solar

- Right pricing
- Regulation Reduction
- Raising Demand
- Research and Development
  - More Efficient Panels
  - Innovative Deployment e.g. reservoirs
  - Managing System Impact through ESS and Solar Forecasting

MAXIMISE CLEAN ENERGY SUPPLY - SOLAR FORECASTING

New consortium to build customised forecasting model that is key to stable national power grid

$6.2m grant to better predict solar power needs

JOSE HONG, THE STRAITS TIMES

The Energy Market Authority (EMA) has awarded a $6.2 million research grant to a consortium to improve Singapore's abilities to forecast the amount of solar power it generates.

This will allow the authorities to better plan for the demand and supply of electricity in the national grid.

The launch of the consortium, led by the National University of Singapore, was an-

more reliant on solar power, said EMA. This form of energy fluctuates on a daily basis, much like wind power.

At the event held at the Sands Expo and Convention Centre, Ms Sim also announced the launch of $17.8 million in grants to build a test bed to develop energy storage capabilities. Two consortiums led by CW Group and Red Dot Power will set up the Energy Storage System.

EMA, which awarded the grants with SP Group, said en-

an installed capacity of up to 10MW of their own energy will be able to sell the excess directly back into the grid without having to register as a market participant.

Currently, consumers with an installed capacity of more than 1MW have to register as a market participant.

The first residents to benefit from this will be in Jurong, as they will have access to the Open Electricity Market, which allows them to pick from multi-

nate inter-ministerial efforts towards the country's long-term energy goals.

He said Singapore needs to focus on solar energy because its geography prevents it from effectively using other forms of renewable energy such as wind and water.

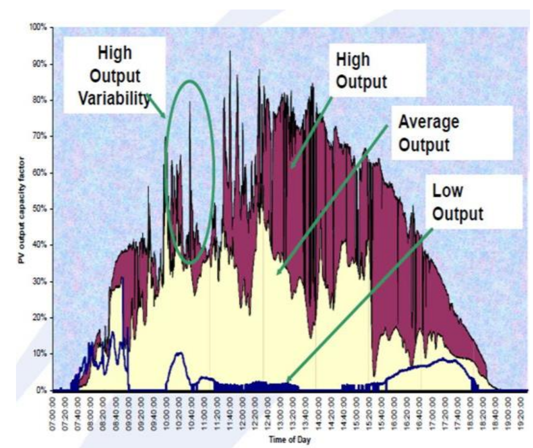
Nanyang Technological University's Energy Research Institute executive director, Professor Subodh Mhaisalkar, said the energy storage and solar forecasting initiatives are essential

Helping it build the grid is SP Group, which manages the national grid.

The micro-grid will use multiple types of renewable energy and will eventually make the entire campus emission-free, said Mr Brandon Chia, head of SP Group's centre of excellence.

Aside from being able to disconnect from the national grid, the micro-grid could also provide energy to it if needed, Mr Chia said.

SIT engineering professor



MAXIMISE CLEAN ENERGY SUPPLY - LONG TERM

Carbon capture

Hydrogen

Imports

MAINTAIN GRID STABILITY

Energy Storage Systems (ESS)

Data-driven Asset Management

Cybersecurity

MAINTAIN GRID STABILITY - ENERGY STORAGE SYSTEMS

SINGAPORE INTERNATIONAL ENERGY WEEK

Singapore beefs up muscle in solar and energy storage

The Energy Market Authority is also making it easier for consumers to sell excess solar energy back into the grid

By Andrea Soh
sandrea@sph.com.sg
@AndreaSohBT

Singapore

SINGAPORE is taking its new energy ambitions a step further by developing its solar forecasting capabilities, enhancing a scheme for selling excess solar energy and installing an energy storage system on the grid.

This comes as Deputy Prime Minister Teo Chee Hean estimated at an industry event on Monday that solar energy could eventually reach up to 20 per cent of Singapore's energy mix.

Asked what he envisioned Singapore's energy mix to be like in 10-20 years during a question-and-answer session at the Singapore International Energy Week, Mr Teo noted that Singapore also hopes to deploy solar panels on vertical building surfaces in future.

A study by the Sustainable Energy Association of Singapore has showed that solar energy can contribute up to two gigawatt-peak by 2020 – a quarter of Singapore's projected peak electricity demand, he added.

Separately, the Energy Market Authority (EMA) announced on Monday that it is awarding a S$6.2 million research grant to a consortium led by the National University of Singapore (NUS) to develop solar forecasting capabilities.

Despite Singapore's sunny climate, forecasting solar power output in the country, especially over long time horizons, is challenging as cloud cover and humidity affect the amount of energy produced by solar sensing, machine learning and grid modelling to improve the accuracy of solar output forecasts and grid management.

Besides the NUS, the consortium comprises Solar Energy Research Institute of Singapore (Seris), the Centre for Remote Imaging, Sensing and Processing (CRISP) at NUS, A*Star's Experimental Power Grid Centre (EPGC), and the Singapore-MIT Alliance for Research and Technology's Centre for Environmental Sensing and Modelling (Censam).

The EMA is also enhancing its Central Intermediary Scheme, under which consumers sell excess solar output into the wholesale energy market. While consumers generating over one megawatt now need to register as a market participant with the Energy Market Company to do so, this cap will be raised to 10 megawatts. With the enhancement, about 10 installations with inverter capacity between

to build the two systems which use lithium-ion and vanadium redox flow technologies respectively. The two were selected out of more than 10 international consortiums from the US, Europe and Asia that submitted competitive bids.

CW Group, a wholly-owned subsidiary of Hong Kong-listed CW Group Holdings Limited, will be working with Nanyang Technological University, while Red Dot Power is working with National University of Singapore, ST Kinetics' subsidiary Singapore Test Services, and German-American technology company Younicos.

The test bed is expected to be operational for three years at two substation locations in the north and north-eastern part of Singapore. They will have a total capacity of 4.4 megawatt-hour, which could power more than 330 four-room HDB flats for a day.

The two technologies will be evalu-

MAINTAIN GRID STABILITY - DATA-DRIVEN ASSET MANAGEMENT

Supply

TUAS POWER
A member of China Huaneng Group
YOKOGAWA

Improving Tembusu Multi-Utilities Complex Cogeneration Plant Reliability and Availability

Grid

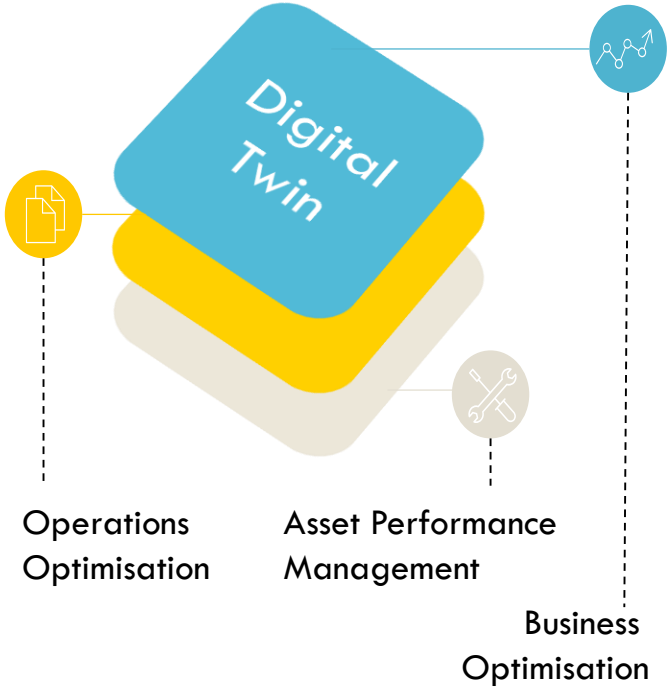
SPgroup
ST Engineering

Developing A Fibre Optic Sensing Solution For Gas Pipeline Monitoring

Consumer

A*STAR Institute for Infocomm Research
MiRai

Securing Last-Mile Communication Systems for Smart Grids



Today

Tomorrow

MAINTAIN GRID STABILITY - CYBERSECURITY

$16m funding for projects to boost Singapore's cyber-security R&D

PUBLISHED SEP 19, 2017, 5:00 AM SGT

Lester Hio (mailto:lesterh@sph.com.sg)

SUTD SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

iTrust Centre for Research in Cyber Security

Electric Power and Intelligent Control (EPIC) Testbed

NATIONAL RESEARCH FOUNDATION
PRIME MINISTER'S OFFICE
SINGAPORE

National Cybersecurity R&D Programme

The National Cybersecurity R&D Programme (NCR) seeks to develop R&D expertise and capabilities in cybersecurity for Singapore. It aims to improve the trustworthiness of cyber infrastructures with an emphasis on security, reliability, resiliency and usability.

NCR is coordinated by National Research Foundation Singapore (NRF), National Security Coordination Secretariat, Cyber Security Agency of Singapore, Ministry of Home Affairs, Ministry of Defence, Government Technology Agency, Info-communications Media Development Authority (IMDA) and Economic Development Board to promote collaboration among government agencies, academia, research institutes and private sector organisations.

Launched in 2013, the NCR was supported at $130 million over five years. The funding supports

CSA SINGAPORE

Co-innovation and Development Proof-of-Concept Funding Scheme

Calling all cybersecurity solution providers.

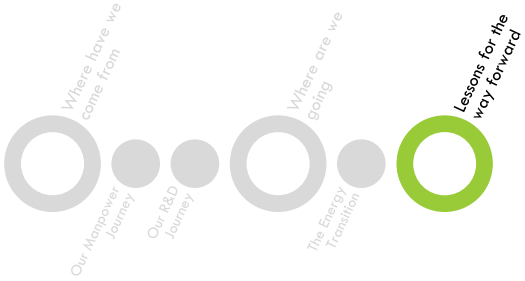
The Cybersecurity Industry Call for Innovation brings together end-users and solution providers to co-innovate on pressing cybersecurity challenges. Potential solutions to these challenges can be developed into the Proof-of-Concept (POC) or Pilots for established organisations.

Click here for more information.

Programme Description

The Co-Innovation and Development Proof-of-Concept Funding Scheme supports the co-development of innovative cybersecurity solutions between solution providers and committed cybersecurity end-users. Through the scheme, CSA provides funding support of up to a maximum of $500,000, for up to 12 months.

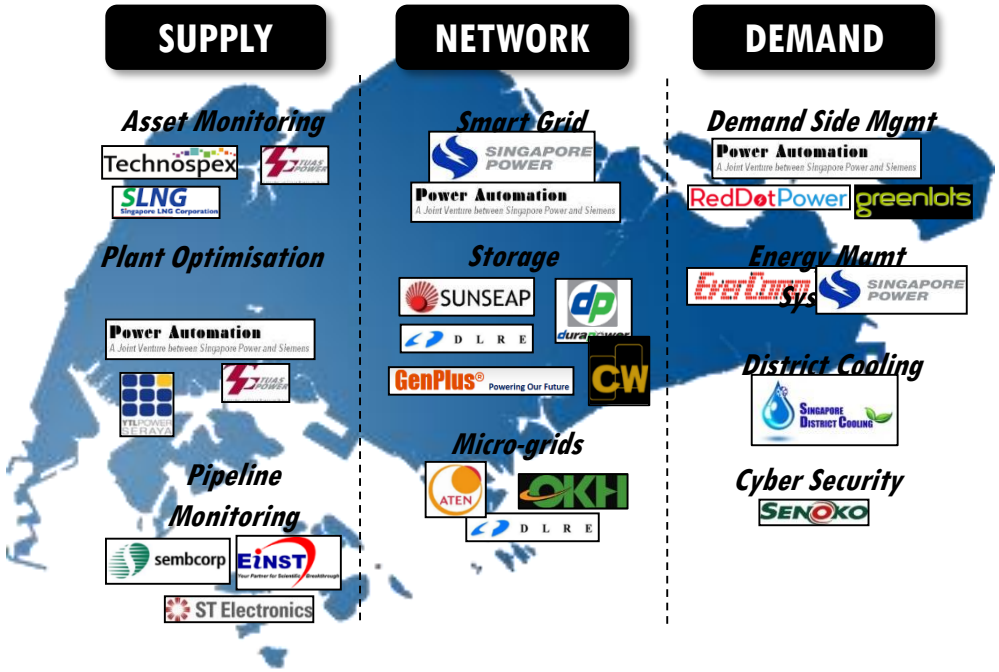
The scheme aims to catalyse the development of innovative cybersecurity solutions that would meet national cybersecurity and strategic needs, with potential for commercial application. Download the info kit here [408 KB].



10 LESSONS FOR THE WAY FORWARD

1. IS THERE A PROBLEM?

Industry partner as end user



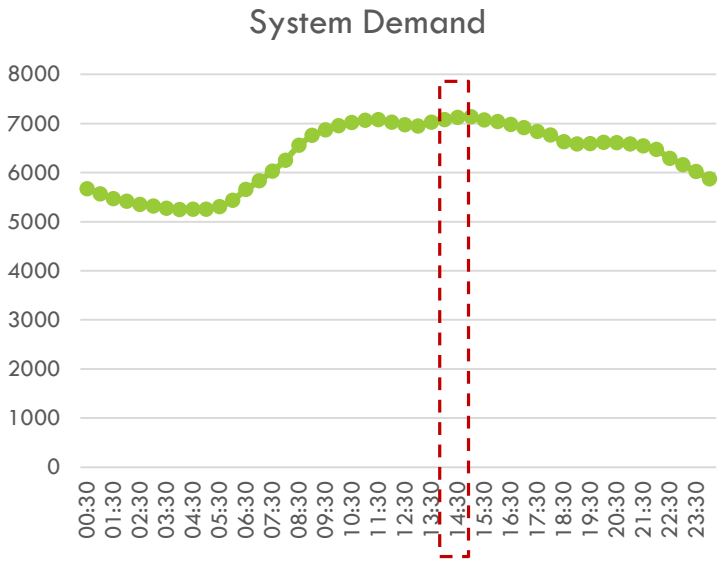
All of the projects funded by EMA have industry partners.

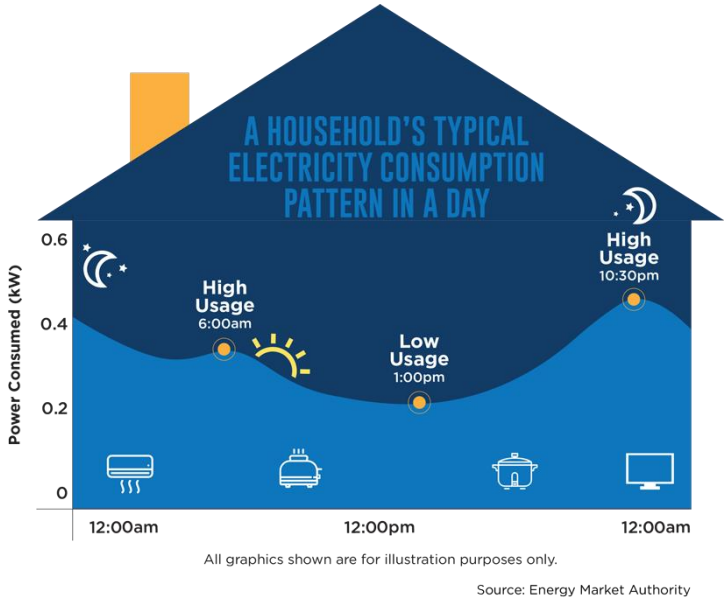
Putting money where your mouth is

All projects have industry 'skin in the game' – cash and in-kind contributions.

1. IS THERE A PROBLEM?

Know your market





Singapore's system peaks around 1:00pm to 2:30pm, while household peaks in the evening.

Household demand is 14.7% of Singapore's demand.

2. IS THE PROBLEM BIG ENOUGH?

Are there big opportunities?

IN FOCUS

TELECOM & INTERNET | , SINGAPORE

PUBLISHED: 10 APR 19 VIEW(S)

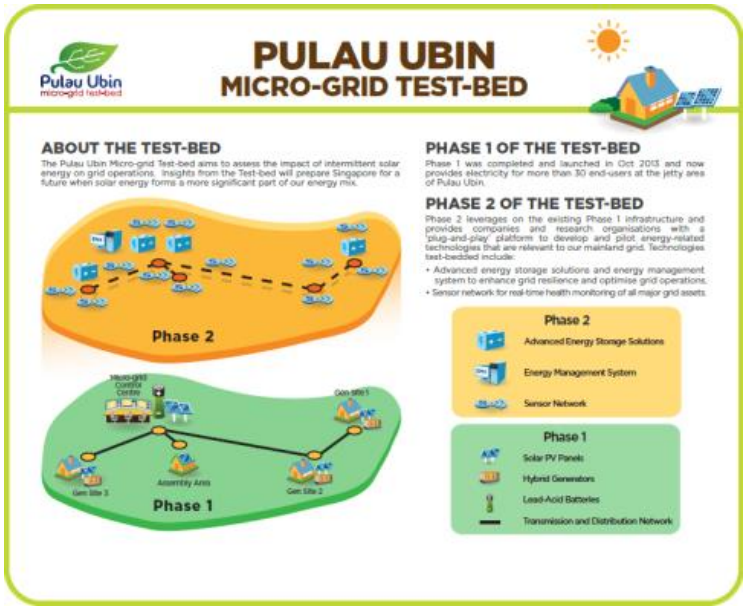
Singapore's data centre capacity to hit 380MW by 2022

But the growing cloud business could reduce the demand for colocation services if colocation tenants make the switch.

Over 2015-2018, an average of 35MW of supply was added to the data centre market per annum in Singapore, according to a report by CGS-CIMB. The average supply from 2019-2022F is expected to be about 50MW per year.

CGS-CIMB analyst Lock Mun Yee and Ervin Seow said that they expect over 380MW of new data centre capacity to come onstream over 2019-2022F, which translates to around 95MW per year on average.

Or uniquely Singapore problems?



Pulau Ubin Micro-grid Phase 2: Piloting various types of batteries to better understand ESS technologies and performance in Singapore's hot and humid environment.

3. IS THERE AN OFF THE SHELF SOLUTION?

Putting money where your mouth is... again

Is there already a mousetrap?

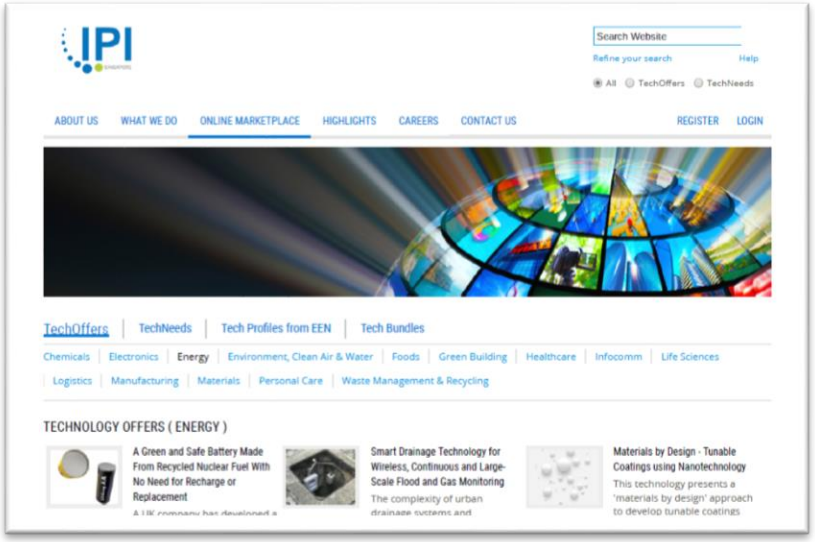
In Yokogawa's project with Tuas Power, part of the solutions are already available.

Can you build a better mousetrap?

Taking an existing product and co-innovating it with end user.

4. WHO IS THE RIGHT PARTNER

Who has the problem and who has the solution?



R&D project: Mitigation of Haze Effect on Gas Turbine Performance

Work with IPI to leverage Tech Portal to match offers and needs.

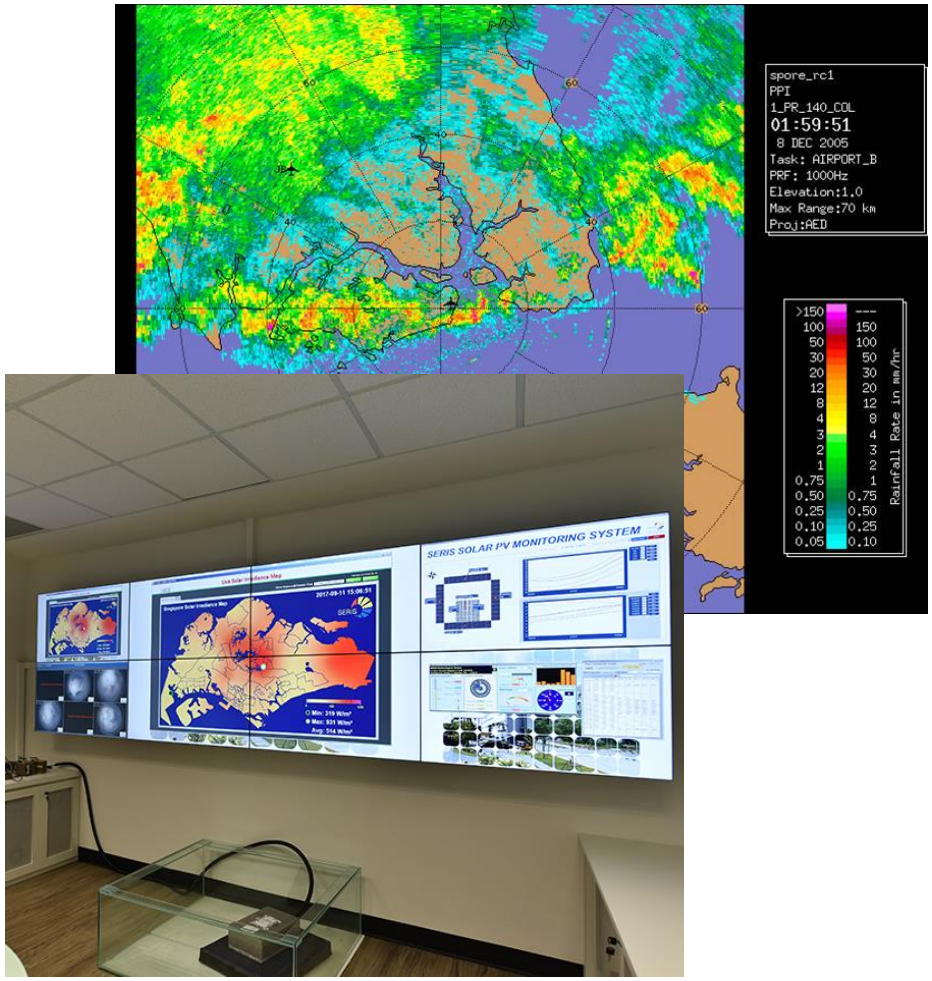
5. DO YOU HAVE THE RIGHT TEAM?

If you want to beat a dog find the right stick.

If you want to do machine learning, get a machine learning expert.

If you want to save half of the universe…

5. DO YOU HAVE THE RIGHT TEAM?



In solar forecasting, by involving MSS, the team gained access to data as well as better understanding of the weather systems, critical for use in Singapore's tropical climate.

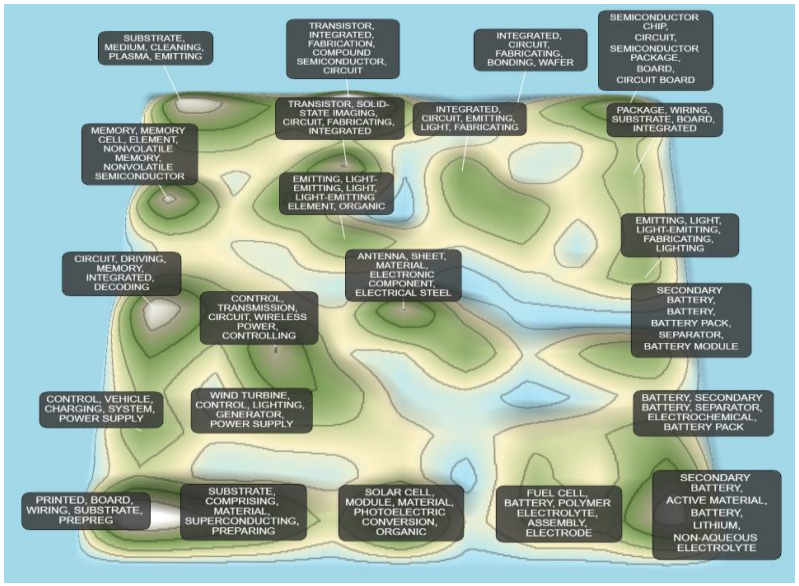
6. WHY ARE YOU BETTER? - A LESSON IN DIFFERENTIATION

Patent landscape

Patent landscape is often conducted to identify areas of opportunity and growth and develop unique solutions. Also to find prospective partners for local enterprises.

Analyse areas where there are fewer patents. Less competition but also maybe less potential.

No right or wrong, but more about choice.



6. WHY ARE YOU BETTER? - A LESSON IN DIFFERENTIATION

Talent & Business model

Keeping talent tap on in the power sector

THE lights will not go out in Singapore, the generating companies here always assure. And they should never. Any disruption or cut to power supplies here could see MRT services grinding to a halt, and so also production and operations across a range of industries. First world economies must have zero-tolerance for blackouts.

With 80 per cent of electricity here currently generated by more efficient, gas-firing plants, and with this figure set to rise to 90 per cent soon, Singapore has already moved to ensure supplies of its natural gas – by diversifying beyond just piped gas imports from neighbouring Malaysia and Indonesia to liquefied natural gas that can be shipped in from anywhere worldwide.

But having tackled the issues of feedstock supply and power generation capacity, the industry now faces the critical challenge of ensuring that there is sufficient skilled technical manpower to run all these power projects, not to mention new in-house facilities of big energy-consumers such as the oil refining complexes here. ExxonMobil has started up two new cogeneration plants – adding to an earlier one – to supply utilities to its Singapore manufacturing facility, which is its largest worldwide. Shell too has its own cogen units, with Singapore Refining Company set to build one shortly as well.

EDITORIAL

This is what a Power Sector Manpower Taskforce has been working on in the past 10 months – on how to ensure enough skilled workers for the industry, as well as fill the void when four in 10 of the sector's technical workforce retire in the next 10-15 years. Its calculations show a critical need for some 2,400 new technical professionals in the coming decade. As power supplies are a critical service, it must, as a matter of national interest, be largely handled by a local, well-trained workforce. Hence, there was no mention in the PSMT report about recruiting foreign talent. Instead, the taskforce put its full weight behind coordinated industry measures to train and develop a local talent pool, including recruitmeht promotions targeting students to mid-career switchers. These include scholarships and formalised career training under a centralised institute, to a sector-wide branding exercise to attract new talent. The training will also equip workers with associated skills for careers in related sectors, like smart energy.

Still, the key to attracting new skilled entrants must be better pay and career prospects – and this should naturally follow the increased competition in the power sector here which has drawn biggies including those from China, France, Malaysia, Japan and India.

Unlike previously when it was mainly government-owned, the power sector is now in the hands of MNCs as well as big local corporations such as Sembcorp and Keppel Corporation which already have, or are venturing into, power projects overseas. The latter suggests that there will also be opportunities for local talent to not only have overseas training and exposure, but also to manage overseas power projects, in Asia, the Middle East, and even Europe.

Manpower efforts matter – as talents and our people are our key resource.

Work with incubators – Shell IdeaRefinery, NUS GRIP, NTU Ecolab – to bring innovations from lab to market by guiding them on business models and execution plans.

6. WHY ARE YOU BETTER? - A LESSON IN DIFFERENTIATION

Leverage on big businesses

EMA strikes energy solutions partnerships worth $12m with PSA and Shell

The PSA Pasir Panjang container terminal. PHOTO: ST FILE

PUBLISHED 5 HOURS AGO | UPDATED 2 HOURS AGO

SINGAPORE - Singapore's Energy Market Authority (EMA) is partnering PSA Singapore and Shell in partnerships amounting to $12 million to develop local energy solutions and nurture local energy start-ups.

The tie-ups were announced on Tuesday morning (May 28) by Dr Tan Wu Meng, Senior Parliamentary Secretary for the Ministry of Trade and Industry and Ministry of Foreign Affairs, at Energy Innovation 2019, an event co-organised by EMA and Nanyang Technological University.

EMA and PSA Singapore's partnership will include a joint research and development (R&D) grant call for innovative solutions in smart grid technologies and energy management for container ports at Pasir Panjang Terminal.

Leverage the distribution channels and referencing of LLEs and MNCs – PSA, SembCorp, Shell to grow local SMEs.

7. IS IT THE RIGHT R&D APPROACH

We put proposals through the scrutiny of international peer reviews and international project evaluation panels – to ensure that the right approach is taken.

To guide us in navigating the maze of emerging technologies and opportunities, EMA works with a network of international experts.

8. IS THE SOLUTION DEPLOYABLE

Singapore's power sector is heavily regulated. Always check if the solution is deployable locally.

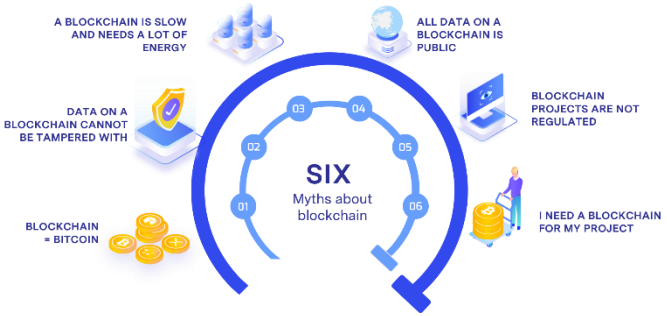
A provision is EMA's regulatory sandbox. The first sandbox was set up to test SP PowerAsset (SPPA)'s use of ESS for peak load shifting and relieve transformer loading at a substation in Bedok.

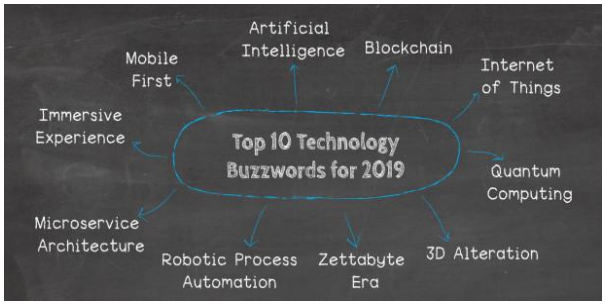
Findings will be used to guide our regulatory approach for SPPA's use of ESS for grid enhancement purposes.

9. AI, BLOCKCHAINS AND IOT

It is an art to find the silver bullet to the problem. Throwing in buzzwords is not one of them.

Singapore's digitalisation push presents industry with ample opportunities, but we should always evaluate if the popular solutions are indeed needed.



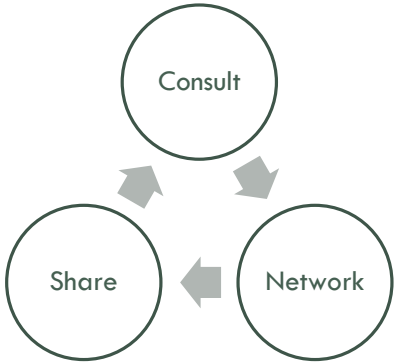


10. JUST DO IT!

NTU joins hands with Enterprise Singapore, SEAS to launch EcoLabs for start-ups, SMEs

By Bhaswati Guha Majumder
April 18, 2019 13:15 +08

Centre of Innovation for Energy (Twitter/NTU)



CONCLUSION

We made progress over the past 9 years… let's keep up the momentum.

Climate change is real, and we are in the cusp of the Energy Transition.

The Transition holds numerous opportunities. Let's share Ideas and build Unicorns for a greater energy future.