PRESS RELEASE

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NUS, Keppel and SLNG join forces to develop new energy-efficient cooling technology for data centres

Singapore, 21 October 2019 – The National University of Singapore's Faculty of Engineering (NUS Engineering), Keppel Data Centres Holdings Pte Ltd (Keppel Data Centres) and Singapore LNG Corporation Pte Ltd (SLNG) have joined forces to develop a novel, energy-efficient and cost-effective cooling technology for data centres. This innovation could further pave the way for more sustainable and compact data centres.

With the rapid expansion of cloud-based services, AI, the Internet of Things and big data analytics, there has been an exponential demand across the globe for data centres in recent years. As the leading data centre hub of Southeast Asia, Singapore accounted for around 50 per cent of the region's data centre capacity in 2015. Due to the high internal load and the need for consistent cooling and operation in a tightly-controlled environment, data centres are among the major power consumers in the building sector.

In addition, Singapore's tropical climate imposes a heavy energy burden on cooling in buildings. In 2018, data centres accounted for 7 per cent[1] of the total annual electricity consumption in Singapore.

"About 37 per cent[2] of the total energy consumed by data centres is used to cool IT equipment. Therefore, improving the efficiency of the cooling system can result in significant energy savings and reduce the carbon footprint of data centres. In this project, we aim to demonstrate a novel way of storing cold energy released from the Liquefied Natural Gas (LNG) re-gasification process and using it to cool data centres efficiently," said Dean's Chair Associate Professor Praveen Linga, who is from the NUS Department of Chemical and Biomolecular Engineering and the leader of the project team.

A five-member team from NUS Engineering, Keppel Data Centres and SLNG will jointly develop a prototype of a new cooling medium that can achieve two key functions: firstly, to efficiently store and carry cold energy from the Singapore LNG Terminal to the various data centres, and secondly, to be circulated within the cooling loop in each data centre to perform effective cooling.

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[1] EMA, Singapore Energy Statistics, 2019 & The Business Time, Singapore's data centre market at a crossroads, Mar 21, 2019

[2] https://www.nccs.gov.sg/docs/default-source/default-document-library/green-data-centre-technology-roadmap.pdf

This novel technology, called Semiclathrate Thermal Energy Carrier System (ScTECS), can potentially enable data centres to improve their power usage effectiveness (PUE) by 20 per cent. The footprint of the cooling infrastructure could also be reduced considerably, saving space and construction costs.

Mr Wong Wai Meng, CEO of Keppel Data Centres, said, “As a leading designer, developer and operator of data centres across Asia Pacific and Europe, Keppel Data Centres continues to innovate so as to offer best-in-class, energy-efficient solutions to our customers. We are pleased to collaborate with NUS and SLNG on how we can make cooling, which is a key aspect of data centre operations, more efficient, and thus contribute to a more sustainable future.”

New generation thermal energy carrier

In conventional chilling technology, a liquid coolant – usually chilled water - is used to cool the air in data centres. Due to the limited thermal capacity of water, large volumes of water are required to supply chilled water in the circulation loop to carry out cooling. Hence, a large infrastructure is required to generate adequate pumping loads to maintain the flow of chilled water in the cooling system.

In this project, the research team will explore the use of semiclathrate hydrates slurries, which are water-based phase-change fluids, as thermal energy carriers to replace chilled water as a cooling medium in the cooling systems used in data centres. The thermal density of the semiclathrate hydrate slurry is two to five times higher compared to chilled water – this significantly reduces the amount of water and power required as well as the size of various equipment and distribution lines.

Assoc Prof Linga explained, “While semiclathrate hydrates have been studied for purposes of gas separation, gas storage as well as thermal energy storage, the challenge lies in the ability to create them efficiently. NUS Engineering researchers will leverage our expertise in hydrate technologies and process engineering to identify a suitable semiclathrate promoter as well as develop a reactor and process design for this novel cooling technology.”

Another innovation that the team intends to pursue is to harness and utilise LNG cold energy from LNG re-gasification terminals and use it to offset the energy demands in data centres. Cold energy generated from LNG re-gasification could be stored in phase change materials and distributed to data centres for cooling purposes. As a start, Keppel Data Centres and SLNG are working together to explore ways to harness and utilise the cold energy from the Singapore LNG Terminal. SLNG will provide key technical inputs and advice related to the LNG cold energy to the team.

SLNG’s CEO, Mr Tan Soo Koong, commented: “SLNG is conscious of and committed to its responsibility to help fight climate change where it can, especially in reducing energy consumption and carbon emissions. We are therefore pleased to be a part of this innovative collaboration with NUS Engineering and Keppel Data Centres. Concurrently, SLNG is also exploring other ways to harness the LNG cold energy from our terminal and be part of the circular economy in Jurong Island.”

The process prototype demonstrating the cooling technology with a capacity of 1 tonne per day will be designed, built and operated for demonstration by 2022 at NUS.

This research project is supported by the National Research Foundation, Prime Minister’s Office, Singapore, under its Green Data Centre Research Programme.

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About National University of Singapore (NUS)

The National University of Singapore (NUS) is Singapore's flagship university, which offers a global approach to education, research and entrepreneurship, with a focus on Asian perspectives and expertise. We have 17 faculties across three campuses in Singapore, as well as 12 NUS Overseas Colleges across the world. Close to 40,000 students from 100 countries enrich our vibrant and diverse campus community.

Our multidisciplinary and real-world approach to education, research and entrepreneurship enables us to work closely with industry, governments and academia to address crucial and complex issues relevant to Asia and the world. Researchers in our faculties, 29 university-level research institutes, research centres of excellence and corporate labs focus on themes that include energy, environmental and urban sustainability; treatment and prevention of diseases common among Asians; active ageing; advanced materials; as well as risk management and resilience of financial systems. Our latest research focus is on the use of data science, operations research and cybersecurity to support Singapore's Smart Nation initiative.

For more information on NUS, please visit www.nus.edu.sg

About Keppel Data Centres

Keppel Data Centres Holding (Keppel Data Centres) is a 70-30 joint venture between Keppel Telecommunications & Transportation Ltd (Keppel T&T) and Keppel Land, both subsidiaries of Keppel Corporation Limited, a leading company listed on the Main Board of the SGX-ST with core businesses in offshore and marine, property, infrastructure and investments.

Keppel Data Centres has a track record of more than a decade in owning, developing and managing high quality carrier-neutral data centre facilities that support mission-critical computer systems. Keppel T&T is also the sponsor of Keppel DC REIT, the first data centre Real Estate Investment Trust (REIT) listed in Asia and on the SGX-ST. Together with assets owned through Keppel DC REIT, the Keppel Group has a global portfolio of more than 20 data centres located in key data centre hubs across Asia Pacific and Europe.

For more information on Keppel Data Centres, please visit www.keppeldatacentres.com

About Singapore LNG Corporation

Singapore LNG Corporation Pte Ltd (SLNG) was incorporated in June 2009 to build, own and operate Singapore's very first open-access, multi-user LNG Terminal. This is a key infrastructure that supports Singapore's energy diversification strategy and future developments in the energy sector. The Terminal began commercial operations in May 2013 and its primary mandate is to provide Throughput (Send-out) Services for the domestic market.

Beyond this, SLNG also offers ancillary services such as Vessel Cool-down, Storage & Reload, LNG Transhipment and LNG Truck Loading services. SLNG will continuously explore new LNG business opportunities as it pursues its vision to be a world-class LNG terminal operator enabling the growth of the energy market and LNG hub in Singapore.

For more information on SLNG, please visit www.slng.com.sg