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Surbana Jurong and NTU Singapore to develop hybrid system to deliver cleaner and more sustainable energy from LNG

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To deliver cleaner, more sustainable energy, Surbana Jurong and Nanyang Technological University, Singapore (NTU Singapore) are developing an integrated urban power generation system that can harvest, store and use cold energy from the regasification of Liquefied Natural Gas (LNG), with the option of using liquefied hydrogen as an additional source of energy.
Called “Cryo-Polygen”, this solution combines the concurrent generation of electricity, gas, cold energy, steam and hot water into a single plant operation.
To test and validate Cryo-Polygen, a pilot testbed will be built on the NTU campus by 2022, near the Surbana Jurong Campus in Jurong Innovation District.
The innovative hybrid system is expected to become commercially available and play a part in reducing carbon footprint and helping Singapore reach its goal of 36 per cent carbon emissions’ reduction by 2030. The cold energy generated from the system can be used to power cold storage warehouses and to cool data centres, industrial parks and buildings.

The Cryo-Polygen project is one of several innovations being developed under the SJ-NTU Corporate Laboratory. Jointly launched in 2018 by Surbana Jurong and NTU, and supported by the National Research Foundation (NRF) and Singapore Economic Development Board (EDB), it aims to develop next-generation sustainable solutions to tackle industrial and complex urban challenges.
The joint SJ-NTU team is also studying the feasibility of locating LNG storage and its related facilities underground in the future. Conventionally, LNG is stored in large-scale cryogenic storage tanks and in Floating Storage Regasification Units located near ports, industrial parks and power generation plants.
Such underground solutions free up the land above for higher value uses. The power supply can also be decentralised and situated closer to infrastructure that requires cold energy, including data centres, cold storage warehouses and hospitals.
Mr Wong Heang Fine, Group Chief Executive Officer, Surbana Jurong, said, “The Cryo-Polygen innovation will be a game changer for sustainable innovations to reduce carbon emissions. Several companies have expressed their interest in applying the Cryo-Polygen innovation to enhance their business delivery. Surbana Jurong is leveraging our vast experience in urban and infrastructure consultancy in the oil and gas sector to drive this innovation in Singapore as well as internationally through our member companies. As Cryo-Polygen produces efficient, cleaner and more sustainable energy, it has the potential to help meet demand for clean energy, reduce our carbon emissions and combat climate change.”
Professor Lam Khin Yong, Senior Vice President (Research), NTU Singapore, said the joint Cryo-Polygen testbed shows the benefit of academia-industry partnerships, where NTU’s cutting-edge research combined with the deep industry expertise of SJ, can produce novel solutions to help address pressing challenges faced by Singapore and other urban cities.

“Over the last decade, NTU has built extensive interdisciplinary research capabilities in the areas of sustainable energy, particularly in the areas of next-generation solar power, thermal energy harvesting, rechargeable batteries, green data centres, AI and power systems integration, which will contribute greatly to our collaboration with Surbana Jurong. The NTU Smart Campus is already a living testbed of

advanced technologies ranging from autonomous electric vehicles and maritime energy to waste-to-energy technologies and renewable energy integration developed in close partnership with industry," said Prof Lam.

Professor Low Teck Seng, NRF Chief Executive Officer, said, "The partnership between Surbana Jurong and NTU under the SJ-NTU Corporate Laboratory has seen good progress in translating research outcomes to commercialisation. The Cryo-Polygen research, which is an excellent initiative towards reducing our carbon footprint, is testament to that. The joint effort also provides a platform for local companies to showcase their sustainable innovations, and it strengthens our ability to export next-generation smart and urban solutions to other cities facing similar urbanisation challenges. The SJ-NTU Corporate Laboratory underscores Singapore's capabilities as a regional innovation hub that redefines cities and transforms them into sustainable and liveable spaces for communities and businesses to flourish."

Mr Damian Chan, Executive Vice President, EDB, said, "The Cryo-Polygen innovation project is an example of the progress being made by the SJ-NTU Corporate Laboratory. The project has the potential to help Singapore achieve several goals, including reducing carbon emissions and developing sustainability solutions that can be commercialised internationally."

Climate Change Demonstrator Plant

The new testbed to be built on the NTU Smart Campus will have a "Climate Change Demonstrator", which shows how cold energy can be harvested, stored and optimally used to refrigerate a container at sub-zero temperatures. The demonstrator plant will be the first of its kind in Southeast Asia.

Spearheading the project will be Surbana Jurong Senior Director, Oil & Gas, Mr Tan Wooi Leong, and NTU Associate Professor Alessandro Romagnoli. NTU will contribute its expertise on the recovery, storage and utilisation of cryogenic energy to complement Surbana Jurong's industry knowledge and experience in LNG and power systems integration.

The demonstrator provides a platform to showcase best-in-class sustainable innovations and their joint contributions towards a reduction of carbon emissions within the Cryo-Polygen system. Enterprise Singapore (ESG), the government agency championing enterprise development, partnered Surbana Jurong to identify local companies with solutions most suited for this showcase. Through ESG, Surbana Jurong has secured partnerships with five Singapore companies:

•Ademco, a security services company, to provide security solutions, in collaboration with AETOS, a member of Surbana Jurong Group;

•Durapower, a Singapore company with a global presence, specialising in research, design, manufacture, and system integration of advanced lithium battery solutions and charging systems for electric mobility and stationary energy storage systems, to provide the battery energy storage system;

•Pan-United Corporation, a technology company focused on concrete product innovation, to provide low embodied carbon concrete with almost half the carbon footprint as compared to normal concrete;

•Sunseap Group, the leading clean energy solutions provider in Singapore, specialising in solar, demand-side management and energy efficiency solutions, to provide the solar photovoltaic system; and

•gush, a Singapore startup specialising in sustainable advanced materials that improve living spaces and environments. This includes paint that purifies indoor spaces and regulates environmental factors to alleviate temperature flux-related implications. gush will be providing air-purifying paint for the demonstrator.

Ms Eunice Koh, Assistant Chief Executive Officer, Enterprise Singapore, said, "Collaborations between enterprises will be the driving force behind sustainable innovation. By pooling their expertise together, enterprises can achieve better innovative outcomes through environmentally and socially aware designs and operations. I congratulate the enterprises involved in the demonstrator for their progressive and sustainable business growth strategies, which will in turn bring about a cleaner and healthier community."