

## PRESS RELEASE

**EMBARGOED UNTIL 29 NOVEMBER 2023, 3 PM**

### **World's first tropical climate data centre testbed, led by NUS and NTU, will boost Singapore's competitiveness in sustainable data centres**

***The flexible, full-scale 'live' data facility brings together researchers and leading industry partners to develop and demonstrate best-in-class, energy-efficient cooling technologies customised for tropical environments***

Singapore, 29 November 2023 – The Sustainable Tropical Data Centre Testbed (STDCT) – the first of its kind for the tropical environment – hosted by the National University of Singapore's College of Design and Engineering (NUS CDE) is up and running, marking a significant milestone in data centre (DC) innovation in Singapore.

The groundbreaking initiative, led by NUS and the Nanyang Technological University, Singapore (NTU Singapore), is funded by the National Research Foundation in line with the Research, Innovation and Enterprise (RIE) 2025 plan<sup>1</sup> to position Singapore as a leading centre for green services and solutions to transform sustainable industries.

Bridging the gap between research and practical applications, this pioneer initiative brings together the academia and industry partners to fast-track the adoption of innovative and sustainable DC cooling solutions tailored for the tropical climate. These collaborative efforts will set new sustainability standards for DC operations in the tropics.

The STDCT, which is the key infrastructure that supports a cutting-edge national-level research programme on DC innovations, was officially launched today by Minister of State for Trade and Industry Mr Alvin Tan, in the presence of distinguished guests from the academia research community and industry.

DCs are the backbone of the digital economy, and they are power-hungry facilities with a large appetite for electricity, especially for those located in hot and humid climates such as Singapore. On average, about 40 per cent of a DC's energy consumption goes into powering its cooling and ventilation systems. Efficient cooling technologies, which the STDCT will be pioneering, are therefore essential for reducing operation costs and lowering the environmental impact of DCs.

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<sup>1</sup> The [Research, Innovation and Enterprise \(RIE\) 2025 plan](#) by the National Research Foundation is a strategic roadmap shaping Singapore's research and innovation activities over a five-year period. The RIE2025 aims to enhance Singapore's scientific foundation, broaden its innovation and enterprise ecosystem, as well as scale up technology translation and strengthen enterprise innovation capabilities.

Mr Ni De En, Director, Urban Solutions & Sustainability, National Research Foundation, said, “The Sustainable Tropical Data Centre Testbed brings together researchers and companies to drive innovations in cooling technologies and improve the sustainability of data centres in our region. Such industry R&D platforms accelerate the translation and commercialisation of research, in support of our climate goals.”

Professor Liu Bin, NUS Deputy President (Research and Technology), said, “NUS is excited to host the Sustainable Tropical Data Centre Testbed on our Kent Ridge campus. This is an unprecedented initiative that aligns seamlessly with Singapore’s Green Plan 2030 and reinforces the nation and NUS’ commitment to sustainability. The STDCT programme, jointly led by NUS and NTU in close partnership with the industry, has been fostering a thriving ecosystem for innovative cooling ideas to flourish. The opening of the testbed facility today will accelerate the creation and translation of game-changing DC cooling technologies that are well-suited for tropical urban settings like Singapore, further advancing the sustainability efforts of the DC sector locally and beyond.”

Professor Lam Khin Yong, NTU Vice President (Industry), said, “The commissioning of the Sustainable Tropical Data Centre Testbed marks a pivotal moment in the evolution of data centre operations in tropical climates. Led by NTU and NUS, in close collaboration with industry, it presents a sustainable solution for the operation and maintenance of data centres. It also reflects NTU's strong commitment to mitigating our impact on the environment, which is one of humanity’s grand challenges that we seek to address through our NTU 2025 strategic plan. As the world's first tropical climate data centre testbed, the STDCT sets a new standard, not just for Singapore but as a global benchmark for the intersection of cutting-edge technology, environmental responsibility, and operational efficiency in data centre infrastructure.”

### **Key infrastructure for DC innovations in the tropics**

The STDCT is an infrastructure that supports a comprehensive research programme to develop cooling solutions for the sustainable operation of DCs in the tropics which was initiated in June 2021. Since the programme’s inception, 20 industry collaborators have contributed state-of-the-art technologies and are actively engaged in technology co-development. (Please refer to the [Annexe](#) for the list of industry partners).

To date, the STDCT has attracted more than S\$30 million in investments for the facility and the five research projects led by scientists from NUS and NTU in collaboration with industry partners. STDCT has also received support from the Infocomm Media Development Authority.

The testbed facility provides a platform for co-innovation, capitalising on the synergy between academia and industry to generate important discoveries and transformative advancements that would benefit the tropical DC sector.

### **Setting new standards for tropical data centre operations**

The STDCT stands as a flexible, full-scale live facility that combines cutting-edge research and real-world application. Occupying a floor area of 770 m<sup>2</sup>, this is a living lab for scientists to experiment and validate innovative cooling ideas, and it also serves as a de-risking platform for companies to test and optimise new technologies in a realistic, tropical setting.

“The new testbed facility supports five research projects under the STDCT programme. These projects involve conducting holistic assessments to identify opportunities to raise the recommended temperature of conventional DCs, identifying the ‘sweet spots’ for sustainable cooling solutions, and integrating these technologies for optimal performance,” explained

STDCT Programme Director Associate Professor Lee Poh Seng, who is from the Department of Mechanical Engineering at NUS CDE.

“Since its inception in 2021, the STDCT research projects have made significant progress and we are well on-track to realise the goals of the programme and make an impact,” commented STDCT Programme Co-Director Professor Wen Yonggang, who is also Associate Vice President (Capability Building) at NTU.

Ultimately, the STDCT programme aims to demonstrate the following outcomes in a tropical setting by mid-2024:

- Reduce energy consumption by up to 40 per cent
- Reduce water usage by 30 to 40 per cent
- Reduce carbon dioxide emissions by about 40 per cent to less than 0.54 million tons per year
- Achieve Power Usage Effectiveness<sup>2</sup> (PUE) of less than 1.2 for a combination of air and liquid cooling (This is below the current requirement of 1.3 set by the Singapore government, and the global average of 1.5 in 2022.)

A whitepaper will also be developed to provide recommendations on optimum DC design and operations, and this is expected to be released in the fourth quarter of 2024.

### **Innovative cooling solutions designed for the tropics**

The STDCT will support five research projects.

Three projects will focus on the development of cutting-edge cooling technologies. A research team led by NUS is designing a unique heat sink coupled with immersion cooling for enhanced cooling performance. Another NUS team is pioneering the world’s first direct chip hybrid cooling system, which consists of a high-performance hybrid sink design with two modes of cooling – air and liquid cooling. The third NUS team is validating the potential of a novel cooling solution that uses a high-performance hygroscopic material to significantly improve cooling efficiency.

In tandem, scientists from NTU are leading two research projects: one project aims to establish the optimum temperature and humidity setpoints for air-cooling of data centres in the tropics, and the second project will develop a digital replica, i.e., digital twin, for multiple innovative cooling technologies of the testbed facility, to enable real-time performance modelling and prediction, and empower AI-based optimisation toward energy efficiency and sustainability.

### **Talent Development**

The STDCT programme not only addresses the immediate demand for sustainable DC operation practices in the tropics, but also nurtures talents to prepare the industry for future growth.

STDCT will establish strategic partnerships with industry standards organisations and leading corporations to provide learning opportunities for students and industry practitioners. These programmes are expected to be offered through the NUS School of Continuing and Lifelong Education in 2024.

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<sup>2</sup> PUE value of 1.0 signifies optimal power usage efficiency.

For a start, STDCT has offered two scholarships, which are supported by industry partners, to groom local talent in related fields such as AI-based digital twin and advanced liquid cooling systems.

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### **About National Research Foundation**

The National Research Foundation, Singapore (NRF), set up on 1 January 2006, is a department within the Prime Minister's Office. The NRF sets the national direction for research and development (R&D) by developing policies, plans and strategies for research, innovation and enterprise. It also funds strategic initiatives and builds up R&D capabilities by nurturing research talent.

Learn more about the NRF at [www.nrf.gov.sg](http://www.nrf.gov.sg).

### **About National University of Singapore**

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 16 colleges, faculties and schools across three campuses in Singapore, with more than 40,000 students from 100 countries enriching our vibrant and diverse campus community. We have also established more than 20 NUS Overseas Colleges entrepreneurial hubs around the world.

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, 30 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; active ageing; advanced materials; risk management and resilience of financial

systems; Asian studies; and Smart Nation capabilities such as artificial intelligence, data science, operations research and cybersecurity.

For more information on NUS, please visit [www.nus.edu.sg](http://www.nus.edu.sg).

### **About Nanyang Technological University, Singapore**

A research-intensive public university, Nanyang Technological University, Singapore (NTU Singapore) has 33,000 undergraduate and postgraduate students in the Engineering, Business, Science, Medicine, Humanities, Arts, & Social Sciences, and Graduate colleges.

NTU is also home to world-renowned autonomous institutes – the National Institute of Education, S Rajaratnam School of International Studies and Singapore Centre for Environmental Life Sciences Engineering – and various leading research centres such as the Earth Observatory of Singapore, Nanyang Environment & Water Research Institute and Energy Research Institute @ NTU (ERI@N).

Under the NTU Smart Campus vision, the University harnesses the power of digital technology and tech-enabled solutions to support better learning and living experiences, the discovery of new knowledge, and the sustainability of resources.

Ranked amongst the world's top universities, the University's main campus is also frequently listed among the world's most beautiful. Known for its sustainability, NTU has achieved 100% Green Mark Platinum certification for all its eligible building projects. Apart from its main campus, NTU also has a medical campus in Novena, Singapore's healthcare district.

For more information, visit [www.ntu.edu.sg](http://www.ntu.edu.sg).

## **Annexe – Industry partners of the Sustainable Tropical Data Centre Testbed (STDCT)**

1. Ascenix
2. CBRE
3. CoolestDC
4. Danfoss
5. Dell Technologies
6. Digital Realty
7. Eaton
8. Georg Fischer
9. GSM
10. Intel
11. Keppel Data Centres
12. M&C Engineering
13. META
14. Nalco Water
15. nVent
16. Red Dot Analytics
17. Shell
18. Sygna
19. Schneider Electric
20. Vertiv