OPTIMISING ENERGY EFFICIENCY FOR HEALTHCARE INSTITUTIONS

CONTEXT

Ng Teng Fong General Hospital (NTFGH) and Jurong Community Hospital (JCH) are members of the National University Health System (NUHS), an integrated Academic Health System and Regional Health System in Singapore that delivers value-driven, innovative and sustainable healthcare. Alexandra Hospital (AH), National University Hospital (NUH), Ng Teng Fong General Hospital (NTFGH) and Jurong Community Hospital (JCH), as well as 7 polyclinics are institutions under NUHS.

NTFGH and JCH are the first hospitals in Singapore to be designed and built together from the ground up as an integrated healthcare development to serve the people living and working in the south-west district of Singapore. NTFGH is a 700-bed acute hospital and the adjacent JCH is a 400-bed hospital with post-acute and continuing care facilities. Together, they form the Jurong Health Campus, and allows for better coordinated and integrated care, and effective facilities management.

As healthcare institutions, NTFGH and JCH consume considerable amounts of energy to deliver clinical services. Despite the operational needs, NTFGH & JCH have adopted a sustainability strategy to look for ways to reduce the carbon footprint on the planet and emission of CO2 and waste, to transform the institutions into sustainable healthcare facilities.

NTFGH & JCH are working towards the Singapore Green Building Masterplan (SGBMP), which has set more ambitious targets to improve the energy efficiency of the Built Environment sector. The Masterplan, dubbed “80-80-80 in 2030” to meet our global climate change commitments, includes the following requirements:

- 80% of buildings to be Green by Gross Floor Area (GFA) by 2030
- 80% of new developments (by GFA) to be Super Low Energy (SLE) buildings from 2030
- 80% improvement in energy efficiency to best-in-class green buildings by 2030

In the interim, NTFGH and JCH are working towards achieving BCA’s Green Mark 2021 Super Low Energy (SLE) certification for the buildings. To meet the SLE certification and the SGBMP target of 80% improvement in energy efficiency for best-in-class green hospital buildings by 2030, NTFGH and JCH are looking at optimising total air side efficiency of existing Air Handling Unit (AHU) to achieve the target of less than or equal to 0.25 kW/RT. AHUs are part of larger systems that are responsible for temperature control, moisture regulation, ventilation, filtration and building pressurization, which are vital to the health and productivity of the hospital building and occupants. Healthcare facility air conditioning plays a much more important role than simply providing comfort to patients and staffs. Medical equipment in hospitals is sensitive to temperature and humidity levels and requires perfect air control to function accurately. Optimising performance and energy efficiency of AHUs will significantly improve the hospitals’ operating performance and expenses. Any solution must be able to meet the cooling requirement of each room based on its use, such as consult room, treatment room, clean utilities, isolation room, ICU, laboratory etc. It has to minimally comply with the Health

Technical Memoranda (HTM) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)[1] standards.

This sector-wide challenge is supported by the Urban Redevelopment Authority (URA) and Smart Nation & Digital Government Office (SNDGO) for the development of sustainability and smart nation initiatives within Jurong Lake District.

PROBLEM STATEMENT

How might we optimise the performance and energy efficiency of existing Air Handling Units while ensuring good thermal comfort for patients and staff, and meeting hospital operational requirements?

WHAT ARE WE LOOKING FOR?

NTFGH and JCH are looking for a solution that is able to optimise energy efficiency by improving the air side efficiency from the AHU through real-time monitoring and adapting to hospital occupancy, clinical needs and visitor flow, without compromising hospital operations, infection control and thermal comfort.

The solution should consider the following:

- Real-time monitoring and adjustments. The solution should be able to sense, capture and monitor AHU performance throughout the day. The solution should be able to automatically adjust the air-conditioning system's performance based on external weather condition, thermal behaviour within the building, hospital occupancy schedule and operational needs.
- Interoperability. The solution should be able to seamlessly collect and integrate data from existing building management systems and/or other systems within both hospitals.
- Data analytics and insights to consolidate improvements. The solution should provide reports and valuable metrics that can be used to highlight system efficiency, energy optimisation indicators, hospital service standards and energy consumption improvements to NTFGH and JCH stakeholders.

OVERALL PERFORMANCE REQUIREMENTS

- Automated. The solution should be able to automatically make the necessary adjustments to energy usage with as little manual inputs as possible.
- Cost-effective. The solution should be cost-effective so as to maximise the savings in energy consumption with returns-on-investment (ROI) within 3 years.
- Scalable. The solution and its assets need to be plug-and-play and work with the current facilities operating management and metering systems in NTFGH and JCH, with the potential to be scaled to other buildings within NUHS cluster.
- Future-proof. The solution should consider possible changes in technology and constant upgrade of OS and software patching without affecting the functions and system performance.
- Auditable data. The data collected will be used for sustainability reporting and certification purposes and should be verifiable by a third party.

The prototype needs to be demonstrated in Singapore. The solution provider should allow the solution to be tested for at least three (3) months in NTFGH & JCH before further refinement and potential

[1] The Society (https://www.ashrae.org) is organized for the sole purpose of advancing the arts and sciences of heating, ventilation, air conditioning and refrigeration for the public's benefit through research, standards writing, continuing education and publications.

deployment. Proposals including Energy Services Company (ESCO) accredited companies will be viewed favourably.

Proposals that combine digital and non-digital components which address the challenge statement are welcome too and will be assessed accordingly.

POSSIBLE USE CASES

1. Adaptable air-conditioning temperature in hospital wards. The solution receives data that the ward occupancy rate is at 50% and senses the environmental temperature within the ward based on ventilation, medical equipment and the presence of staff and visitors within the ward. With the multi-variant sensors and optimizer not only able to reduce energy usage it is also able to adapt the indoor air quality control and temperature to continue to provide conducive environment for the patients, staff and visitors.

2. Visitor experience is enhanced. Alice and her elderly mother have been waiting for a doctor's appoint for an hour in the waiting room. It is a hot day outside and the room is crowded with other patients waiting for their appointments. However, the waiting room feels cool enough and well-ventilated and the wait does not feel unpleasant.

WHAT'S IN IT FOR YOU

- S$50,000 of prize money for each winner of this challenge (see Award Model)
- Access to IMDA's innovation consultancies (e.g. Design Thinking, Digital Storytelling, UI/UX) and PIXEL corporate innovation hub (e.g. hot-desking, project studios, ARVR, usability, 5G test labs) for prototyping and commercialisation
- Co-innovate with NTFGH and JCH with access to their expertise, facilities, and human resources in developing the solution, and potential for the solution to be commercialised at both hospitals and other healthcare institutions
- Contribute to JLD's sustainability efforts and towards the collective green ambitions of the district, with profiling opportunities and potential to scale successful solutions within the district

EVALUATION CRITERIA

The evaluation process shall take place over two stages. Proposals shall be evaluated based on the evaluation criteria set out for the first stage. Thereafter, shortlisted proposals shall be subjected to a second stage evaluation in the form of an interview / pitch, and the scoring shall be based on a re-defined assessment criteria for the selection of the challenge finalist(s).

Solution Fit (30%)	Relevance: To what extent does the proposed solution address the problem statement effectively?
Solution Readiness (30%)	Maturity: How ready is the proposed solution to go to the market? Scalability: Is there any evidence to suggest capacity to scale?
Solution Advantage (20%)	Quality of Innovation: Is the solution cost effective and truly innovative? Does it make use of new technologies in the market, and can it potentially generate new IP?
Company Profile (20%)	Business Traction: Does the product have user and revenue traction? Team Experience: Do the team members possess strong scientific/technical background?

AWARD MODEL

30% of the prize money will be awarded to each selected finalist at the start of the POC/prototype development process. The remaining 70% will be awarded after completion of the POC/prototype solution, based on milestones agreed between the Problem Owner(s) and the solution provider. Prize money will be inclusive of any applicable taxes and duties that any of the parties may incur.

Note that a finalist who is selected to undertake the prototype development process will be required to:

- Enter into an agreement with Problem Owner(s) that will include more detailed conditions pertaining to the prototype development;
- Complete an application form with IMDA that will require more financial and other related documents for potential co-funding support.

Teams with public research performers are required to seek an endorsement from their respective Innovation and Enterprise Office (IEO) and submit the IEO form together with the proposal.

SUBMISSION GUIDELINES AND DEADLINE

The proposal should include the following:

- 1 deck of slides in PDF format explaining the proposed solution, how it addresses the problem statement and meets the desired performance requirements. To include information such as the proposed cost model, data inputs, system that the proposed solution will run on, potential benefits, and the team's implementation plan.
- Video or pictures (300dpi) of any prototype or simulation, if applicable.
- Track record of the company/ CV of the team.

All submissions must be made by **21 April 2023, 1600 hours (SGT/GMT +8)**. Problem Owner(s) and IMDA may extend the deadline of the submission at their discretion. Late submissions on the OIP, or submissions via GeBIZ, will not be considered.

Please visit https://www.openinnovation.sg/challenges to sign up for this challenge.