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BUILDING AN ENERGY-EFFICIENT NATION

THE 3FOR2 PROJECT, CONCEIVED AND DEVELOPED BY THE SINGAPORE-ETH CENTRE, COMBINES PRACTICAL CONSTRUCTION WITH LOW MATERIAL COSTS TO ENABLE ENERGY AND SPACE EFFICIENCY IN HIGH-RISE BUILDINGS.

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IMAGES » COURTESY OF SINGAPORE-ETH CENTRE



The Singapore-ETH Centre is a research hub by ETH Zurich (the Swiss Federal Institute for Technology Zurich) and Singapore's National Research Foundation (NRF) as part of its CREATE campus. It is the only research centre set up by ETH Zurich outside Switzerland, and was established in 2010 to create pragmatic solutions to pressing problems.

One exemplary solution is the 3for2 building design concept, developed by its architectural and engineering researchers. It is a new and effective approach for the construction of sustainable high-rise buildings, focusing largely on advancing the technologies of air-conditioning, which accounts for more than half (approximately 60 per cent) of energy consumption across buildings in Singapore.

In partnership with Siemens Building Technologies and United World College South East Asia (UWCSEA), the concept was implemented at the end of 2015 in the administrative arm of the UWCSEA Dover campus. The 550-square-metre pilot, titled 3for2@UWCSEA, is a physical test bed to experience, observe and further improve the system.

"Despite decades of technology development, widespread deployment of highly energy-efficient air-conditioning technologies in the commercial building sector has not yet occurred outside of a few European countries," says Professor Arno Schlueter, Leader of the 3for2 Project and Professor of Architecture and

Building Systems at ETH Zurich. He explains that this is partly due to the nature of the building and construction industry. Developers and consultants who typically select air-conditioning technologies during the building design stage often do not bear the cost of the building's future energy consumption. As a result, it is a challenge to convince them to invest in highly efficient air-conditioning systems.

Combining design and construction, new lean and energy-efficient air-conditioning technologies (alongside other related services) are incorporated into the building structures of 3for2@UWCSEA. Flat cold-water radiators are attached to the ceiling; bulky mechanical equipment is moved from the ceiling and hidden along the exterior of the facade; and ductwork is integrated into concrete slabs. Besides saving on construction materials and energy used over the period of operation, the system enables the construction of three floors within the conventional space of two, without compromising on perceived floor-to-ceiling heights. Furthermore, sloped windows allow for an improved quality of daylight within the office.

"The GBIC (Green Buildings Innovation Cluster) will co-fund the implementation of UWCSEA's 3for2 project, including its measurement and verification," says Tan Tian Chong, Group Director of Research at the Building and Construction Authority (BCA). He continues, "We will also collect data from the project

to ensure that the knowledge and best practices will be consolidated for dissemination to the industry."

All in all, 3for2 enables developers to save construction costs, while generating lower utility bills for tenants, contributing to the building of a more sustainable city. Since its implementation, the 3for2@UWCSEA has demonstrated favourable statistics. Based on the aggregation of 18 days of operation from December 2015, it has been estimated to consume 77 kilowatt-hours per metre squared (an estimate based on a projected typical 252 days of operation per year). By comparison, at present, 90* per cent of large office buildings in Singapore consume 141 kilowatt-hours per metre squared each year.

The team aims to lower the energy footprint of the system by an additional 40 per cent. Over the next two years, technologies will continue to be fine tuned with new systems installed by 2018. The goal is the construction of Singapore's most energy-efficient office.

**Based on data from the BCA's 'Building Energy Benchmarking Report 2015'.*

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