

# SG GREEN



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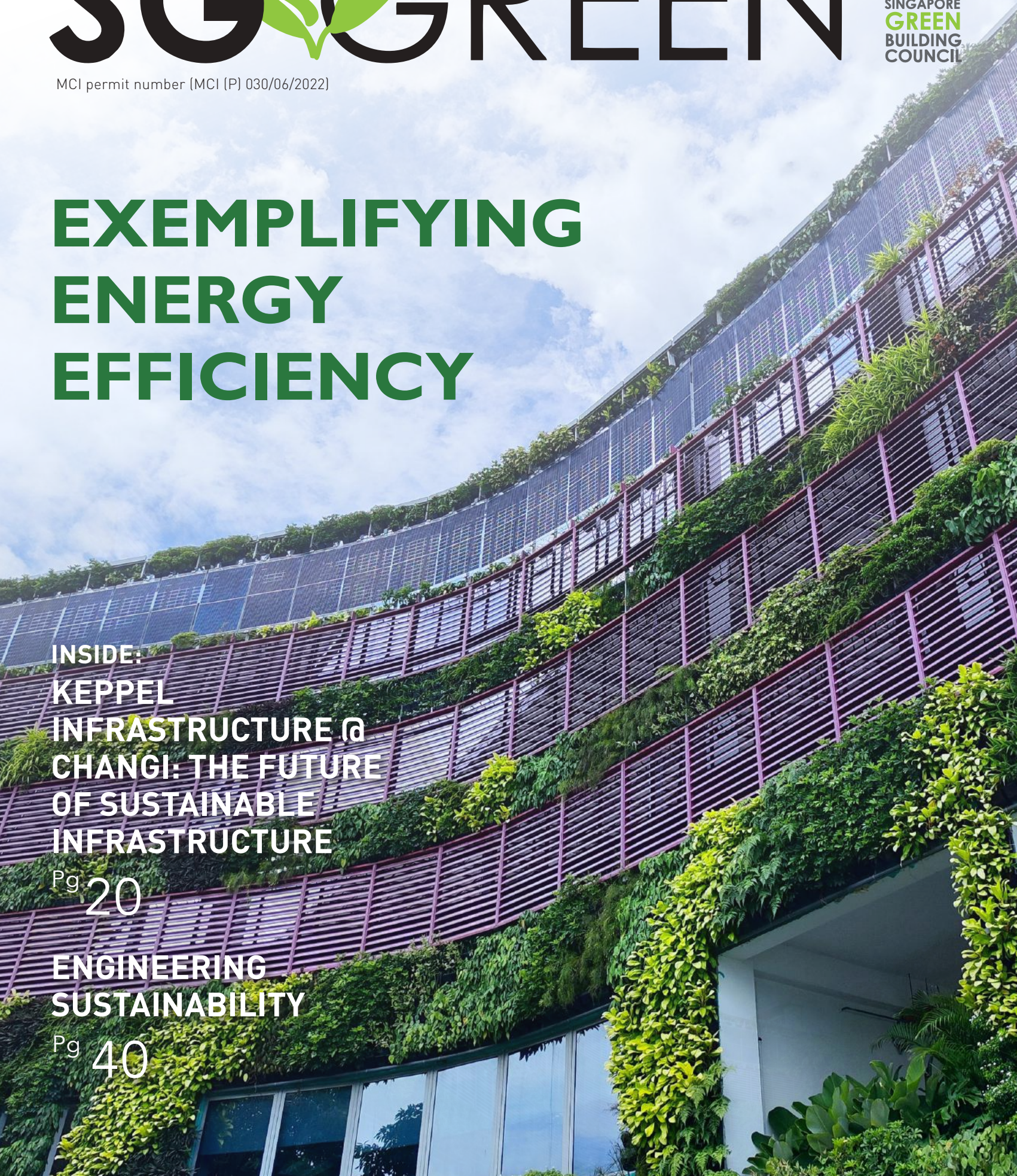
## EXEMPLIFYING ENERGY EFFICIENCY

INSIDE:  
KEPPEL  
INFRASTRUCTURE @  
CHANGI: THE FUTURE  
OF SUSTAINABLE  
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# SGBC Corporate Membership



For more information, please contact Grace Chua at [grace\\_chua@sgbc.sg](mailto:grace_chua@sgbc.sg) or (65) 6797 0898.

## Be part of the Singapore Green Building Council Network

The Singapore Green Building Council (SGBC) enables sustainability across the building and construction value chain, championing capability development and innovative solutions that support industry transformation through Membership, Certification and Outreach. Together with a growing network of Member organisations united by a commitment to green building and sustainability, SGBC drives impactful change to the built environment.

## Membership Benefits

SGBC Membership is meaningful, rewarding and aligns organisations with national and international sustainability standards and goals. Being a Member of SGBC positions your organisation on the forefront of green building and sustainability, paving the way for further collaborations with like-minded organisations. Membership also comes with a host of exclusive privileges and benefits:



### Marketing Support

- Enjoy exclusive use of SGBC Member logo on corporate collateral and assets
- Boost visibility with organisational listing on the SGBC Members Directory
- Profile solutions and expertise by contributing content to SGBC communication channels such as SGBC Members Bulletin, SG Green Magazine, SGBC Blog and our various social media platforms



### Preferential Rates

- Enjoy exclusive discounts on SGBC certification fees for green building products and services
- Enjoy bulk discount on renewal fees for Green Mark Accredited Professionals
- Gain exclusive access and preferential rates to a wide range of learning & development and networking events



### Impactful Partnership

- Collaborate with SGBC to deliver impactful events for the green building community
- Demonstrate leadership and showcase capabilities through SGBC events such as seminars, webinars, courses, conferences and learning journeys
- Gain business intelligence on industry and regulatory developments, and connect with the regional and international green building community and WorldGBC

SGBC Members may select one of the following complimentary **Bespoke Benefits** for each year of Membership:

#### Marketing

- Quarter (¼) page Sustainability Listing on SG Green Digital Magazine
- One (1) spotlight technical article/ interview feature on SGBC LinkedIn

#### Certification

- Preferential rates for SGBC certification schemes

#### Learning & Development

- Ten (10) passes for any on-demand courses on SGBC Digital Academy
- One (1) pass for an instructor-led SGBC Course (live)
- Speaking opportunity at one (1) SGBC Webinar

# SGG GREEN

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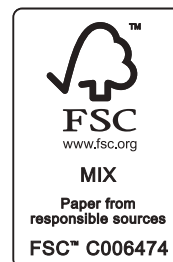
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# MESSAGE FROM THE EDITORIAL TEAM

illustration by Freepik.com

The world is facing a daunting challenge - to meet the growing energy demand while simultaneously reducing our carbon footprint. Climate change is rapidly becoming a global crisis, and the need for sustainable solutions has never been more urgent. The built environment is one of the significant contributors to greenhouse gas emissions, accounting for nearly 40 percent of energy-related carbon dioxide emissions. Therefore, building energy-efficient and sustainable buildings is crucial in mitigating the adverse impact of climate change.

Energy efficiency is the foundation of sustainable buildings. It is the process of optimising energy usage by minimising energy waste and maximising output. Energy-efficient buildings use less energy for heating, cooling, lighting, and other operations, resulting in reduced carbon emissions, lower operating costs, and improved indoor air quality. Such buildings are designed and constructed to conserve energy, minimise waste, and reduce their overall environmental impact.

In this issue of SG Green, read about how built environment sector players are pushing the envelope for energy efficiency. The collection of articles covers the principles of energy efficiency,

design strategies, construction techniques, and operational practices that are essential for creating super low energy buildings, zero energy buildings and even positive energy buildings. The magazine will also explore technologies and materials used in high-performance buildings, including renewable energy sources, smart building systems, and green building materials.

SG Green Issue 16.0 features two case studies on positive energy buildings in Singapore: the Keppel Infrastructure @ Changi building and the Samwoh Smart Hub. Both exemplary building projects are designed to be extremely energy-efficient and make use of renewable energy sources to generate more energy than they consume. Check out the individual articles to find out what goes beyond the façade of these high-performance buildings.

By exemplifying energy efficiency, the built environment can contribute to a greener, healthier and more sustainable future.

Yours Sincerely,  
**SG Green Editorial Team**







# EXISTING BUILDING PERFORMANCE: THE DECARBONISATION GOLDMINE

Retrofitting buildings can be challenging to get going, but doing so provides a business case relevant for the current times and addresses environmental needs





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## Existing Building Performance: the Decarbonisation Goldmine

To meet Singapore's national Net Zero by 2050 target, eliminating reliance on fossil fuels as an energy source is essential. However, Singapore is challenged by constraints around onshore renewable energy generation capacity, making full electrification of all assets as they currently perform challenging. For this reason, decarbonising the built environment requires an integrated approach that reduces energy use to as low as reasonably possible.

While that sounds straightforward, the goal is only the beginning of the process, says Mr. Freddy Toh, Technical Director of Cundall Singapore.

"Singapore already has the Singapore Green Plan 2030 target," he says. "But our challenge is while everybody knows about net zero, we need to know how to break that goal into achievable small steps and incrementally improve energy performance before we talk about net zero."

### WHERE TO START

Mr. Marcus Kan, Managing Director of Cundall Singapore, says portfolio owners and asset managers often do not know where to start, how to start or what form staging of works should take.

"For example, they might consider renewable energy, but not be aware that understanding how they use energy, and how to economise on that use, is generally the best place to begin."

Carrying out energy audits identifies what building systems are using energy and how much; and sets out opportunities for reducing that use. Organisations in Singapore who have taken this as a starting place for their net zero journey range from major blue chip corporate tenants through to clients with global asset portfolios such as DFS.



DFS Global Energy Audit - T Galleria by DFS Singapore





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## Existing Building Performance: the Decarbonisation Goldmine

Engineering design for new elements also emphasises low-carbon materials, prefabrication to reduce construction waste, and bolted connections to ensure materials can potentially be dismantled and re-used in future.

### THE RETROFIT GOLDMINE

From an environment, social and governance (ESG) perspective, existing buildings are a 'gold mine' for deriving tangible performance improvements and enhancing reputation for asset owners, investors and portfolio managers, says Mr. David Kim, Principal Sustainability Consultant of Cundall.

"Singapore is a prime candidate for emissions reductions and ESG gains through improving existing buildings as it has a significant tranche of existing buildings," Kim says.

Building Performance Services (BPS) is an integrated discipline that combines building services design engineering, building services commissioning and re-turning, and sustainability strategy, audits and certifications.

As a strategic and holistic approach to improving existing buildings it has delivered some significant results. Vicinity Centres in Australia is developing a net zero strategy across its portfolio. It has been recognised for the substantial energy use and emissions reductions achieved through engaging BPS with the #1 Ranking in GRESB for Listed retail Centres in Oceania in 2021.



Vicinity Retail Portfolio NABERS rating - Chadstone, Australia © Aaron Pocock Photography

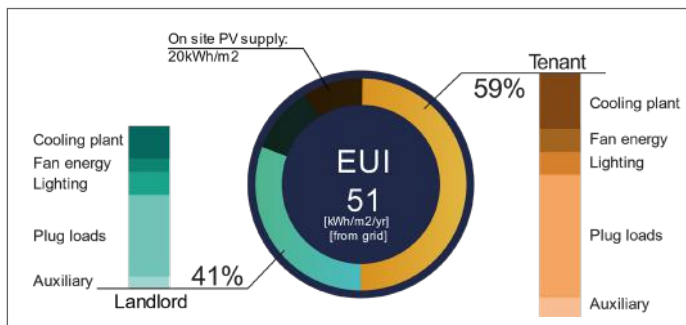


## Existing Building Performance: the Decarbonisation Goldmine

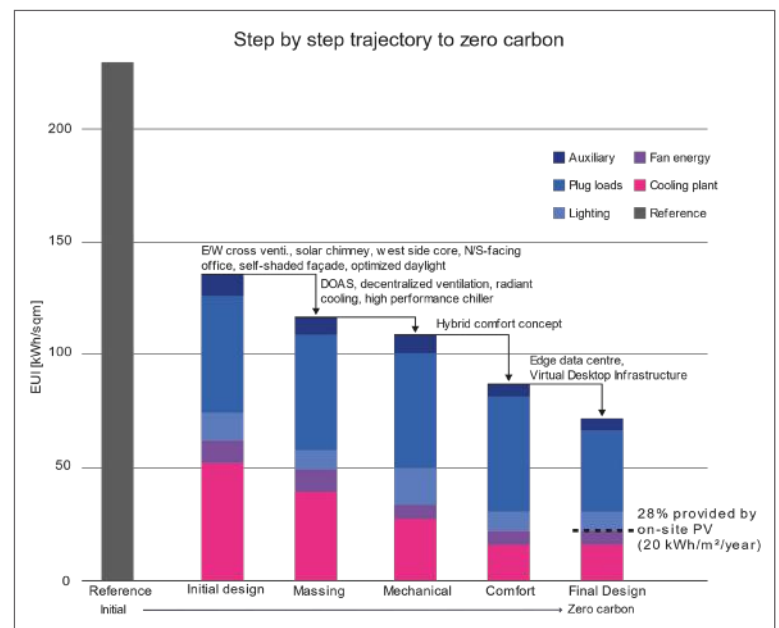


Treehouse, Hong Kong, China © Ronald Lu & Partners

We are evolving the performance-based thinking approach to inform the design stage for new buildings, as we did with the award-winning Net Zero Treehouse project in Hong Kong. By leveraging data on every aspect of operational energy use in developing the building services design, an ultra-low energy building was demonstrably achievable.



© Ronald Lu & Partners and Cundall



Treehouse Energy Use Intensity © Ronald Lu & Partners and Cundall



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## Existing Building Performance: the Decarbonisation Goldmine



Vicinity Retail Portfolio NABERS rating - Chadstone, Australia ©Aaron Pocock Photography

### **BUILDINGS WORK SMARTER, NOT HARDER**

The process for portfolio-scale existing building enhancements to achieve meaningful OPEX reductions that represent a sound return for retrofit CAPEX spend, is informed by the initial energy audit and then enabled through strategic interventions including smart building technologies.

Smart building approaches also have a close alignment with the Building and Construction Authority's (BCA) Green Mark certification scheme, says Ms Annie Nguyen, Building Automation Associate Director from Cundall.

The scheme recognises the environmental win of retaining existing buildings through allocating higher points for existing building retrofits in key criteria of the Intelligence credit, she explains. These kinds of retrofits also align with the Singapore Smart Nation policy, ensuring no building is left behind. The value of smart buildings in terms of operational sustainability has also been recognised through the recent integration of the WiredScore framework with Green Mark.

Where there are existing controls and smart features, recommissioning is often the first step in the trajectory towards ultra-low energy buildings.



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## Existing Building Performance: the Decarbonisation Goldmine



“Even for a conventional existing building, we need to consider the controls element as this is what drives optimisation for every piece of equipment and for monitoring how key equipment performs.”

Taking this a step further, where digital engineering design for structures and mapping of existing services is combined with the controls, automation and BMS solution, asset owners and managers can gain the benefits of an operational digital twin. This opens up further benefits for maintaining optimum performance through enabling improved maintenance, real-time analytics, exception and fault detection and diagnostics.

### SHOW US THE DATA

Asset performance data produced by analytics and monitoring can also be published for stakeholders including investors and potential tenants, so there is transparency around building performance.

This may also enable asset owners to potentially obtain green finance options for upgrades to existing buildings. As Kim points out, the competitive interest rates offered by sustainability-linked loans and other financial products can potentially make a significant difference when considered across time and a substantial portfolio.

There are also social aspects to consider.

“Older buildings have a certain heritage value for the society they have served. Repurposing and transforming buildings, and increasing their value provides a business case relevant for the current times whilst addressing environmental needs,” Kan says.

“Corporates are racing to demonstrate results in their journey towards net zero carbon. They can make a significant contribution by playing a part in the transformation of an existing building to increase its value, and better meet their core requirements of an efficient, healthy and high-performing workplace.” 🍀

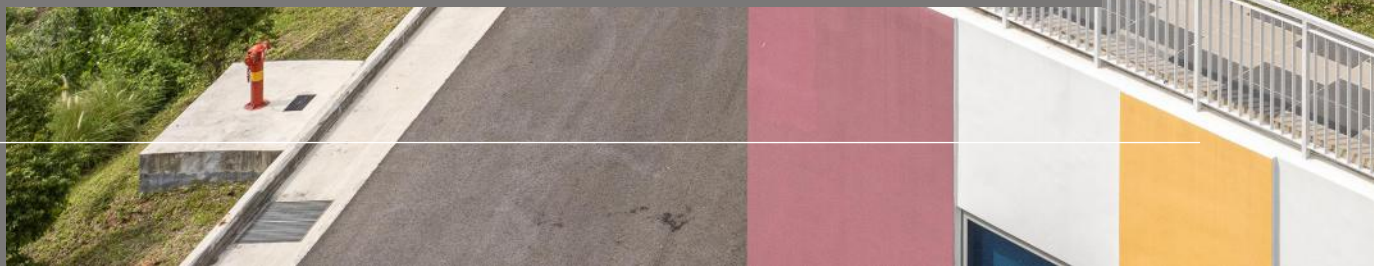
**Article contributed by  
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# CHAMPIONING A SUSTAINABLE BUILT ENVIRONMENT

As the Built Environment sector accounts for more than 20 percent of Singapore's carbon emissions and more than 30 percent of the nation's electricity consumption, there is a clear mandate for the industry to transform and contribute to a more resilient, sustainable and liveable Singapore. Find out how SGBC Member Samwoh Corporation is championing a sustainable built environment.







*Located in the Sungei Kadut Eco-District, the Samwoh Smart Hub is Singapore's first positive energy industrial building.*



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## Championing a Sustainable Built Environment



*Samwoh's newest asphalt production plant is 15 percent more energy efficient than conventional plants and can achieve a carbon abatement of 1,220 tonnes per year.*

Long before sustainability became trendy and a necessity, a few Singapore companies began focusing on making the city resilient and sustainable. One of these companies is Samwoh Corporation, a homegrown integrated engineering and construction company, whose research and innovation journey to make building materials sustainable started as early as 2005.

In fact, Samwoh completed the Samwoh Eco-Green Building in 2009, which was the first in the region to be constructed using up to 100 percent Recycled Concrete Aggregates (RCA). The Samwoh Eco-Green Building demonstrated that through innovative and practical research, technology can help Singapore reduce its reliance on external sources for construction materials.

Samwoh also developed its own research & development (R&D) centre to innovate and test green technologies as well as sustainable building materials. Today, the Samwoh Innovation Centre is the largest and most comprehensive living laboratory in the industry.

Fast forward to 2022, Samwoh has upped the ante in its sustainability journey with the completion of the Samwoh Smart Hub, Singapore's first positive energy industrial building that will serve as Samwoh's headquarters.

"When we conceptualised our new home, we aimed to provide an insightful learning ground for many built environment and energy professionals; a platform to showcase and inspire others in the drive towards greater sustainability among our Built Environment community," Samwoh's said Mr. Eric Soh, CEO of Samwoh.

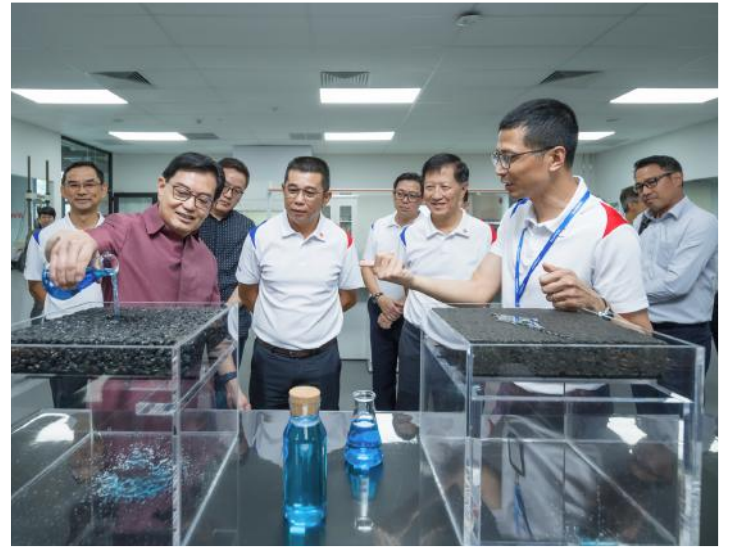


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## Championing a Sustainable Built Environment

“We also hope that the Smart Hub, with its people-centric features and greenery, will inspire our employees to embrace sustainability in their daily lives and produce great work every day.”

The Samwoh Smart Hub consumes less energy than it produces through a combination of green building technology applications, smart digital systems to track and improve energy use, as well as innovative solutions. Currently, it is achieving an energy surplus of about 25 percent.



*The opening of Samwoh Smart Hub was graced by Mr Heng Swee Keat, Singapore’s Deputy Prime Minister and Coordinating Minister for Economic Policies.*



*The total solar farm capacity generated from the 2,588 solar photovoltaic panels installed on the roofs, can power up to 300 HDB four-room flats in a month.*



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## Championing a Sustainable Built Environment



*The 35,000 sqm facility even has pockets of garden spaces amounting to nearly 40 percent of the green coverage on site, above than the design planning guidelines of 30 percent.*

With understanding of the tropical climate in Singapore, the building was designed to have full floor-to-ceiling glass windows for optimal lighting at the North and South facing facades with double-fin cladding on the East and West of the building. The facades diffuse direct heat and allow for a cooler interior while the full height windows allow for optimal natural lighting in the indoor space. At the same time, the full glass windows are installed with high performance solar film certified under the Singapore Green Building Product (SGBP) certification scheme that helps to mitigate unwanted heat gain without the conventional dark tint. Other green materials used in the construction of the Samwoh Smart Hub include green concrete and

*The facility is also home to the largest and most comprehensive living laboratory in the industry, the Samwoh Innovation Centre.*

ground granulated blast furnace slag developed in-house by Samwoh.

In Singapore, air-conditioning accounts for a bulk of the building's total energy load. In response, Samwoh adopted a first-of-its-kind solar-driven direct current chiller and thermal energy storage tank to reduce the energy needed for cooling the building. Using elevated chilled water and Direct Current Smart Fan Coil Units with occupancy and carbon dioxide (CO<sub>2</sub>) sensors, various systems and technologies are in place to improve cooling system efficiency of the building.



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## Championing a Sustainable Built Environment



The double fins cladding on the East and West of the building diffuses direct heat and allow for a cooler interior.



The full floor-to-ceiling glass windows at the North and South facade allow for optimal natural lighting in the indoor space.



The meeting rooms and offices are equipped with occupancy sensors which activates the air-conditioning when motion is detected.







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## Championing a Sustainable Built Environment



Smart digital systems for lighting control and smart plugs are also installed to ensure that air-conditioning, lighting and electricity are only used when needed, reducing any unnecessary wastage. A building management system with automation controls and diagnostic features also optimises day-to-day energy efficiency.

These technologies are powered by energy harvested from 2,588 solar photovoltaic (PV) panels installed on the roof. The total solar farm capacity generated can power up to 300 Housing & Development Board (HDB) four-room flats for a month. Apart from channeling the energy generated for consumption, the energy is also stored in a Thermal Energy Storage in the form of chilled water as reserves for chilling the building at night and on cloudy days.

The new premises also house Samwoh's latest asphalt production plant which is 15 percent more energy efficient than conventional plants and can achieve an annual carbon abatement value of 1,220 tonnes, similar to taking 265 cars off the road in a year.

The building is not just sustainable in its operations and design. The building was constructed using different types of recycled and durable materials like rock debris from Jurong Rock Caverns (JRC), recycled concrete aggregate (RCA), granite fines, and self-healing concrete. Some of the building columns are also equipped with optic fibre cables to collect data and monitor the structural performance of the building.

Located in the Sungei Kadut Eco-District, the Samwoh Smart Hub supports and contributes to the green development of the area. The 35,000 sqm facility even has pockets of garden spaces amounting to nearly 40 percent of the green coverage on site, above than the design planning guidelines of 30 percent.

The Samwoh Smart Hub, together with continuous research on sustainable solutions and green technologies, demonstrates Samwoh's steadfast commitment to greening the Built Environment and championing a liveable and sustainable Singapore. ✔

**Article contributed by  
Samwoh Corporation**





BREACHING  
INLET TO  
SPRINKLER  
SYSTEM



# KEPPEL INFRASTRUCTURE @ CHANGI: THE FUTURE OF SUSTAINABLE INFRASTRUCTURE


Remodelling an existing building into a paradigm of cutting edge energy efficiency







# KEPPEL INFRASTRUCTURE @ CHANGI: A POSITIVE ENERGY BUILDING


 **600,000 kWh**  
of renewable energy collected  
annually using solar panels


 **>200%**  
replacement of building's annual  
energy consumption

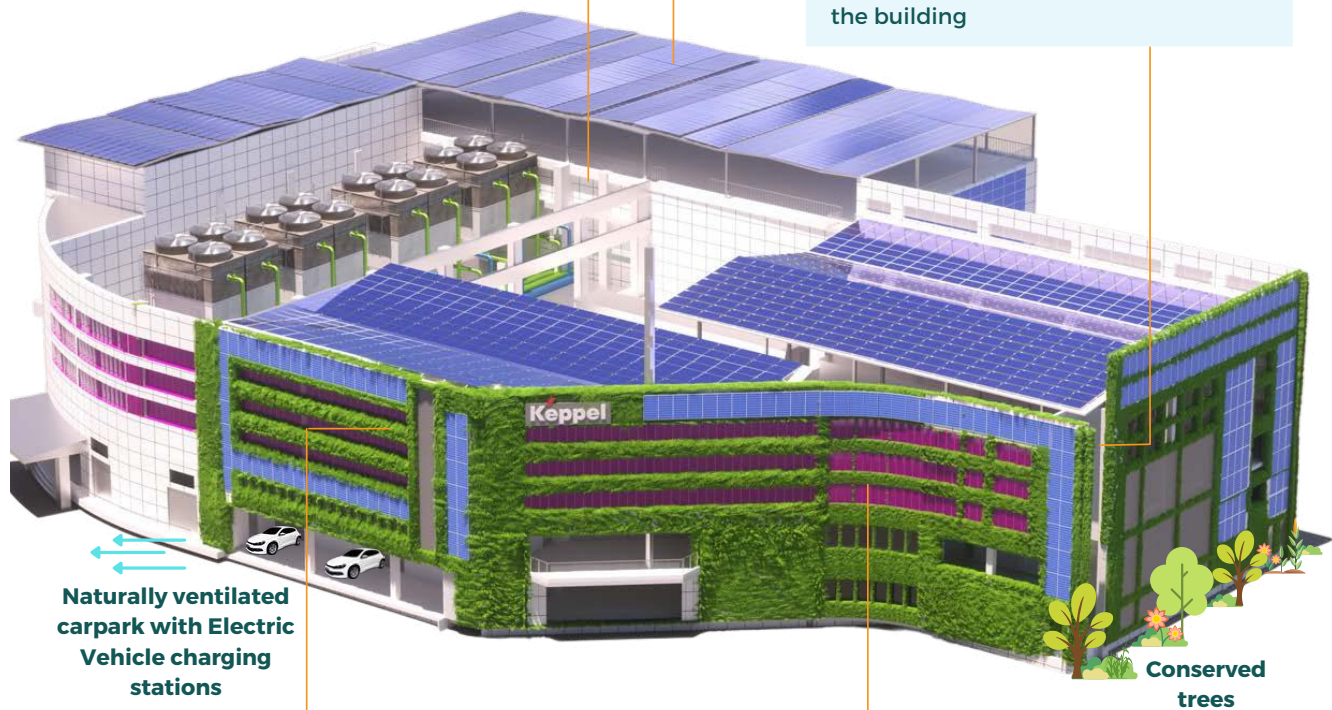
 **245 tonnes**  
reduction in CO2 emissions annually

 **7,000 new trees**  
carbon sequestration capacity

**1** Use of **highly efficient**  Air-Conditioning and Mechanical Ventilation systems, sun pipes, smart sensors and LED lights


**2** **>4,000 square meters**  of solar panels on rooftop and building façade yields more than **200%** of the building's annual energy consumption


**3** Sustainable materials such as  low-volatile organic compound paint, zero-ozone depletion potential refrigerant, and products with **Singapore Green Building Certification** are used for the building



**Naturally ventilated carpark with Electric Vehicle charging stations**

**Conserved trees**

**4** **>910 square meters of vertical greenery and sky gardens** reduces urban heat island effect and incorporates biophilic design in building 

**5** **Rainwater harvesting, automatic drip irrigation with rainwater and NEWater** and efficient water fittings certified to **PUB Water Efficiency Labelling Scheme** reduces the building's water consumption 





*Keppel Infrastructure @ Changi's Operations Nerve Centre offers a real-time bird's eye view of Keppel Infrastructure's cooling operations across Singapore.*

Retrofitting existing buildings for better energy performance can be challenging but Keppel Infrastructure @ Changi, located in Changi Business Park, has been upgraded and modernised from a decade-old building to a model of energy efficiency.

Keppel Infrastructure @ Changi is the first building in Singapore to be conferred the highest accolade of Green Mark Platinum Positive Energy under the new and more stringent Green Mark: 2021 scheme.

### **SINGAPORE'S FIRST POSITIVE ENERGY BUILDING UNDER UPDATED GREEN MARK SCHEME**

Under the updated scheme, a Green Mark Platinum Positive Energy building has at least 115 percent of its energy consumption, including plug load, supplied from onsite renewable sources.

The scheme raises environmental standards in energy performance and places greater emphasis on other important sustainability outcomes, such as enhancing a building's resilience to climate change, adopting smart technologies and creating healthier environments for building users.

Mr Kelvin Wong, CEO of BCA, said, "The Green Mark 2021 scheme was developed to help raise sustainability standards in buildings and support Singapore's push towards a low-carbon built environment. The refreshed scheme launched last year places greater emphasis on criteria such as design for maintainability, reduction of embodied carbon throughout a building's life cycle, integration of smart technologies, and creation of healthier environments for building users.





Keppel Volt electric vehicle chargers are available at Keppel Infrastructure @ Changi.

“We are pleased that Keppel Infrastructure @ Changi has met the requirements to be certified Green Mark Platinum Positive Energy. Such buildings help contribute to Singapore’s targets, such as having 80percent of new developments by Gross Floor Area to be Super Low Energy buildings from 2030. We hope to see more built environment stakeholders pursuing more ambitious sustainability standards as Singapore pushes towards its target to create a low-carbon built environment.”

Keppel Infrastructure’s retrofitting works was aimed at redeveloping Keppel Infrastructure @ Changi into a leading-edge Operations Nerve Centre for the company’s cooling operations as well as one of the greenest buildings in Singapore. This approach reflects Keppel’s commitment to sustainability, as well as Keppel’s determination to contribute to Singapore’s national sustainable development agenda.



### GREEN FEATURES OF KEPPEL INFRASTRUCTURE @ CHANGI

The Keppel Infrastructure @ Changi building, annexed to Keppel DHCS’s Changi District Cooling Systems Plant, was built in 2013 on a site layout of 1.06 ha. The fast-track retrofitting works commenced at the end of 2021 and were completed in May 2022.

Ms Cindy Lim, CEO of Keppel Infrastructure, said, “When we decided to retrofit this near decade-old building at the end of last year, we challenged ourselves to push the envelope and turned it





*Keppel Infrastructure @ Changi is annexed to Keppel DHCS's Changi District Cooling Systems Plant.*

into one of the greenest buildings in Singapore. Our approach reflects both Keppel's commitment to sustainability, as well as our determination to contribute to Singapore's national sustainable development agenda."

Works on the building included upgrading of the high-efficiency air conditioning and mechanical ventilation system, as well as installing smart sensors, LED lights, electric vehicles charging infrastructure and vast vertical greenery. Over 4,000 square metres of photovoltaics were also installed on the rooftop and building façade,

which is expected to yield about 600,000 kWh/year of renewable energy, more than double of the building's consumption. This is equivalent to at least 245 tonnes of CO<sub>2</sub> emission per year and carbon sequestration capacity of more than 7,000 new trees planted.

The building is also fitted with water-efficient fittings to reduce potable water usage and is able to harvest rainwater for irrigation. In addition, the internal fit-outs, road kerbs, wheel stoppers and waterproofing system were constructed using sustainable materials and products.



In addition, as part of the refurbishment of the Keppel Infrastructure @ Changi building, the National Parks Board co-funded the building's vertical greening and biophilic landscaping under the Skyrise Greenery Incentive Scheme (Vertical Greenery), which added over 910 square metres of greenery to the building. This greenery reduces the urban heat island effect, improves the performance of the indoor environment and also enhances the health and mental wellbeing of occupants.

### OPERATIONS NERVE CENTRE

Besides being a high-quality green building, Keppel Infrastructure @ Changi also houses Keppel Infrastructure's Operations Nerve Centre, a mission critical operation nerve centre which enables a real-time bird's eye view of Keppel Infrastructure's cooling operations across Singapore. Over time, the Operations Nerve Centre will have its coverage expanded to Keppel Infrastructure's water, waste treatment and energy plants in Singapore, and later on, to global operations.

By leveraging new digital technology, Keppel Infrastructure is able to monitor its operations remotely. Staff can be deployed as and when necessary, allowing processes to be streamlined and enabling a smaller number of staff to cover a larger area of operations.

As an operations nerve centre, Keppel Infrastructure @ Changi demonstrates how digital technology, artificial intelligence and IoT is harnessed and deployed for remote operations, predictive maintenance and performance optimisation to enhance the efficiency and reliability of energy assets and services.

### ENERGY-AS-A-SERVICE

As a developer and operator of several large-scale infrastructure projects in Singapore and overseas, Keppel Infrastructure is well-poised to leverage its track record and experience to seize opportunities brought on by decarbonisation and digitalisation trends.



Keppel Infrastructure @ Changi is a prime showcase of Keppel Infrastructure's innovative "Energy-as-a-Service" offering, which redefines a building's energy delivery model. In providing Energy-as-a-Service, Keppel Infrastructure is able to offer its array of renewable energy, power, cooling and electric vehicle (EV) charging solutions to building owners on a subscription or service contract basis.





*Keppel Infrastructure @ Changi features greenery that reduces the urban heat island effect, improves the performance of the indoor environment, and enhances the wellbeing and experience of occupants and visitors.*

This delivery model not only maximises energy savings but also improves user experience with access to best-in-class energy solutions and uninterrupted service, without requiring customers to make upfront capital investments for the infrastructure. Furthermore, through the aggregation of energy resources, Keppel Infrastructure's Energy-as-a-Service model can help buildings achieve significant energy savings while

meeting the needs of their tenants sustainably.

Keppel Infrastructure has secured over 30 customers using its Energy-as-a-Service solutions, and is looking to replicate this model in Singapore and beyond, as the Company helps its customers and communities on their journeys to net zero. ✔

**Article contributed by  
Keppel Infrastructure**





CAPITALAND  
SUSTAINABILITY  
X CHALLENGE

— 2023 —

Innovating for a sustainable built environment



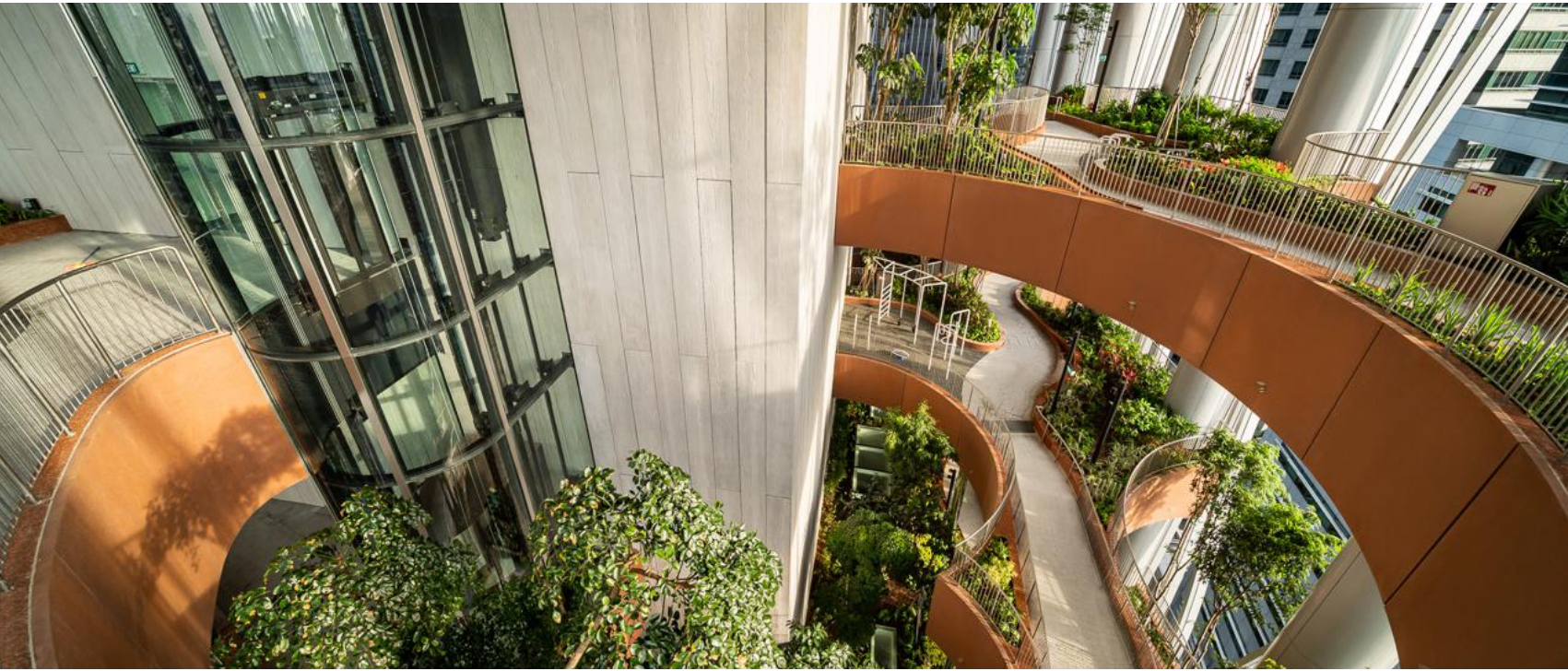


# INNOVATING FOR A SUSTAINABLE BUILT ENVIRONMENT

The CapitaLand Sustainability X Challenge 2023 seeks to uncover green building technology and solutions that can address built environment sustainability challenges







CapitaLand's sustainability journey started over two decades ago, and its business has been grounded in sustainability. CapitaLand's 2030 Sustainability Master Plan (SMP) is a strategic blueprint which outlines its goals and directs its sustainability efforts towards a common purpose, and CapitaLand Investment has also committed to Net Zero for its scope 1 and scope 2 carbon emissions by 2050. With the world adding a New York City's worth of real estate every month, it is imperative to rethink the way we design, build and operate buildings. Key stakeholders, in particular – governments, corporates, investors and financiers, hold the collective influence to act on Net Zero commitments on a grander scale.

Innovation is an important lever to achieving CapitaLand's SMP targets and in its Net Zero journey. CapitaLand is striving to effect change within the built environment sector through innovation, and the CapitaLand Sustainability X Challenge (CSXC) is one of its conduits. CSXC is the first global sustainability-focused innovation challenge for the built environment by a Singapore-based real estate company. Working with both public and private sector partners such as Building and Construction Authority of Singapore (BCA), Enterprise Singapore (EnterpriseSG), DBS etc.,

CapitaLand aims to bring its stakeholders onboard its journey to uncover green building solutions globally to address sustainability challenges in the built sector.

CSXC 2023 is open from now till 1 June 2023, with over S\$1 million in funding to cover the cost of piloting at CapitaLand's global network of properties for up to 10 chosen sustainable building innovations. Successfully piloted innovations may be implemented in CapitaLand's global portfolio across more than 260 cities in over 40 countries, providing startups with the chance to scale up their solutions.

This year, CapitaLand is partnering with some of its tenants to provide a sandbox in their premises for innovations sourced through CSXC. The initiative is aimed at widening the impact of CapitaLand's sustainability efforts to its eco-system partners and accelerate the transition to a climate-resilient built environment. Through the green building innovations, tenants could gain potential energy and water consumption savings, reductions in waste, or improvements in overall health and well-being. More spaces within the Group's properties worldwide will be available for the startups to testbed their solutions.





CapitaLand Investment's  
Chief Sustainability Officer,  
Vinamra Srivastava

Mr Vinamra Srivastava, CapitaLand Investment's Chief Sustainability Officer, said: *"CapitaLand's sustainability journey started over two decades ago. We recognise that innovation is a key lever to achieve our sustainability targets. CSXC offers startups from around the world the opportunity to testbed their innovations for the built environment at our properties as well as tap on leading industry expertise to commercialise and scale up their solutions. Twenty innovations from our first two challenges have been given the opportunity to be piloted at 24 CapitaLand properties in five countries. We are implementing innovations from the successful pilots at several of our properties."*

*"Collective action is necessary to effect meaningful change, and our stakeholders' involvement is integral in our journey to achieve Net Zero emissions by 2050. We have been actively engaging tenants through initiatives such as our green lease programme, providing green fit-out guides and activities to raise awareness on sustainability. By partnering with them to pilot CSXC innovations at their spaces, we hope to work collaboratively to improve their sustainability performance, and leverage innovation to create a better future. We thank BCA, EnterpriseSG, DBS and our other partners for their continued support of CSXC," added Mr Srivastava.*

The challenge addresses four areas:



#### **Low Carbon Transition**

We are searching for solutions to achieve on-site clean energy solutions for our buildings, significantly reduce the energy consumption in existing buildings, or reduce the embodied carbon in our new construction / asset enhancement of our existing buildings.



#### **Water Conservation & Resilience**

With increasing water scarcity, flood risks and more intense rainfall, we are looking for solutions to adapt and mitigate against such risks and reduce our water intensity.



#### **Waste Management & Circular Economy**

We seek a circular economy approach to keep products and materials in continual use and reduce waste. Submitted solutions should help us better manage our waste and implement circular economy solutions.



#### **Health, Safety, & Wellness in Buildings**

The indoor air quality of a building impacts the health and well-being of building users. We seek solutions to enhance wellness of users in our existing buildings.

<sup>1</sup>Figures as of 28 February 2023.



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## Innovating for a Sustainable Built Environment



The CSXC 2022 concluded with a Demo Day in July 2022 featuring 10 finalists pitching and answering live questions from judges on a global telecast. L-R: Dr Koh Poh Koon, Guest-of-Honour, Senior Minister of State for Sustainability and the Environment, and Manpower, Mr Lee Chee Koon, Group CEO of CapitaLand Investment, Mr Michael Petgrave, Co-founder & CEO of CleanAir.ai, Mr Miguel Ko, Chairman of CapitaLand Investment, Mr Rohit Sipahimalani, Chief Judge of CSXC 2022 and Chief Investment Officer, Temasek. On screen: (L) Mr Andrew Zhu, CSO Assistant of Sunman Energy, (R) Mr Robert Grajewski, Senior Vice President of Enexor BioEnergy



New Generation Bio-Energetic Water Saving Stick from Austria which reduces water consumption for irrigation that is testbedded in a trial plot at Aperia in Singapore.

Since its launch in 2020, CSXC has received over 600 entries from 50 countries. Among the selected innovations from CSXC 2021 that have successfully completed its pilot is a New Generation Bio-Energetic Water Saving Stick (WS-Stick) from Austria which reduces water consumption for irrigation. Testbedded in a trial plot at Aperia in Singapore, the WS-Stick facilitates the transfer of moisture from the air to the soil to allow healthy plant growth with a reduction in irrigation water. In the trial, it achieved up to 33% in irrigation water savings.

Another innovation that has completed its pilot at LogisTech in Singapore is CONTINEWM®, a patented ceramic net from Japan which acts as an infrared emitting filter. It achieved up to 51 percent reduction in fan consumption and 16% reduction in cooling load for the two air handling units that were equipped with a total of 50 CONTINEWM® nets. CapitaLand will continue to use these innovations at the respective properties.



CONTINEWM®, a patented ceramic net which acts as an infrared emitting filter from Japan that is testbedded at LogisTech in Singapore.



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## Innovating for a Sustainable Built Environment



A water treatment solution for cooling towers from Singapore that is being testbedded at CapitaGreen in Singapore.

One of the winners from CSXC 2021, a Singapore startup Climatec Corp, is testbedding its unique chemical-free and electricity-free cooling tower water treatment that improves water efficiency by significantly reducing blowdown at CapitaGreen in Singapore. The solution has achieved more than 80 percent reduction in cooling tower blowdown water based on interim results.



An insulating glass retrofit technology from USA that is being testbedded at the first level of Creekside 5 in Portland, Oregon.

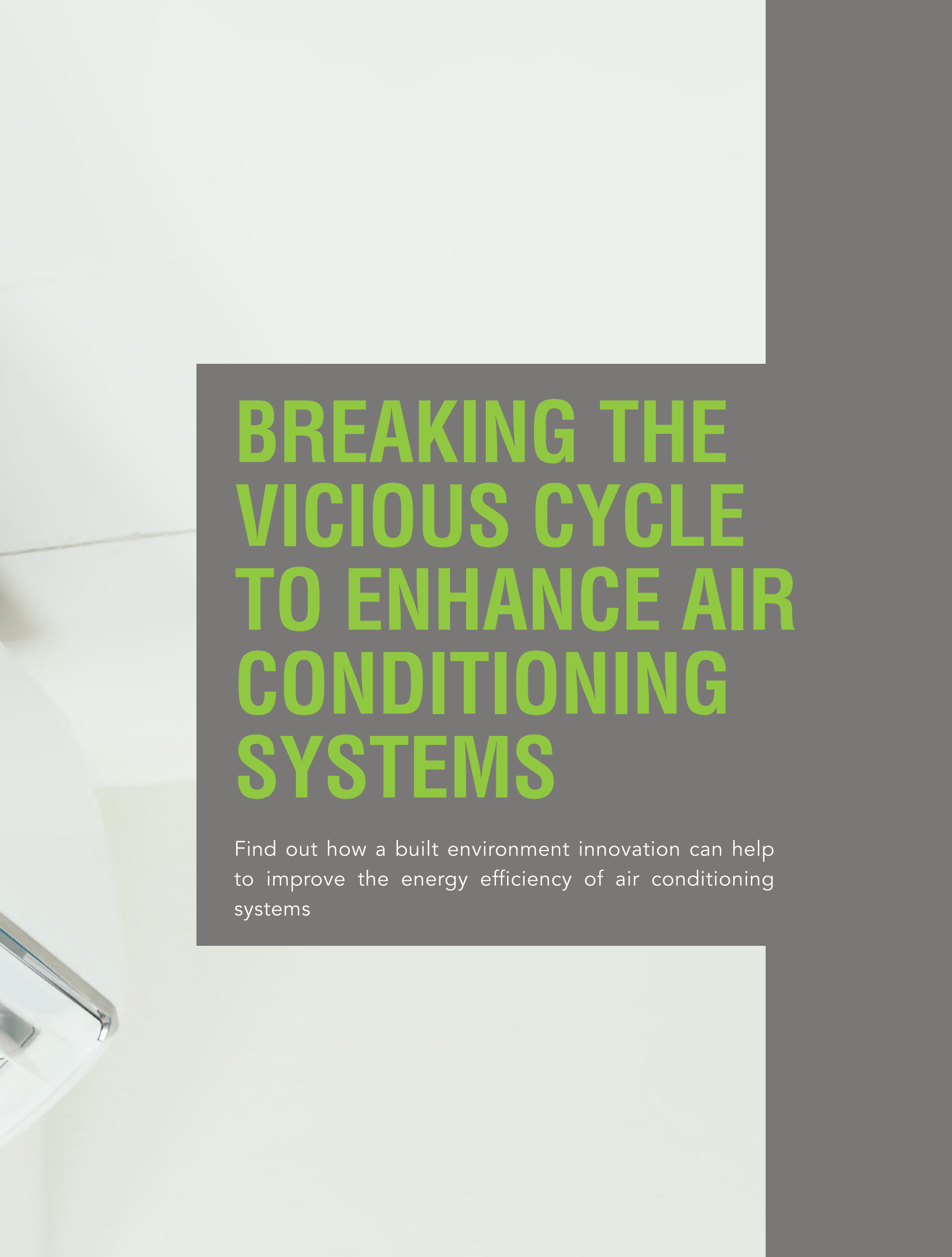
Another winner of CSXC 2021, INOVUES, INC from the USA, is piloting its insulating glass retrofit technology at the first level of Creekside 5, a three-storey building in Creekside Corporate Park in Portland, Oregon. The technology is able to reduce heat gain in buildings during summer and heat loss during winter while lowering the impact of ambient noise, which improves the indoor thermal and acoustic comfort for the occupants.

Latest updates on CSXC and the pilots can be found at [www.capitaland.com/csxc](http://www.capitaland.com/csxc). ✓









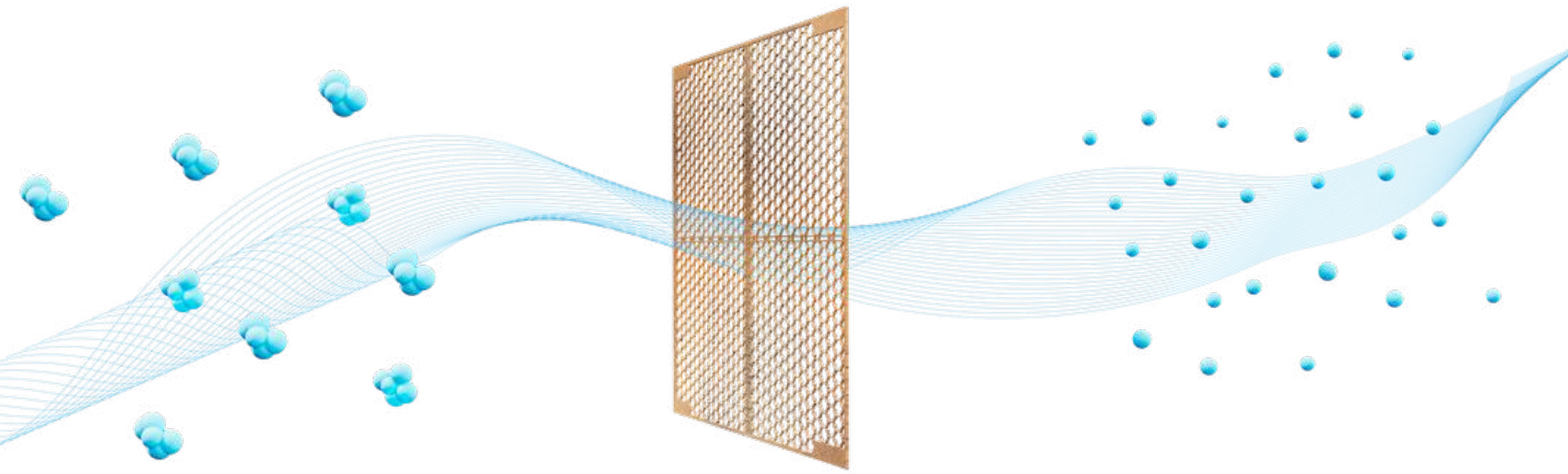
# **BREAKING THE VICIOUS CYCLE TO ENHANCE AIR CONDITIONING SYSTEMS**

Find out how a built environment innovation can help to improve the energy efficiency of air conditioning systems



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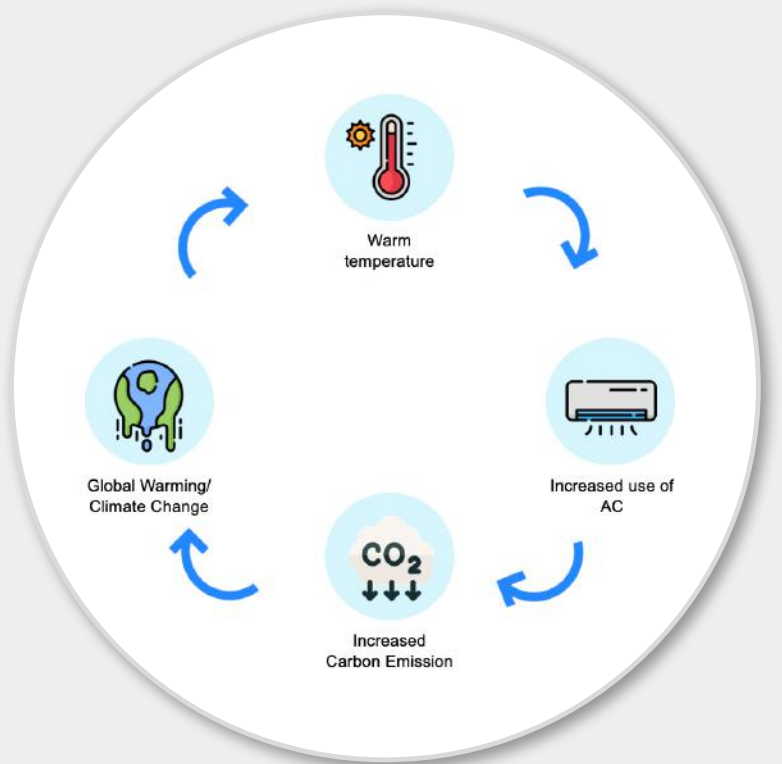
## Breaking the Vicious Cycle to Enhance Air Conditioning Systems



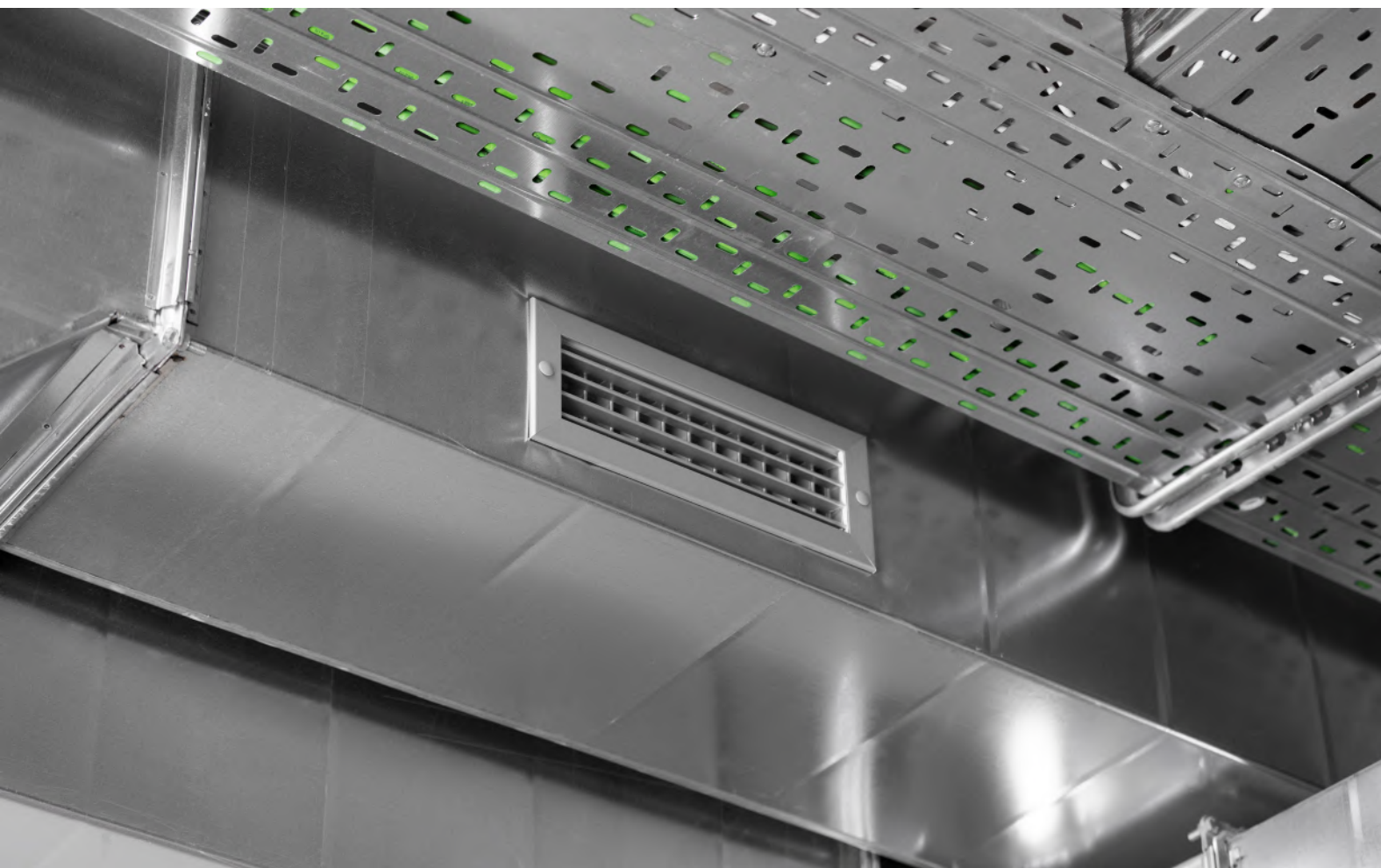
Singapore experiences high temperature and humidity all year round. As a result, air conditioning has become ubiquitous in Singapore’s built environment: workplaces, residential areas, schools, shopping malls, and even transportation infrastructure such as the Mass Rapid Transit (MRT) network all have air conditioning, and usage is only growing with time.

While Singapore’s climate has always been warm, the effects of global warming have resulted in accelerated temperatures, further exacerbating the need for air conditioning. This has created a vicious cycle, where the use of air conditioning contributes to global warming, which in turn leads to even higher temperatures and greater demand for air conditioning.

As buildings account for a significant 40 percent of global energy consumption, it is essential to prioritise sustainable building solutions in the effort to reduce carbon emissions. One critical aspect of sustainable building solutions is the optimisation of air conditioning systems, which play a significant role in the energy efficiency of buildings.







The energy efficiency of air conditioning systems is influenced by various factors, including the set temperature, outdoor temperature, and the performance of the heat exchanger. A key factor in improving energy efficiency is ensuring smooth airflow through the air conditioning system. By securing smoother airflow, the workload on the heat exchanger is reduced, leading to more efficient cooling and reduced energy consumption.

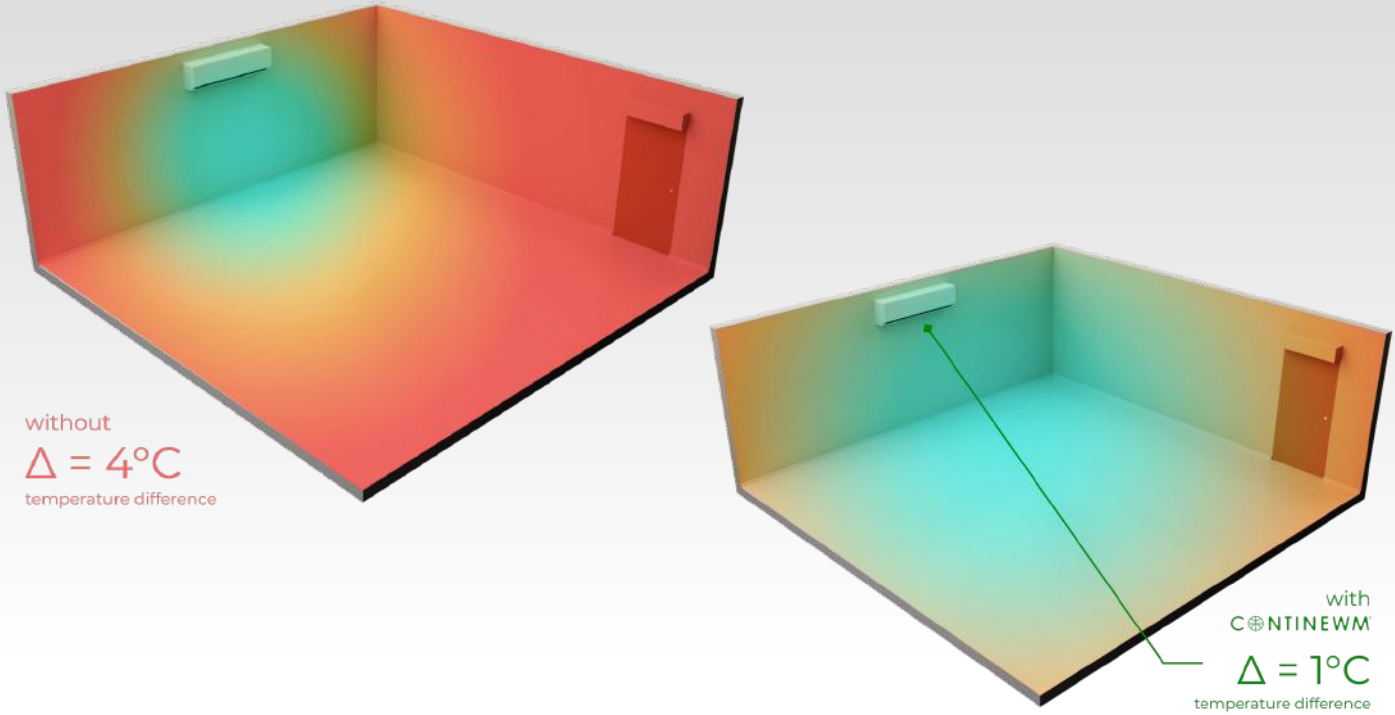
To achieve this, there are various solutions that building designers and operators can implement. SGBC Member Bizsu has developed a modern solution to enhance air conditioning systems

called CONTINEWM® nets. These nets are made of natural ceramics sourced from Japan and have the ability to neutralise electrostatic charges in air conditioners. In simpler terms, this unique feature of the nets helps to break down large and irregular water droplets into finer vapors, leading to improved heat exchange, even temperature distribution, and reduced energy consumption. Moreover, experiments demonstrated that when the solution is not used, there can be an average temperature difference of 4°C over a 10-meter distance from the A/C unit. However, when the nets are used, the average temperature difference over the same distance is approximately 1°C.



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## Breaking the Vicious Cycle to Enhance Air Conditioning Systems



Additionally, the nets have air purification properties that eliminate any lingering odours and other impurities. The dust and impurities in the air carry a positive charge, while the CONTINEWM® nets carry a negative charge. As a result, when these charges come into contact with each other, the air becomes uncharged and settles down instead of passing through the nets.

From a financial standpoint, the implementation of such solutions can boost the economic competitiveness. In office buildings, air conditioning accounts for up to 52 percent of electricity consumption. By installing this solution, businesses can reduce their air conditioning bills by approximately 25 percent with a 2-minute installation process, creating lifetime value.

A study was conducted by Bizsu to test the effectiveness of the nets as part of the CapitaLand Sustainability X Challenge 2021. The study was carried out at LogisTech, a flagship industrial building in Singapore that serves as a testing ground for energy-saving technologies. During

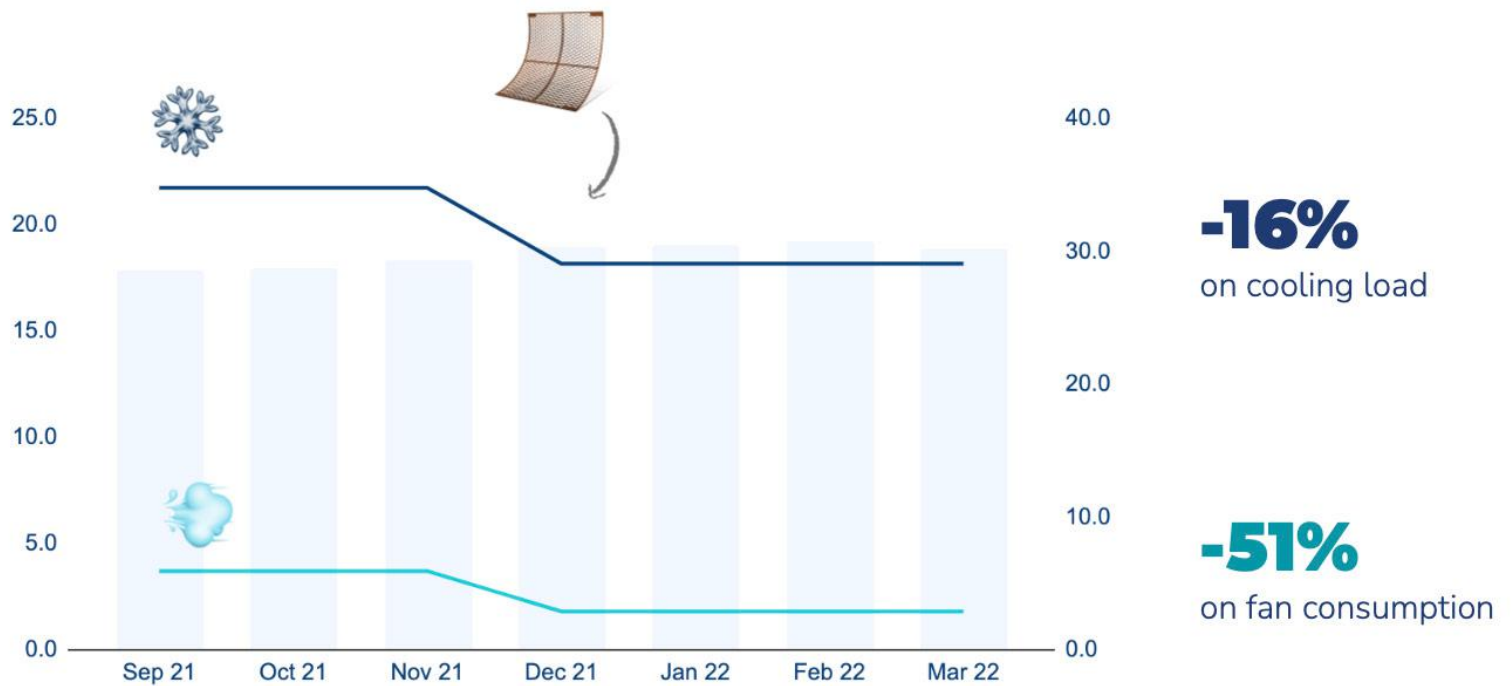


the pilot programme which took place between December 2021 and March 2022, LogisTech underwent air handling unit (AHU) retrofitting and implemented a new building management system (BMS) system to monitor the efficiency of 50 CONTINEWM® nets.



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## Breaking the Vicious Cycle to Enhance Air Conditioning Systems



The study focused on two key parameters: cooling load, measured through energy valves, and fan consumption, measured through power meters. Results showed that despite a rise in outdoor temperatures, there was a significant reduction in cooling load and fan consumption, with a 16 percent reduction in cooling load and a 51 percent reduction in fan consumption.

By focusing on sustainable building solutions and implementing energy-efficient air conditioning systems, building designers and operators can significantly reduce energy consumption while ensuring comfortable living and working environments. Regular maintenance and servicing of these systems are also crucial in ensuring optimal performance and prolonging the life of the system.


In conclusion, with global energy consumption increasing by 1.86 percent annually over the past four decades and a two-fold increase in total energy demand, it is increasingly important to promote the adoption of innovative energy-efficient technologies available in the market. This is particularly important in working towards the Net Zero goal by 2050. In addition to reducing greenhouse gas emissions, switching to energy-efficient technologies can lead to a reduction in energy costs, pollution, and a boost to economic growth in the long run. ✔

**Article contributed by  
Bizsu**







A photograph of a modern, multi-story building with a concrete facade and large glass windows. The building is partially obscured by lush green trees in the foreground. The sky is a clear, bright blue. The text is overlaid on a dark grey rectangular background on the right side of the image.

# GETTING BEHIND THE ENGINEERING COMPLEXITIES IN THREE SIGNATURE SJ CAMPUS INNOVATIONS

Find out more about the green building and engineering features that have been built into the new Surbana Jurong Campus

*Photo Credit: Darren Soh*



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## Getting Behind the Engineering Complexities in Three Signature SJ Campus Innovations



Speak to Aaron Foong, and it's with equal measure of excitement and pride that he describes the structural engineering effort that went into putting in place the visionary design of the SJ campus.

And for the Managing Director at KTP Civil & Structural Engineering who is also the Qualified Person (Structure) for this project, he is particularly eager to talk about three signature elements of the new campus: the cantilevered blocks, the design of the campus' spine walkway and the first thing that visitors will likely see when they're dropped off at the SJ Campus - the entrance canopy.

### THE CAMPUS' INVERTED PYRAMIDS

For Foong, the stacking of the campus' cantilevered blocks are a significant "wow" feature. He describes it as an "upside-down" building. "If you look at the cross-section of most buildings," he explains, "you will see a larger base and the building tapers in as it goes higher. This is norm of stability e.g. pyramids are built that way."

What the SJ campus offers is a "reversal", Foong says. Using block C2 as an example, which he says is the narrowest block of the campus, the proportion of the cantilevered portions of the building that overhang the base constitute almost two-thirds of the entire building footprint.



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## Getting Behind the Engineering Complexities in Three Signature SJ Campus Innovations

While Foong appreciates the philosophy behind the cantilevered design, in particular in its intent in providing significant natural shading as a Super Low Energy Building (SLEB) while offering an open and breath-taking view, the challenge for him was in delivering on that vision via engineering innovation and the use of precast, post-tensioned concrete Vierendeel frames, which involve the use of a series of rectangular frames, in place of the more conventional diagonal beams.

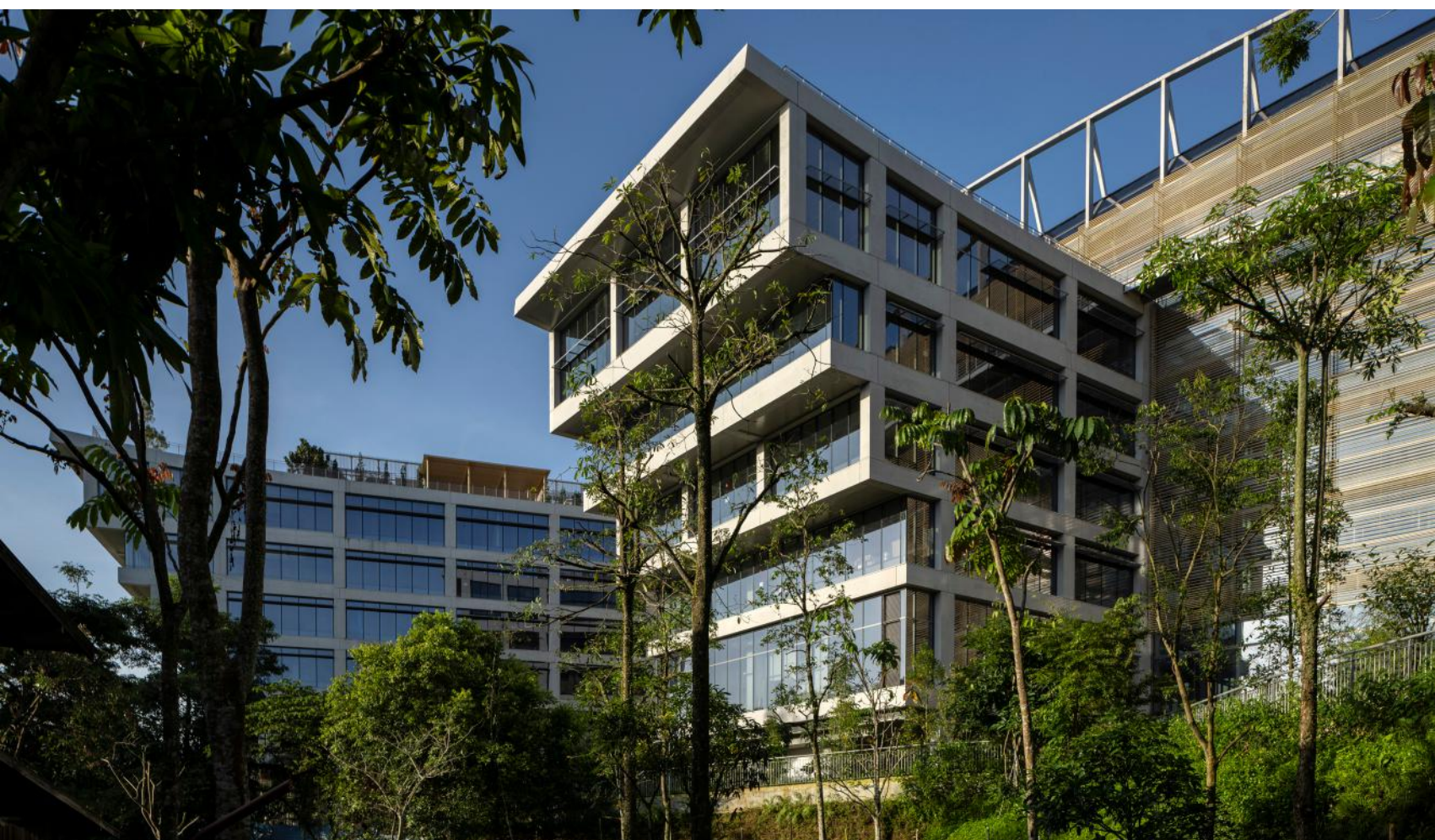
### THE CENTRAL SPINE - COMBINING STRENGTH WITH THE DELICATENESS OF GLASS

The other element of the SJ campus that excites Foong for its embedded engineering innovations is

the central spine that connects not just all 10 blocks of the campus, but which remains open to the public and combines the best of the campus' open and indoor spaces.

He calls it the steel "A" frame, with one side a long sloping glass wall; and in his passionate expositions over the thought that went into building it, the picture he paints is of a highly delicate, sophisticated piece of engineering.

"It's all very elegant," he says, for an entire frame that stands 7-8 storeys high, with one side supported by the concrete block structure and the opposite side supported by a long-span steel arch.





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Getting Behind the Engineering Complexities in Three Signature  
SJ Campus Innovations





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## Getting Behind the Engineering Complexities in Three Signature SJ Campus Innovations



“We don’t have the luxury of applying brute force to the structure, it is a finesse product, the translucent aesthetics is key to the spatial quality of the atrium,” he adds, of the frame that forms the centrepiece for a few other engineering complexities. For example, as the spine linking to the campus’ east and west, it had to be designed to ensure stability against the movements expected of the buildings over time, whether through natural deformation, occupation or environmental wind.

“It is a complex structure with many variations of load paths coming into elements that are very slender, supporting brittle glass, with link bridges connecting all the buildings,” Foong emphasises.

To deal with these challenges, the engineer boils it down to “creative engineering backed by sophisticated, rigorous analysis.”



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## Getting Behind the Engineering Complexities in Three Signature SJ Campus Innovations



### THE CAMPUS DROP-OFF: ELEGANCE AT FIRST SIGHT

For visitors whose first experience of the campus will come via the entrance drop-off, the arching canopy of the drop-off will be an awe-inspiring welcome.

It is an entire cantilever, up to 16 metres in length carrying brittle glass elements, that is quite uniquely not supported by any tie-backs. How this

was achieved was in Foong's view, again down to sophisticated parametric analysis. For regular cantilevers of similar length, Foong estimates that a section depth of about 1 to 1.5 metres would be necessary. But the campus' drop-off canopy was designed at about only 400mm.

The end result, in Foong's mind, is a grand drop-off or porte-cochere that combines innovative design and engineering, with practical shade.



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## Getting Behind the Engineering Complexities in Three Signature SJ Campus Innovations

### COMBINING ENGINEERING AND ARTISTRY

From the sheer audacity of the cantilevered buildings and central spine to the elegance of the smaller footprint of the drop-off, what links all of these innovations is the engineering complexity in delivering on artistry.



As Foong explains it, “the hardest part for a structural engineer, beyond all the rigorous analysis, is still to balance cost-efficiency, productivity and modularisation, to create an elegant functional structural product. You are trying to be a sculptor with sophisticated engineering design.”

And in his sculpting of the SJ campus, Foong exudes a confidence in what the structural engineering behind the complex stands for - it will be an international showcase of what Surbana Jurong can do, in delivering on ground-breaking design, and overcoming constraints with industry-leading complex intricate structural analysis and design. ✓

**Article contributed by  
Aaron Foong  
Managing Director (Urban), Surbana Jurong**





# IMPROVING VENTILATION EFFICIENCY

Lower ACMV carbon footprint can be achieved with a high-efficiency Axial Fan system for ventilation





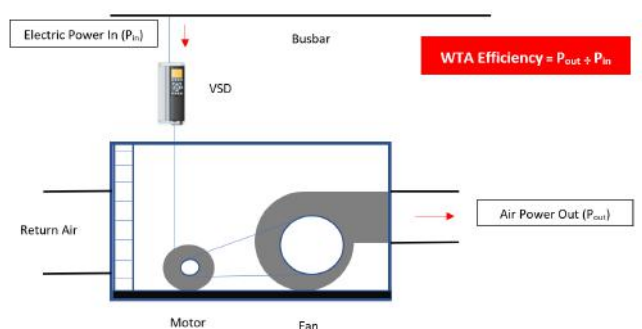




## Improving Ventilation Efficiency

### INTRODUCTION

The ventilation system constitutes an important part of the Air Conditioning & Mechanical Ventilation (ACMV) framework that plays a vital role of circulating the required air at the right pressure in the air-conditioned or clean room spaces to maintain appropriate design conditions. Air Handling Units (AHUs) and ventilation fans are the second most significant energy consumers of an ACMV system after the chillers, accounting for 30-40 percent of the overall ACMV's energy consumption. From the end user or the ACMV system's owner perspective, high "Wire to Air Efficiency" (WTA), maintenance simplicity and lower floor footprint of the ventilation systems are critical in order to minimise the total cost of ownership. In simple words, WTA efficiency means how much air power is generated for every unit of electrical energy consumed.



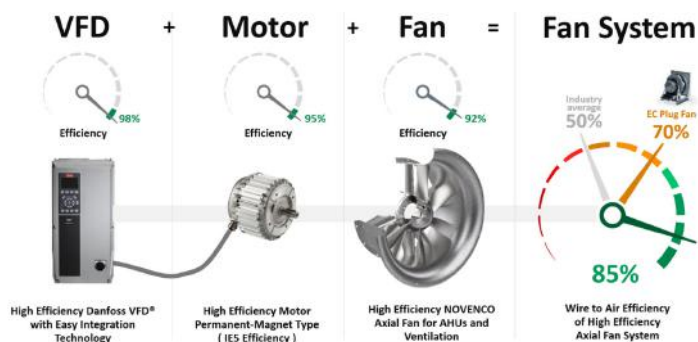
### TRADITIONAL VENTILATION SOLUTIONS

Traditionally, AHUs utilise belt-driven centrifugal fans for air circulation in the air-conditioned spaces of commercial buildings. However, belt-driven centrifugal fans with backward curved aerofoil design blades driven by IE4 motors typically deliver 50-60 percent WTA efficiency. In the last two decades, the ACMV industry started to see the utilisation of Plug Fans in the AHUs which eliminates belt losses, thus improving WTA efficiency. Typically, the WTA efficiency of Plug Fans driven by IE4 motors is in the range of 63-68 percent. Also, usage of Plug Fans eliminated the belt dust issues which are important for clean room applications. Plug Fans driven by electronically commutated (EC) motors that have IE4 or IE5 efficiencies, typically have WTA efficiencies in the range of 65-70 percent. However,

EC Plug Fans have maintenance complexities as any component failure necessitates replacement of the whole assembly comprising the fan, motor and speed controller. Therefore, individual component level repairs in EC Plug Fans remain a significant challenge. Also, AHUs driven by multiple EC Plug Fans have some efficiency challenges due to air turbulence zones within the fans' spaces.

### MODERN HIGH EFFICIENCY AXIAL FAN VENTILATION SOLUTION

Axial Flow Fans have been extensively utilised worldwide for car park, basement & tunnel ventilation and cooling tower applications. Europe has been using Axial Flow Fans in AHUs for the past several decades. Axial Flow Fans technology has advanced significantly in the last decade and today, these fans have very high efficiency, develop high total pressure and produce low noise thus making them suitable for almost all AHU applications. Modern high-efficiency ventilation solutions utilise high-efficiency Axial Fans coupled to IE5 permanent magnet motors and advanced Variable Speed Drives that have high efficiency, easy integration technology and features focused on high uptime.



Typical WTA efficiency of Axial Flow Fan systems driven by IE4 or IE5 motors is in the range of 70-75 percent. Some Axial Fan manufacturers have advanced their technology to a significantly higher level, delivering WTA efficiency of 80-85 percent which is typically 15-25 percent better than the EC Plug Fans. Additionally, the floor area requirements of AHUs using High Efficiency Axial Fan Systems is lower, freeing up the space for commercial activities. Higher efficiencies also translate to lower sound levels of the Axial Fans compared to EC Plug Fans.



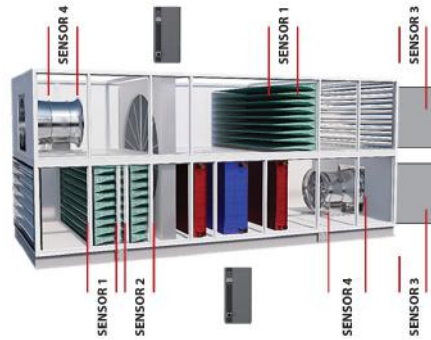
## Improving Ventilation Efficiency

### INFLUENCE OF SYSTEM EFFECT ON WTA EFFICIENCY

It should however be noted that the published WTA efficiency figures for various types of fan systems are under ideal test laboratory conditions where the resistance to air flow at the entry and exit sides of the fans are minimal. In real life situations, fans are installed inside an AHU or in a room where they experience significantly higher resistance depending on the geometry of the installation thus lowering their WTA efficiencies. This influence of the geometry of the installation on the fan systems leading to the lowering of the published WTA efficiency figures is referred to as a "system effect". Therefore, higher published WTA efficiency and lower system effect ensure lower energy consumption of a fan system.

### HIGHER WTA EFFICIENCY + LOWER SYSTEM EFFECT = LOWER ENERGY CONSUMPTION

Depending on the aerodynamic performance, different fans have varying levels of system effects for the same geometry of installation. In general, belt-driven centrifugal fans have very high system effect and EC Plug Fans have a somewhat lower system effect. However, the system effect of Axial Fans is much lower than that of the belt-driven centrifugal fans or the EC Plug fans which significantly lowers their energy consumption than what is reflected by comparing the published WTA efficiency data alone.



Technologically-advanced high-efficiency Axial Fans typically consume 45-55 percent lower energy as compared to belt-driven centrifugal fans and 20-35 percent

lower energy compared to EC Plug Fans due to their much higher WTA efficiencies and much lower system effect. The red coloured air streams in the illustration below represents efficiency loss due to system effect in belt-driven centrifugal fans and EC Plug Fans.

High-efficiency Axial Fan systems are integrated with modern Variable Speed Drives (VSD) that have advanced built-in features such as Condition Based Monitoring, filter cleanliness monitoring, intelligent heat management and automatic motor adaptation. These help to ensure:

- easy integration to permanent magnet motors (IE5 motors)
- highest levels of motor-drive efficiency
- high uptime of the AHUs
- maximisation of the AHUs' WTA efficiency and lowest energy losses
- maintenance simplicity as individual component level repairs are possible

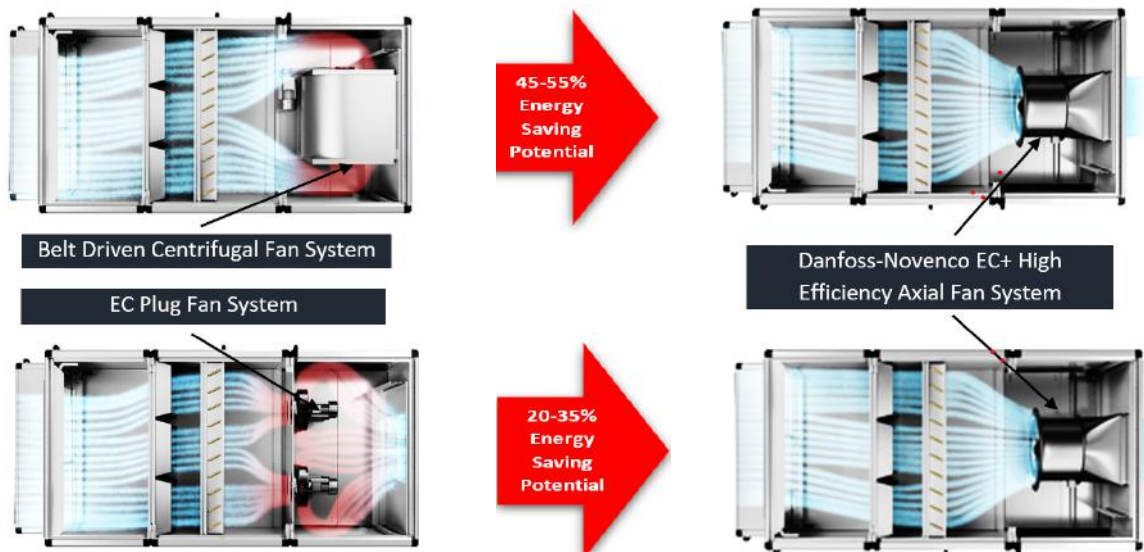


Image source: NOVENCO





### CASE STUDY: KEPPEL BAY TOWER, SINGAPORE

Keppel Bay Tower, a landmark building in Singapore, was certified as the country's first Green Mark Platinum (Zero Energy) commercial building by the Building and Construction Authority of Singapore at the end of 2020. The successful application of five energy saving technologies in the commercial building delivered annual energy savings of over 2.2 million kWh. Impressive energy savings of over 45 percent were delivered in the building's AHUs by retrofitting them with high-efficiency Axial Fan systems which contributed significantly to the overall energy savings. Information on the Keppel's journey to achieve the Singapore's first BCA Green Mark Platinum Zero Energy commercial building certification can be [found here](#).

Over 1,200 belt-driven AHUs retrofitted in the South East Asia and India regions over the last few years with high efficiency Axial Fan systems have delivered energy savings of 45-55 percent. Likewise, retrofits of several EC Plug Fans driven AHUs have delivered 20-35 percent energy savings.

### CONCLUSION

Ventilation systems consume significant energy. One of the important measures to reduce the carbon footprint of an ACMV is to improve the WTA efficiency of the ventilation system. AHUs using a traditional belt-driven fan system have WTA efficiency in the region of 50-60 percent, while EC Plug Fan driven AHUs have WTA efficiency of around 65-70 percent. Making use of modern high-efficiency Axial Fan systems improve the WTA efficiency of AHUs and ventilation systems



## Improving Ventilation Efficiency



### KEPPEL BAY TOWER AHU RETROFIT CASE STUDY IN PICTURES

- 1 – 2: Old fan system being removed.
- 3 – 4: New NOVENCO fan being installed.
- 5 – 6: Advanced Danfoss VSD installed and commissioned.

to 80-85 percent. Due to the significantly higher WTA efficiency and much lower system effect, high efficiency Axial Fan system driven AHUs consume up to 60 percent lower energy compared to belt-driven AHUs and up to 35 percent lower energy compared to EC Plug Fans driven AHUs and therefore contribute significantly in lowering the the carbon footprint of the ACMV system and by extension, the building. Also, the sound level of the high efficiency Axial Fan driven AHUs is lower.

In today's context where lower carbon emissions, lower operating costs, lower floor footprints and lower maintenance complexities are becoming increasingly important, extensive utilisation of a high-efficiency axial fan system in AHUs and ventilation systems is a significant leap in the right direction. ✓

**Contributed by  
Deepinder Chani**

*Director-Commercial Buildings & Refrigeration (Asia Pacific & India)  
Danfoss Industries Pvt Ltd.*







# HITTING THE GREEN MARK THROUGH SMART LIGHTING

Lighting the way towards higher green building certification standards





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## Hitting the Green Mark through Smart Lighting



To help Singapore further raise sustainability standards for its built environment, the Building and Construction Authority (BCA) introduced the Green Mark 2021 (GM 2021) on 1 November 2021.

The tightened scheme is aimed at enhancing overall environmental performance and driving decarbonisation in the built environment. It includes a set of revised energy-efficiency standards and re-certification process to spur greater reduction in energy consumption and carbon emissions from buildings.

Under the new standard, energy efficiency via demand reduction (w/m<sup>2</sup>) and consumption reduction (KWhrs) has become the singular determinant of a building's rating. The updated scheme also recognises sustainable parameters via badge of honour for health & wellbeing, whole life carbon, resilience, maintainability and intelligence.

Although it has been more than a year since GM 2021 has taken effect, not all buildings in Singapore have been able to stay on the mark. What are the primary considerations to obtain the GM 2021 recognition? Would adoption of green solutions make a difference to the scoring and lead to the desired outcome? Signify Singapore shares a breakdown of the key considerations, with a special emphasis on lighting.

### ENERGY EFFICIENCY (EE)

#### Demand reduction

Be it developing a new building or retrofitting an existing one, achieving the targeted Lighting Power Density (LPD) shown in the table below is not an easy task.

| Green Mark Award | LPD in W/m <sup>2</sup> |
|------------------|-------------------------|
| SLEB             | 5.0                     |
| Platinum         | 5.5                     |
| Gold Plus        | 6.0                     |



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## Hitting the Green Mark through Smart Lighting

As it is challenging to achieve these LPDs while maintaining the required uniformity and glare limit, it is important to incorporate high-efficiency LED luminaires with sophisticated optics and control systems. Look for experienced designers who are able to help architects, mechanical & electrical consultants and facility managers to achieve the required scoring of the scheme.

### Consumption reduction

Dimming or switching off lights through sensors that detect occupancy and daylight penetration has a direct impact on consumption reduction. A retrofit-ready wireless control system will enable multi-site management and monitoring of lighting infrastructure suitable for large spaces.

Such a system will monitor temperature, air quality, noise level and relative humidity to optimise the environment for end users. It can also guide employees to uncrowded areas of a building and enable them to reserve a space based on acceptable occupancy level while maintaining physical distance. Small- and medium- sized offices or shops can opt for a stand-alone control system.

### SUSTAINABILITY BADGES

In addition to mandatory energy efficiency, buildings can also obtain the decorated Sustainability badge by scoring 10 points in each of the following categories.

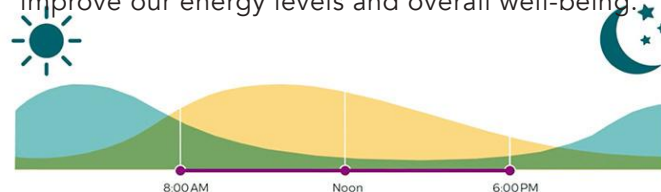
#### Health & Well-being

It is possible to achieve a score of 3 out of 10 points in this category, with adoption of circadian lighting, high colour rendering index and Ultraviolet-C (UV-C) lamps in aircon ducts.

Humans have internal clocks in the brain that synchronise physiological functions with dynamic lighting levels. When inside a building, it can be disturbed due to non-exposure to direct daylight.

Circadian rhythm plays a major role in good sleep quality, cognitive performance and immune system. Lighting is connected with stimulating the most important hormones of cortisol (that helps to meet stress) and avoiding the sleep-inducing effects of the other hormone, melatonin, so that we can

stay more alert during work hours and get better sleep at night. The art of balancing the correct type of light by replicating natural variations in colour temperature at the correct time of day helps improve our energy levels and overall well-being.



■ Cortisol  
■ Melatonin

Image source: Signify Singapore

The other category in Health & Wellbeing, known as 'Restorative and Community Spaces', refers to a range of spaces in a building catered for a broad spectrum of human activities designed for resting, relaxing or community bonding. These spaces help to reduce stress and provide conducive places to work or rest.

To further enhance this relaxation environment while gaining an additional point in this category, builders can opt for energy-efficient colour changing lights. These solutions can promote quality sleep by automatically dimming the lights before bed and gradually brightening the lights when morning arrives to allow for a gentle waking up process.

#### Maintainability

The quality of lighting products is extremely important and the following factors must be taken into account: absence of light flickering and minimum colour shift – which contributes to 2.5 out of 10 points. Good lighting technology should also have a long-term lifespan, using sustainable materials that limit wastage, facilitate recycling and automatically contribute to the circular economy.





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## Hitting the Green Mark through Smart Lighting

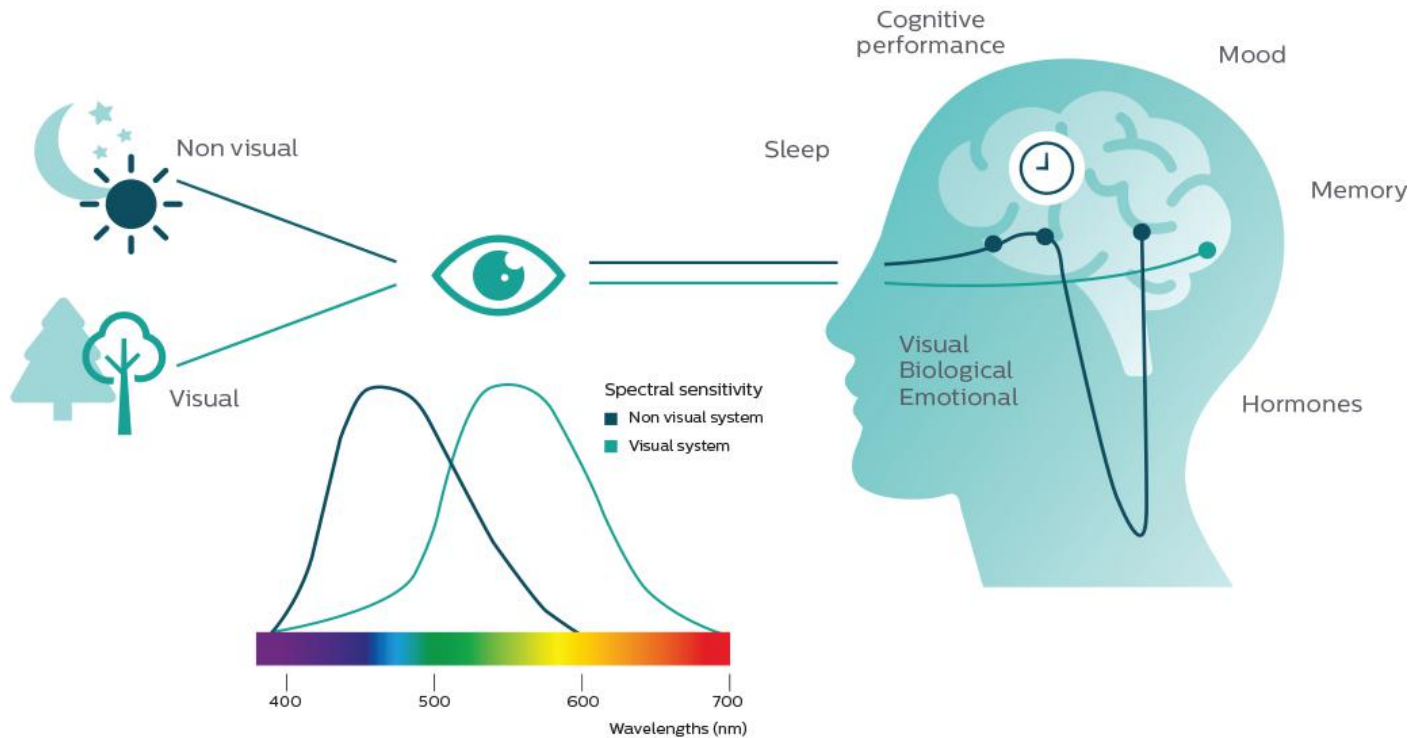


Image source: Signify Singapore

### Intelligence

Smart control lighting systems can further complement point scoring so it is advisable to look into the following parameters.

#### MAXIMUM ENERGY SAVINGS FOR BUILDINGS

Consider LED luminaires and control systems as they help buildings achieve over 70 per cent savings in Building Operating cost (OPEX). Facility managers can enjoy peace of mind due to the luminaires' lifetime of more than 50,000 hours, equivalent to about 14 years in an office, with little maintenance expense.

#### UV-C FOR THE PREVENTION OF FUTURE PANDEMICS AT WORKPLACES

The emergence of COVID-19 has also underscored the profound impact of the built environment on our health and well-being. The quality of the air we breathe, the water we drink and the cleanliness

of the surfaces we touch can all affect our health. Generally, we are always at some risk of contracting and spreading viruses in enclosed, indoor areas like the office, factory, restaurant and schools.

UV-C is a known disinfectant for air, surfaces, objects and water that can help mitigate the risk of falling sick. This technology has been proven to be effective and safe in eliminating all bacteria and viruses tested to date, including the SARS-CoV-2 virus.

Builders can adopt a broad range of UV-C lamps and luminaires for a variety of applications and purposes. For instance, consider air-con ducts and indirect UV-C systems for workplaces, classrooms and eateries; and portable UV-C desk lamps for homes. UV-C trolleys can be used to disinfect big, vacated rooms overnight and small portable UV-C chambers to disinfect objects like a mobile phone, a car key and a computer mouse.



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## Hitting the Green Mark through Smart Lighting

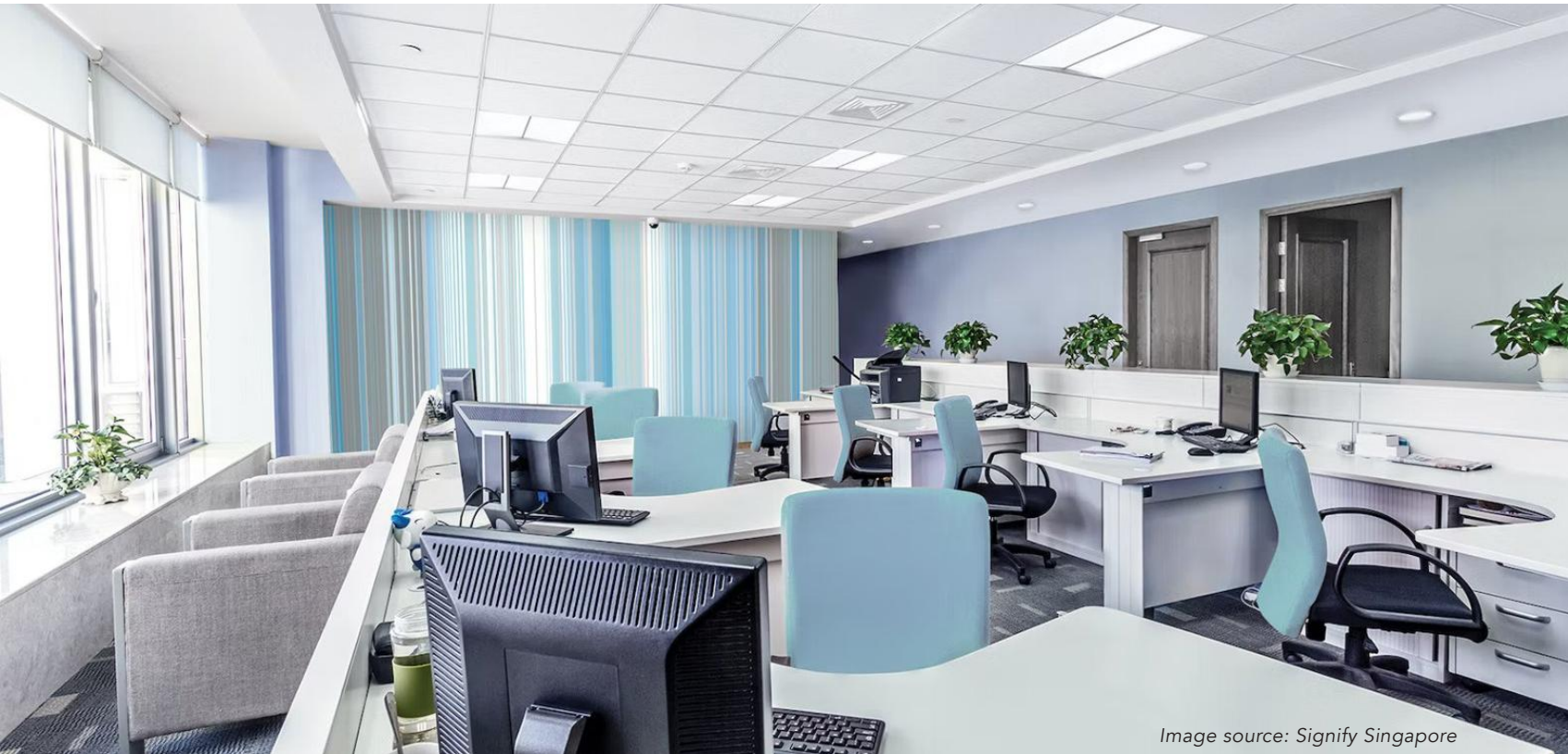


Image source: Signify Singapore

Signify's lighting in an office space.



Image source: Signify Singapore

Upper air UV-C

### LIGHT MATTERS

Achieving GM 2021 certification is not an end in itself but a channel for the built environment to transition towards a low-carbon, sustainable future. The adoption of the right lighting, a central component of any building or structure, is an essential strategy in the pursuit of a net zero future. ✔

**Article contributed by  
Signify Singapore**









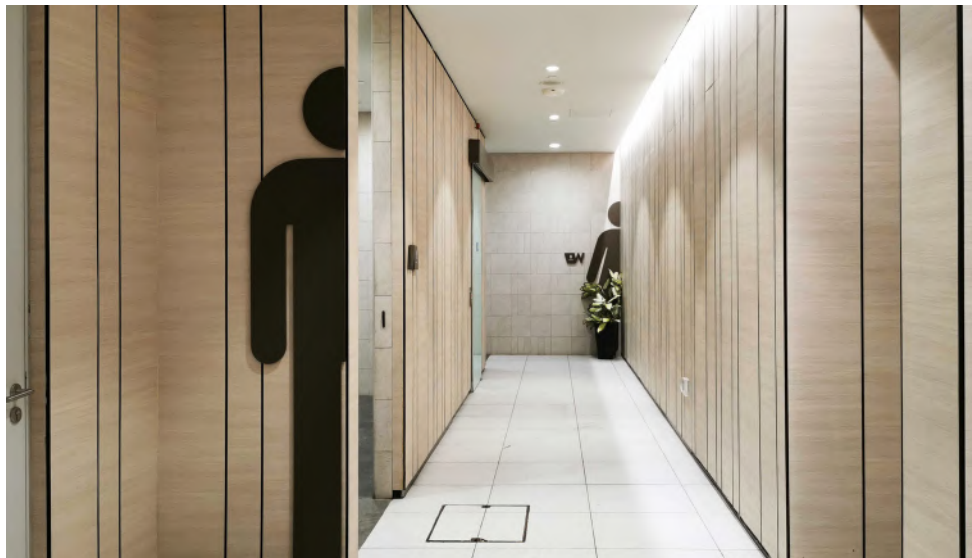
# OPTIMISING MANPOWER WITH ON-DEMAND CLEANING THROUGH SMART WASHROOM MANAGEMENT

Find out how SGBC Members SIMPPLE and UnaBiz helped Downtown East enhance their manpower deployment and achieve the 5-Star Happy Toilet Programme Certification



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## Optimising Manpower with On-Demand Cleaning through Smart Washroom Management



*Downtown East's 5-star Happy Toilet Certification*

Smart Toilet Management, also known as Smart Washroom Management, is a critical part of Facilities Management. By deploying simple Internet of Things (IoT) solutions such as sensors, facility managers can understand and improve operational processes and the washroom experience for its tenants. This is especially important as poor toilet hygiene, sanitation and waste disposal will affect public health.

At NTUC Club's Downtown East, SIMPPLE and SGBC Member UnaBiz have been working together since 2019 to deploy and manage an end-to-end, full-cycle, closed-loop Smart Washroom and workflow automation solution for twelve of its washroom facilities.

Welcoming over 1 million visitors monthly at its facilities and spanning a total of 147,000 square metres with facilities that include D'Resort, the Wild Wild Wet water park, retail, dining, entertainment, and MICE facilities, Downtown East required a solution for early cleanliness detection.

The management's main aims were to enhance guests' experience whilst optimising cleaning resources across the property. Since the implementation of the Smart Washroom solution, Downtown East has logged a 50 percent decrease in the number of toilet-related complaints and increased the customer service quality to an all-time high.



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### HOW PRE-EMPTIVE AND ON-DEMAND CLEANING WORKS AT DOWNTOWN EAST

The Smart Washroom solution works over low power consumption and wireless data connectivity. A hygiene level indicator comprises data from UnaBiz's connected IoT ammonia sensors that detect odour levels, people counters for traffic flow count, and feedback panels that capture ratings of guests' experience to monitor the cleanliness of the facilities.

IoT sensor data is then transmitted over the Sigfox 0G technology, a low-power wide-area network, owned and operated by UnaBiz to SIMPPLE's software by SIMPPLE, an integrated mobile and web-based facilities management platform.

The unified dashboard on the software displays real-time updates on the environment, status and

location of the workforce, specified routines and ad hoc tasks, and activates an intelligent seamless workflow of on-demand cleaning activities when pre-set thresholds are breached. The system also blends sensor and restroom feedback data for data analytics.

### GREEN SENSORS AND THE HAPPY TOILET PROGRAMME

Several of UnaBiz's sensors are awarded the Very Good rating (2-ticks) under the Singapore Green Building Product (SGBP) certification scheme administered by the Singapore Green Building Council (SGBC) and the People Counter and Ammonia Sensors have been jointly certified by the Restroom Association (Singapore) under the Happy Toilet Programme's (HTP) Detect, Feedback, Eliminate & Clean (DFEC) smart solutions.



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*Ammonia sensors by UnaBiz detect and report odour levels for usage-based cleaning.*

As testament to NTUC Club's commitment to enhance guest experiences, Downtown East has received the 5-star HTP certification from the Restroom Association (Singapore), supported by the National Environment Agency (NEA). A 5-star premium rating is given to toilets which are equipped with eco-friendly and/or user-friendly facilities, and meet the basic cleanliness, hygiene, and amenities standards, among other criteria.

Felice Low, Infrastructure Director of NTUC Club, shared "Aligned with the Singapore Green Plan 2030, NTUC Club aims to adopt proven smart and green technologies across our premises. We are happy to see our efforts from 2019 bearing fruit at Downtown East where operations become more data driven. We hope to roll this out successfully to other sites and continue to champion Integrated Facilities Management technology adoption to improve workforce and workflow productivity, enhance our guest experiences, and lead by example to be the best-in-class in Singapore."

"The best IoT experience is one that is straightforward and has the best fit-for-purpose. As companies seek to transform themselves with new

technologies, they are confronted by an incredibly complex and diverse marketplace", remarked Jonathan Tan, Managing Director, UnaBiz Singapore.

He adds, "Wireless Networks act as the backbone that brings IoT to life. Since there is no one connectivity solution to all problems, UnaBiz provides a range of different low-power wide-area (Sigfox, LoRaWAN®, NB-IoT, LTE-M) network services that best meet your business's IoT requirements. Our solutions are characterised by simplicity and energy-efficiency. In recent months, UnaBiz has received numerous requests from multinational corporations and government agencies seeking to monitor their consumption of electricity and water, and quality of indoor air. Championing sustainable solutions, and attaining green building certifications in the built environment is surely the way forward, and in many organisations' green roadmap. As a company with environmental awareness, we let little go to waste. That's why we champion low-power solutions that save you time and save our planet." . 🟢

**Article Contributed by  
UnaBiz Singapore**



# green means



# comfortable

## What's a Green Home?

It goes beyond living in a certified green building, it's about reframing your lifestyle and how you live at home to create a more comfortable and healthier home that's **good for the environment and you.**

Here are some small changes you can do for your home that could make a big difference:

## GO natural

Maximise the natural resources around you.

Use a fan in the day

save up to **10-30%** energy consumption

Get some potted plants

increase productivity by **up to 15%**

Open your windows

improve indoor air quality for **better sleep and health**

## GO healthy

Make decisions that optimise the home for your body.

Choose light colour temperature

set the right **mood** in each room

Choose Low-VOC materials

**1000x** reduction in indoor air pollutant levels

Clean AC filters every month

improve **air quality** & save electric bills

## GO smart

Use smart technology and energy-efficient appliances.

Use smart window tinting

**84%** drop in symptoms like eyestrain, headaches

Get an energy efficient fridge

save as much as **10%** on electricity bills

Use smart home control systems

save up to **20%** energy consumption for your home

## Build Green Into Your Home

There are a number of things you can do in your home to build green into your home, and often times **small actions can create a big difference.** And when you're ready to renovate your home to make bigger changes, be sure to check out the various green home renovation loans offered by local banks.

Visit [greenbuildings.sg](http://greenbuildings.sg) to learn more about what you can do for your home.







## UPLIFT YOUR GREEN BUILDING & SUSTAINABILITY KNOWLEDGE

The Green Mark Associate foundation-level accreditation, managed by the Singapore Green Building Council (SGBC), signals a working knowledge of green building fundamentals, the Singapore built environment's legislative framework as well as sustainability trends, which can open doors to a growing pool of job opportunities available in green building and sustainability.

If you are a new industry entrant or a non-technical built environment related professional seeking to pursue a career in the greening of the built environment or demonstrate competency in the fundamentals of Singapore green building, the Green Mark Associate accreditation will uplift and enhance your professional development.



[Find out more](https://www.sgbc.sg/sgbc-certifications/green-mark-associate)

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