

SG GREEN



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FORGING AHEAD, EMERGING STRONGER

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FORGING AHEAD, EMERGING STRONGER

Resilience rises from adversity, and this was put on full display in 2020 when the world grappled with the global pandemic. In spite of the challenging circumstances brought on by one of the biggest crises the world has ever faced, humanity has proved to be an adaptable, resilient species.

The world's coronavirus response also laid bare a stark truth: sweeping affirmative action can be undertaken on an immense scale if the nations of the world worked together. For a few months in early 2020, people living in certain parts of the planet experienced substantially better air quality brought about by nationally-instituted pauses in heavy industrial activity. This shows the huge impact that can be made when people band together and work towards a common, shared goal. If such global action can be galvanised to combat the pandemic, the same can be done for the existential crisis of climate change.

The Singapore built environment sector, quite literally, came to a standstill when the pandemic hit. Construction projects were paused, industry activities were shelved and the entire industry was caught unprepared, more so than other industries that are more digitally-inclined. But the sector proved itself to be hardy, flexible and resilient, taking full advantage of digitalisation to ensure business continuity as well as looking into new, advanced technologies to forge ahead and emerge stronger after the brunt of the pandemic blows over.

In the 12th issue of SG Green, we put on display a collection of stories that embodies resilience in the face of adversity. Even with the challenges brought on by the pandemic, SGBC Founding Member Keppel Land Limited transformed Keppel Bay Tower into Singapore's first-ever Green Mark Platinum (Zero Energy) Commercial Building, making use of several green building innovations to achieve the momentous milestone.

To accelerate positive outcomes in the new normal, the industry needs to collaborate and count on one another to fill gaps and harness expertise. Singapore Polytechnic, one of the nation's most established institutes of higher learning, is ready to support the built environment sector with a suite of laboratories and centres of excellence aimed at creating a powerful ecosystem to enable stronger efforts in promoting sustainable practices to the rest of the built environment. More details on SP's industry-centric capabilities can be read in this issue.

As we gear up for a very different business-as-usual and the acceleration of national sustainability efforts through the Singapore Green Plan 2030 and the Singapore Green Building Masterplan, the built environment sector must continue to forge ahead and emerge stronger. We hope that the magazine will give you an idea of some of the innovative technologies that are out there in the industry.

Yours Sincerely,
SG Green Editorial Team





KEPPEL BAY TOWER: A GREEN BUILDING SHOWCASE

On the historically rich landmark, previously known as Keppel Harbour, sits Keppel Bay, one of Singapore's most acclaimed waterfront precincts, strategically located within the Greater Southern Waterfront.

Standing tall in this coveted waterfront locale is Keppel Bay Tower, a Grade A office building operated by Keppel Land. Featuring leading-edge technological innovations, the eco-icon is the first commercial building in Singapore to be certified as a Green Mark Platinum (Zero Energy) building by the Building and Construction Authority (BCA), paving the way for more zero energy commercial buildings in Singapore in the years to come.





SINGAPORE'S FIRST GREEN MARK PLATINUM (ZERO ENERGY) COMMERCIAL BUILDING

As a leading sustainable company, Keppel Land creates innovative live-work-play environments of enduring value, celebrated for their innovation and green designs, and is committed to developing and managing low-carbon buildings.

To push the envelope of environmental sustainability, Keppel Land sought to leverage technological innovations to transform Keppel Bay Tower into Singapore's first super low-energy high-rise existing commercial building.

Unlike a new building which can be designed with new energy-efficient technologies from the onset, it is much more difficult to implement such technologies in an existing operating building,

such as the almost 20-year-old Keppel Bay Tower, where the infrastructure is already in place, as well as to improve upon its high Green Mark Platinum baseline. Having to implement the improvement works without disrupting the building's ongoing operations also compounded the challenges. Therefore, Keppel Land had to identify leading-edge technologies that were suitable for an existing commercial building to be implemented in Keppel Bay Tower, and, for the first time, integrate the various technologies as well.

In 2018, the company leveraged a grant from the BCA to testbed five new and emerging energy-efficient technologies at Keppel Bay Tower, which satisfied various criteria including technological novelty, cost effectiveness, ease of implementation and application, as well as scalability. The aim



was to reduce the building's energy consumption significantly and improve its energy efficiency by 20 percent from its already very energy-efficient Green Mark Platinum baseline.

LEVERAGING SMART AND INNOVATIVE SOLUTIONS

The energy-efficient technologies piloted at Keppel Bay Tower were:

1 IES Intelligent building control system

The smart building control system employs a high-precision physics-based simulation engine that utilises high computing capability and available data for energy optimisation. With improved data analytics and better control, the building's total energy consumption has been reduced by over 5 percent.

2 Lumani Smart lighting system

The smart lighting system utilises occupancy sensors which allow seamless transition in lighting levels according to building occupancy. Photo-sensors dim perimeter lightings when there is sufficient daylight near the windows. This fully autonomous system is over 10 percent more energy-efficient than best-in-class LED lightings.

3 Danfoss-Novenco High-efficiency air distribution system

Keppel Bay Tower features air handling unit fans which are about 45 percent more energy-efficient than other best-in-class technologies. The fans also run at a lower noise level than regular systems, resulting in a more pleasant environment for building occupants.

4 Innovative Polymers Cooling tower water management system

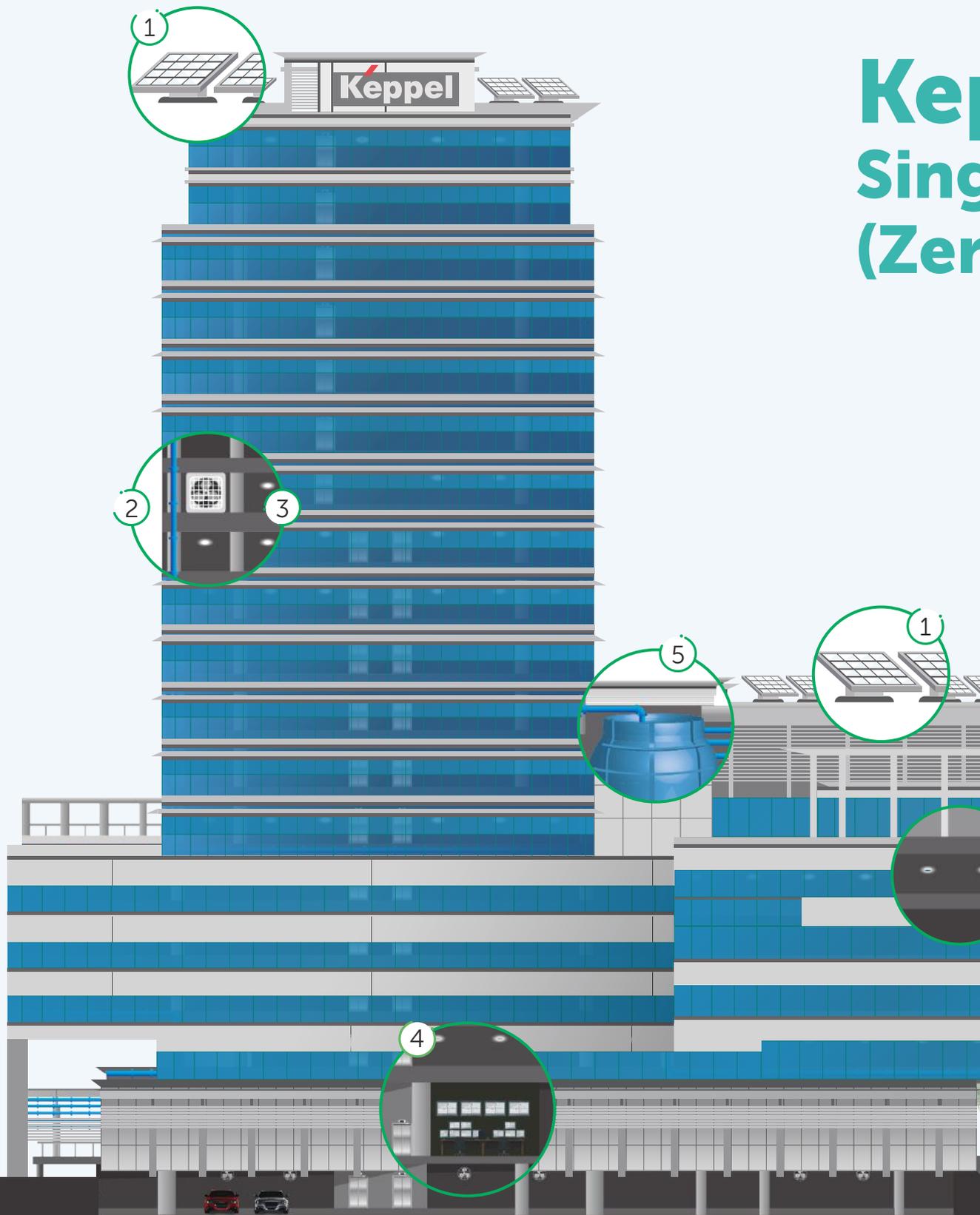
The cooling tower water management technology helps to remove and prevent the build-up of solids and sediments in the building's cooling tower system. It also removes dissolved oxygen from the water, thus slowing down the rate of corrosion. In addition, the system disinfects the water in the cooling towers to prevent the growth of algae and bacteria, thus eliminating the need for chemical water treatment. The implementation of this technology improves the system's heat transfer efficiency and has resulted in a more than 5 percent reduction in air-conditioning energy usage.

5 Yitu Air-conditioning fresh air intake control system

This system utilises integrated sensors to optimise the building's intake of fresh air according to indoor activities. The system, with machine-learning capability, has resulted in an over 10 percent reduction in air-conditioning energy usage, better thermal comfort and a more pleasant indoor environment for building occupants.

With the implementation of these energy-efficient technologies, by February 2020, Keppel Land had achieved a reduction of 22.3 percent in annualised energy consumption of the building, exceeding its initial target of 20 percent. Following the successful pilot, some of these technologies, such as the high-efficiency air distribution system, are currently being replicated to the rest of the building.

Keppel Singapore (Zero)



Smart, eco-features of Keppel Bay Tower

1

PV Panel System

allows the harvesting of about 100,000 kWh of energy per annum

2

Energy-Efficient Air Distribution System

features air handling unit fans which are about 45% more energy-efficient than other best-in-class technologies

3

Demand Control Intake System

utilises intake fans to regulate airflow according to demand, optimising energy use and better thermal indoor environment

Keppel Bay Tower - Singapore's first Green Mark Platinum (Low Energy) commercial building



Energy Use Index (EUI) of <math><115 \text{ kWh/m}^2 \text{ per year}</math>

Almost 50% more energy-efficient compared to typical office buildings in Singapore



Overall energy savings of over 30% or 2.2 million kWh/year

Equivalent to the amount of energy required to power more than 400 five-room HDB flats in Singapore for a year



Reduction of over 2,400 tonnes of carbon emissions per annum

Purchase of Renewable Energy Certificates generated from PV panels installed in Keppel Offshore & Marine's yards in Singapore. Together with the installation of onsite PV panels at Keppel Bay Tower, these initiatives will result in a reduction of over 2,400 tonnes of carbon emissions per annum



4

Intelligent Building Control System

employs a high-precision physics-based simulation engine to improve data analytics and control

5

Cooling Tower Water Management System

utilises a patented solution that reduces cooling tower water usage and eliminates the need for chemical water treatment

6

Smart Lighting System

utilises occupancy sensors which allow seamless transition in lighting levels according to building occupancy

Control Fresh Air System

Integrated sensors monitor fresh air intake to indoor activities, energy usage for thermal comfort and environmental quality



In addition, an assembly of photovoltaic (PV) panels spanning over 400m² has been installed on the roof of the 18-storey Keppel Bay Tower, as well as its six-storey podium block. The installation of the PV panel system generates an energy yield of about 100,000 kWh per annum.

Upon completion of these initiatives, Keppel Bay Tower's annualised energy consumption, or energy use index (EUI), will be less than 115 kWh/m² per year, a reduction of over 30 percent from its 2017 Green Mark Platinum level and almost 50 percent less compared to typical office buildings in Singapore¹. This translates to energy savings of over 2.2 million kWh a year from its 2017 baseline, which is equivalent to the amount of energy required to power more than 400 homes² in Singapore for

one year. This also translates to cost savings of approximately S\$400,000 annually. The remaining energy use will be offset through the purchase of Renewable Energy Certificates (RECs) through Keppel Land's electricity retailer, Keppel Electric, which are generated from PV panels installed at Keppel Offshore & Marine's yards in Singapore.

In January 2020, Keppel Bay Tower became the first commercial development in Singapore to utilise renewable energy to power all its operations, including the offices of tenants in the building. The purchase of RECs, together with the installation of onsite PV panels at Keppel Bay Tower, results in a reduction of over 2,400 tonnes of carbon emissions per annum.



In December 2020, about two years after Keppel Land commenced on the initiative to transform Keppel Bay Tower into Singapore's first super low-energy high-rise existing commercial building, Keppel Bay Tower was certified by the BCA as a Green Mark Platinum (Zero Energy) building, surpassing the original target. It is the first commercial building in Singapore to achieve this accolade.

Mr Louis Lim, CEO of Keppel Land, said, "In line with Keppel's Vision 2030, Keppel places sustainability at the core of our strategy and operations. We are honoured by BCA's recognition of Keppel Bay Tower as the first Green Mark Platinum (Zero Energy) commercial building in Singapore, which is a testament to our strong

commitment to improve the environmental performance of our buildings, as we leverage technology and push boundaries to redefine urban spaces in our bid to build a more sustainable future."

Commenting on the achievement, Mr Kelvin Wong, CEO of BCA, said, "This is a significant milestone in our green building journey and I applaud Keppel Land's commitment and efforts in this outstanding accomplishment. It also demonstrates how research and innovation can make zero energy, high rise commercial buildings a reality. I believe this is just the first of many more to come and I look forward to upcoming contributions from across the Built Environment value chain to realise our collective goal of a greener and more sustainable Singapore."

Keppel Bay Tower: A Green Building Showcase

PROMOTING ECO-CONSCIOUSNESS AMONG STAKEHOLDERS

Throughout this journey, Keppel Land collaborated with various stakeholders, both internal and external. The core team from Keppel Land was a multidisciplinary one, and comprised in-house professionals from the operational excellence, property management and asset management departments. The team was able to overcome the challenges faced with management's commitment and support, as well as by having experienced personnel who were focused on achieving the goal.

External stakeholders included BCA, business partners, and importantly, about 30 tenants at Keppel Bay Tower, who have all been supportive of the company's efforts in improving the environmental performance of the building.

For example, Keppel Land collaborated with Envision, a global leading smart energy management company and tenant in Keppel Bay Tower, to introduce a smart building control system to further improve the air-conditioning energy efficiency by about 10 percent.

It also partnered Signify Singapore³ to roll out a scheme for Keppel Bay Tower's tenants to replace their existing office lamps with energy-efficient LED lighting with no upfront capital investment required. This initiative helps tenants enjoy about 30 percent savings on their utility bills and reduces the total building energy consumption by about 5 percent.

ENVIRONMENTAL STEWARDSHIP

As a sustainable landlord, Keppel Land actively encourages its tenants to adopt green practices. In 2019, Keppel Land achieved 100 percent participation from all its office tenants at Keppel Bay Tower in signing green leases, which is a demonstration of the company's commitment to work with its tenants to provide energy-efficient, resource-efficient and healthier interior spaces for building occupants. The green leases have incorporated the requirements of the BCA-HPB Green Mark (for Healthier Workplaces) Certified standard, which focuses on the health and well-being of building occupants in green offices.

In addition, the Keppel Group, as Keppel Bay Tower's anchor tenant, is committed to resource



efficiency and minimising its environmental impact. The Group has woven environmental considerations into its strategy and set targets to reduce its carbon emissions, waste generation and water consumption intensities, as well as invest in renewable energy generation. The Group is also committed to avoiding single-use plastics at its offices and events.

Keppel Bay Tower: A Green Building Showcase



EMBRACING INNOVATION

Keppel Land is committed to investing in technology and digitalisation. Keppel Bay Tower incorporates smart features such as facial recognition and mobile applications for contactless access, to reduce the number of touchpoints and enhance tenants' experiences. Asset enhancement works to upgrade the lobbies, lift cars and other common areas were completed in 2019, which

rejuvenated Keppel Bay Tower into a modern and sleek commercial development.

Keppel Bay Tower also offers a suite of flex-space, shared facilities and amenities under Keppel Land's KLOUD brand, which is poised to meet the evolving needs of tenants as some look for more flexible lease tenures and adaptable spaces amid COVID-19.

BUILDING A SUSTAINABLE FUTURE

Keppel Land places sustainability at the core of its strategy and operations and is working to reduce its carbon footprint both from the development of its properties and from operational activities. In 2019, Keppel Land's carbon emission intensity was about 22 percent below 2010's level, exceeding its original target of 16 percent by 2020, which was met in 2016. Given the progress achieved, the company has now set an even higher target to reduce its carbon emission intensity by 40 percent from 2010's level by 2030.

Keppel Land will continue to keep abreast of new building technologies and invest in innovations which will further reduce the energy consumption and improve the environmental performance of its buildings. The company will also seek to replicate the energy-efficient technologies which have been successfully implemented at Keppel Bay Tower to the other buildings in Keppel's portfolio, where feasible.

In the wake of COVID-19, the design and use of offices and homes have evolved. The pandemic has brought to the fore the importance of smart, flexible and sustainable designs, innovative building and management systems, as well as building features that improve health and wellness. These are attributes that Keppel Land's developments have long been known for, and Keppel Land will continue to seize business opportunities in smart, green developments of the future. 🍀

Resources:

- ¹ Average EUI of large office buildings (>15,000m² GFA) in 2018 was 219 kWh/m² per year. Source: BCA Building Energy Benchmarking Report (Statistics and Figures) 2019.
- ² Based on average energy consumption of a five-room Housing and Development Board flat, which is 418 kWh/month. Source: SP Services.
- ³ Formerly known as Philips Lighting.

STRENGTHENING ACCESS TO SUSTAINABILITY

Singapore Polytechnic, one of Singapore's most established institutes of higher learning and a SGBC Founding Member, is well-poised to support the transition to a greener, more sustainable and carbon-efficient built environment.



Strengthening Access to Sustainability



Going green is not the responsibility of any one organisation: it takes a whole-of-industry approach to drive affirmative climate action to mitigate the impact of climate change, with industry stakeholders working together to amplify efforts and widen reach. Industry players and end-users alike now have greater access to sustainability for the built environment, enabled through a new collaboration between Singapore Polytechnic (SP) and the Singapore Green Building Council (SGBC).

The partnership was cemented on 11 December 2020 by a Memorandum of Understanding (MoU) signed in-person at Singapore Polytechnic, witnessed by Mr. Desmond Lee, Minister for National Development. Under the auspices of the MOU, both SP and SGBC will work together to enable exchange of technical resources and expertise to efficiently and proactively promote green products and practices to the industry and community through five key initiatives:

- 1 Advancement of Greener & More Sustainable Built Environment Materials
- 2 Understanding the Embodied Carbon of Materials
- 3 Co-organising of Green Building related Courses/ Seminars/ Conferences
- 4 Outreach to Institutes of Higher Learning (IHLs)
- 5 Exploration of joint Research Opportunities in Green Technology

“As we strive to emerge stronger from COVID-19, a key priority will be our efforts to build a more resilient and sustainable built environment. It is heartening to see industry organisations taking the lead to manage sectoral challenges,” said Mr. Lee, who is also Minister-in-charge of Social Services Integration. “The expertise brought to the table by both organisations – the research & development know-how of SP together with the industry connections of SGBC – will create a powerful ecosystem to enable stronger efforts in promoting sustainable practices to the rest of the built environment.”

A key initiative of this collaboration is the advancement of greener and more sustainable built environment materials and products. SP’s expertise in the testing of built environment materials will help to enhance SGBC’s industry-recognised Singapore Green Building Product (SGBP) certification scheme for green building products, which complements the national Green Mark certification scheme for green buildings. SGBC is also looking into expanding the coverage of its certification programme to address a wider range of construction materials and products in support of Singapore’s move towards zero waste. SGBC will work closely with SP to effectively and meaningfully determine the green quotient for such construction products through certification and testing. This will allow the industry greater access to a wider pool of green building materials certified for their environmental performance.

Strengthening Access to Sustainability

“The urgency to build a sustainable environment for future generations has become more significant and clearer in recent years as we see more enterprises and consumers adopt new business practices and consumption habits respectively in confronting the impact of climate change,” said Mr Soh Wai Wah, Principal & Chief Executive Officer of Singapore Polytechnic. “Our collaboration with the Singapore Green Building Council will enable the built environment sector to harness the polytechnic’s long-standing research and technological expertise in creating advanced materials as well as to co-develop practical sustainable solutions and products for consumers. This strategic partnership will bring Singapore Polytechnic and local enterprises closer together to support our national vision of creating a low-carbon, sustainable future for Singapore.”

The second main objective of the MOU is to support the industry in seeking a better understanding of the embodied carbon of construction materials. The built environment is responsible for 40 percent of global carbon emissions, with embodied carbon emissions being especially critical. If embodied carbon emissions are not addressed before the building project moves past the design stage, there is no way for building owners to reclaim lost carbon savings once the building is constructed and subsequently used. Enhancing understanding of embodied carbon would allow both industry practitioners and end-users to make sense of a product’s carbon footprint and from there make more informed building material choices, especially when undergoing building and renovation projects.

“It is no exaggeration to say that the world has been turned upside down from wide-reaching events and developments on the global front. Our buildings and infrastructure assets play a very pivotal role in our sustainable development ambitions and climate aspirations as we move into a very different business-as-usual,” emphasised Dr. Ho Nyok Yong, President of the SGBC. “Greening the built environment must be one of our top priorities as we go forward, I am confident that both SGBC and SP will leverage our respective strengths to make this partnership a success, working together to drive meaningful and impactful change for the built environment sector and help Singapore transition to a low-carbon and climate-resilient future.”



The other initiatives under the MOU revolve around outreach to the industry and students of Singapore’s institutes of higher learning, along with exploration of potential joint research projects in deep-expertise areas of green building such as renewable energy, tri-gen technology, urban regenerative technologies as well as low-carbon/ net zero carbon solutions.

Strengthening Access to Sustainability

A PARTNER IN INDUSTRY COLLABORATION

Established in 1954, SP is Singapore's first polytechnic with 10 schools that offer 40 full-time courses and three common entry programmes for close to 16,000 students. SP adopts a proven creative teaching and learning framework and offers students a holistic, authentic, industry-relevant and Industry Transformation Map aligned curriculum, innovative and vibrant learning spaces, and enriching overseas programmes.

Under the Development Cluster, 11 Consultancy and Technology Innovation Centres stand ready to collaborate with the industry to provide professional consultancy services and develop innovative technologies. With full-time consultants and researchers, the centres work with industry stakeholders in a structured and targeted framework to uplift the industry's workforce and technology capabilities under the following National Research Innovation and Enterprise areas:

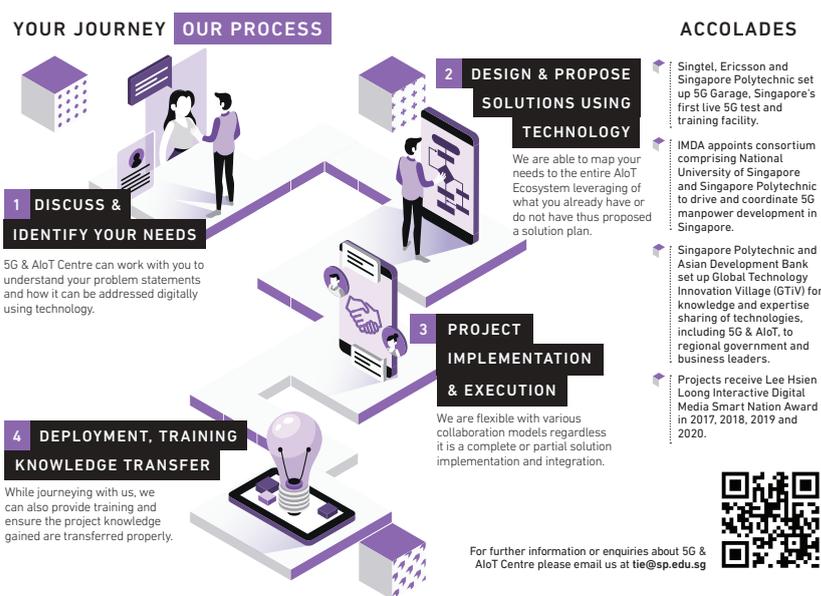
- 5G & AIoT
- Additive Manufacturing

- Advanced Manufacturing
- Advanced Materials (Green Specialty Chemicals & Materials for the Built Environment)
- Building Information Modelling
- Business Innovation and Excellence
- Consumer Care and Chemicals
- Data Science & Analytics
- Energy and Chemicals
- Food Technologies
- Infocomm Technologies (Immersive Tech – Mixed reality)
- Advanced Maritime Technologies through various collaboration platforms
- User Experience (Adopting Design Thinking and Human Centric Innovation framework)

Read on to find out more about key Consultancy and Technology Innovation Centres that are relevant to the built environment sector.

5G & AIoT Centre

As Singapore's first-ever 5G live-testing and ideation facility, the SP 5G & AIoT Centre develops and integrates high-tech 5G within the AIoT ecosystem for low latency, centralised monitoring, intelligent control as well as data analysis of various solutions and corresponding sub-systems. The Centre strives to grow Singapore's 5G ecosystem and drive the adoption of both 5G and AIoT by enterprises in their digital transformation journeys. 5G will bring the entire AIoT ecosystem to a whole new level of real-time performance that existing 4G technology is unable to do. The centre aspires to be the catalyst that provides technical project development and consultations as well as training in the areas of 5G, AI, IoT, embedded systems applications, smart devices, wireless applications, cloud computing, cybersecurity and data analytics.



For the built environment, 5G and AIoT can help empower building managers to leverage artificial intelligence to minimise carbon footprint, improve energy efficiency as well as track sustainability outcomes.

Strengthening Access to Sustainability

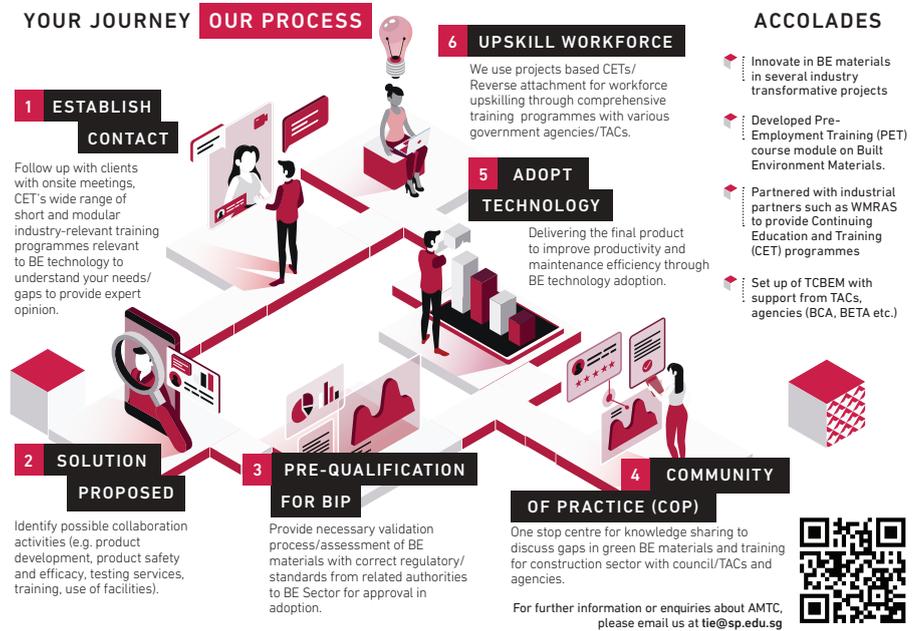
Advanced Materials Technology Centre

At the Advanced Materials Technology Centre (AMTC), SP is developing technology solutions in three main areas:

- 1 Built Environment Materials
- 2 Metal Additive Manufacturing
- 3 Active Ingredients for Personal Care & Healthcare

This Technology Centre of Excellence in Built Environment Materials is able to help industry players develop capabilities, solutions and prequalification in two key areas:

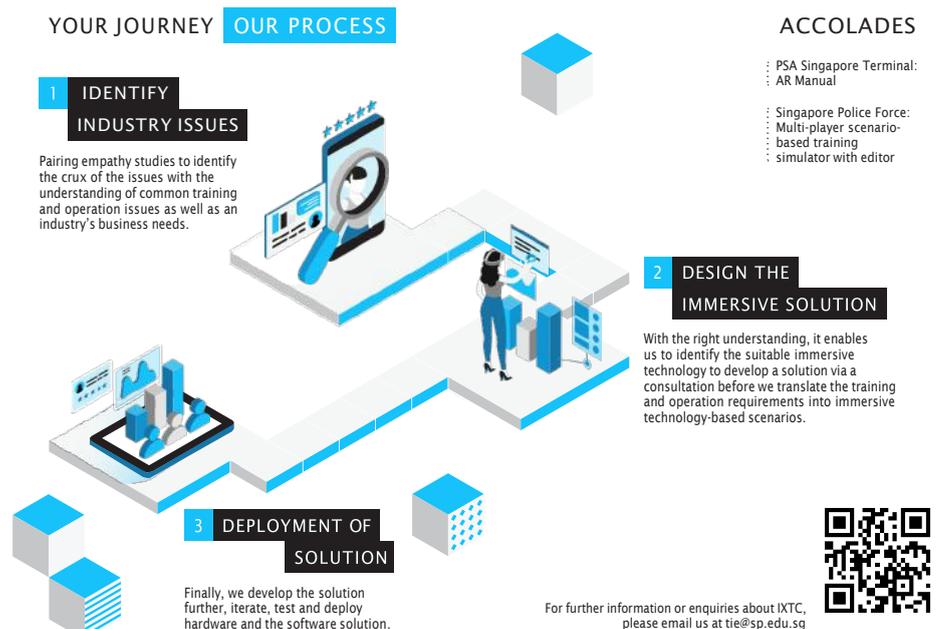
- High Performance BE materials for enhanced productivity and maintenance efficiency
- Sustainable BE materials by recycling waste



Immersive eXperience Technology Centre

The Immersive eXperience Technology Centre (IXTC) provides easy access to build fast-to-deploy solutions without requiring the end-user to have any prior programming knowledge, helping businesses implement the simulation of real-world tasks with high realism and accuracy.

The Centre's capabilities blur the lines between the virtual and physical worlds with the use of Realistic Virtual Reality Immersive Simulation and in-house rapid development of Augmented Reality (AR) and 360 solutions.

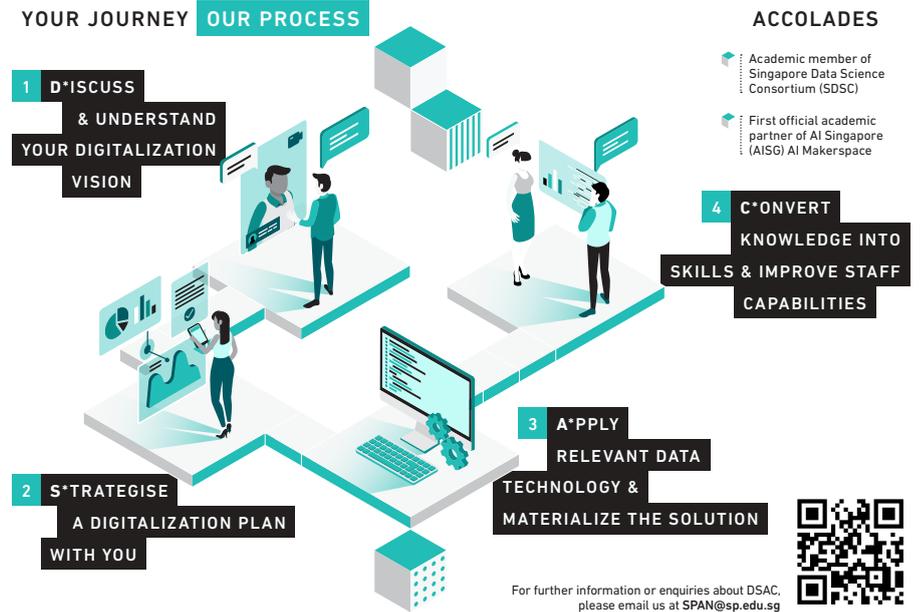


Strengthening Access to Sustainability

Data Science and Analytics Centre

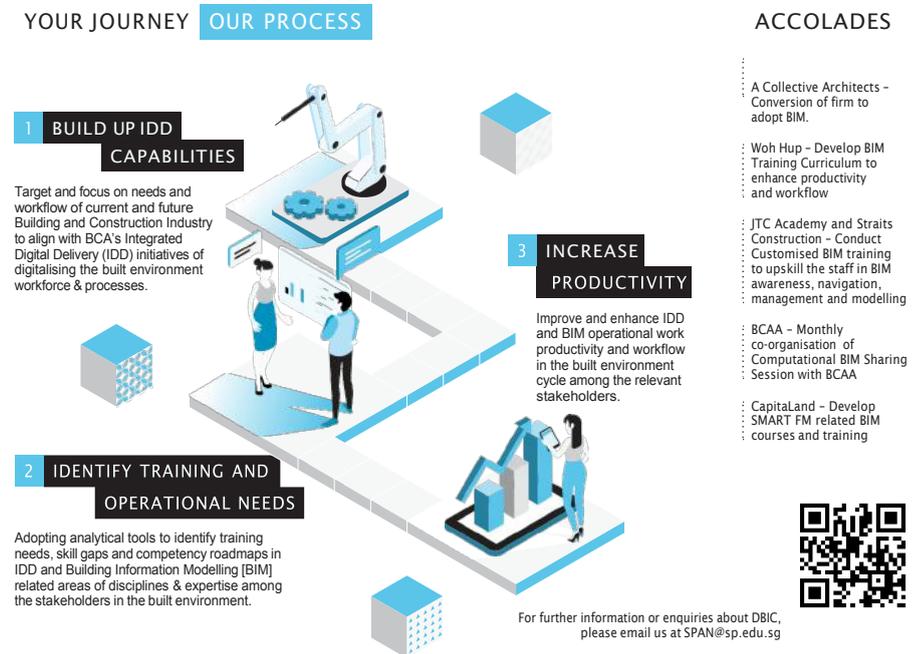
The Data Science and Analytics Centre (DSAC) supports SkillsFuture and industry transformation outcomes in Artificial Intelligence, Data Science and Analytics (ADSA) by partnering businesses on their journey towards digital transformation.

By co-creating solutions, the Centre helps businesses to grow their capabilities and leverage ADSA technologies to make data-driven decisions and improve productivity.



Digital Building Innovation Centre

The Digital Building Innovation Centre (DBIC) capitalises on digital technology to help the built environment sector transform the way it collaborates as well as foster productivity and innovation across various disciplines and sectors. Offering a full suite of fully-customised Integrated Digital Delivery (IDD) training programmes and solutions based on each individual company's training needs, the DBIC can provide organisations with a new way to design, build and operate. ✔



For more information on any of Singapore Polytechnic's Consultancy and Technology Innovation Centres, email SPAN@sp.edu.sg





THE BUILDING BLOCKS OF SUSTAINABILITY

Tasblock Composite Pte Ltd is in the business of ensuring that the materials which compose our places and spaces will remain low-carbon and sustainable throughout their entire lifespan.





The past decade has witnessed a paradigm shift in the building and construction industry. The warning call of climate change becomes louder and more unmistakable, and when coupled with greater access to information brought about by technology, has increased the demand for greater sustainable development. The built environment, in particular, is in a prime position to address the impact of climate change. While occupying slightly over three percent of the world's total land mass, buildings account for more than half of the globe's energy consumption and nearly 40 percent of its carbon emissions. Being integrated into almost every part of society, buildings are crucial to civilisation, with human beings spending inordinate amounts of time in buildings or in the vicinity of one.

More recently in the wake of the global pandemic, the emphasis on health and wellbeing has never been greater, and the built environment is in a prime position to deliver healthy, equitable, resilient spaces and places for people to live, work and play in the new normal.

THE IMPORTANCE OF MATERIAL SELECTION

While considerations for the design, construction and eventual operation of a building are key to any project, material selection is also paramount. It only makes sense that the sustainability of the building products governs the eventual sustainability of the final product, seeing that each building is composed of a plethora of building products that work together to create a structure that will stay in place for years on end. Certain considerations, such



as embodied carbon emissions (the carbon dioxide equivalent of emissions associated with the full supply chain of all materials and systems put into any built environment project) have to be accounted for during material selection. If embodied carbon emissions are not addressed before the building project moves past the design stage, there is no way for building owners to reclaim lost carbon savings once the building is constructed and subsequently used.

In Singapore, building products and materials are assessed for their environmental performance through the Singapore Green Building Product (SGBP) certification scheme managed by the Singapore Green Building Council (SGBC). While the Building and Construction Authority's (BCA) Green Mark Scheme certifies the complete building

for its environmental performance, the SGBP does the same for the building materials that go into a building, helping to ensure that the final structure will be green, healthy and sustainable from inside-out.

The SGBP is structured on a holistic framework that covers energy efficiency, water efficiency, resource efficiency, health & environment protection as well as any other green features present in the product. In addition, the SGBP assesses products across their entire life cycle: from manufacturing to installation/operation and all the way to its end of life. Based on assessment of the product's documentation and testing reports, it will be awarded a rating ranging from 1-tick to 4-ticks (Good to Leader), depending on the verified environmental qualities of the product.



Achieving the highest possible 4-ticks Leader rating is no mean feat: the certifying company will have to produce a long list of test reports and documentation that include energy/waste/water management policies, related ISO certification, carbon footprint reports, environmental impact reports as well as substantiated evidence of recycled content. Therefore, only the most sustainable built environment materials supported by an organisation anchored in sustainability will make the grade.

BUILDING SUSTAINABILITY

One of the latest building products that has cleared the SGBP's rigorous 4-ticks Leader criteria is a humble stadium chair from SGBC Member Tasblock Composite Pte Ltd. The TAS SC001 Stadium Chair is the first-ever product in its object category to achieve the highest possible SGBP rating, a sound testament to the emphasis on sustainability that went into such a common and unassuming product. The chair bears almost no volatile organic



compound (VOC) and formaldehyde emissions and incorporates recycled materials in its manufacture. When used in the thousands in sports stadiums or other similar facilities, these chairs will be able to help keep emissions low and create a better indoor environment for occupants and patrons.

The Building Blocks of Sustainability



The Building Blocks of Sustainability

As a manufacturer of low-impact, environmentally-friendly composite materials with design and manufacturing capabilities in Singapore, Tasblock's variety of built environment solutions are inextricably tied to three key ideals: to be built with the least amount of energy, to have as low an environmental impact as possible and to produce a product with the longest possible lifespan.

Headquartered in Singapore, Tasblock also operates in Indonesia, Malaysia and Turkey. In Indonesia alone, the company has participated in several large-scale built environment projects that include renovation of infrastructure assets and modernisation of public access areas such as pavements, parks, bus and train stations.

REINVENTING SUSTAINABILITY

Tasblock believes that nothing in the world is infinite, which is why finite resources must be put to good use to produce materials that will last for extended amounts of time. This is evident in their proprietary material which creates products that are strong and durable but will not ever rust or fissure. Indeed, one of Turkey's parks contains many Tasblock benches, which has been on-site since 2008 and still remain in serviceable condition.

The material which Tasblock uses to produce its built environment solutions is essentially a fiberglass-reinforced thermoset: a composite of natural minerals, fiberglass and resin. A special hot compression technique is used to rapidly cure the base material into desired shapes using large-capacity presses and custom-manufactured moulds. This material is versatile enough to take on any shape, colour and texture, allowing it to be manufactured into a wide range of different applications.

In addition, the chemically-stable nature of the Tasblock material will not oxidise nor rust and is totally impermeable while also having decent corrosion-resistant properties. The material is also well-suited for outdoor applications: it scores 90 - or Extra Hard - on the Shore D Hardness Scale (measures the hardness of hard rubbers, semi-rigid plastics and hard plastics), placing it well above the



The Building Blocks of Sustainability



durability of wood and plastic. The material resists the damaging effects of sunlight, and this resistance can be further enhanced with special formulation depending on the products' intended usage. The versatility of Tasblock's material allows for a whole range of uses, including:

- Building facade applications
- Tactile paving applications
- Benches for streets, ships, schools, parks
- Bollards
- Litter bins
- Stadium chairs
- Bus stops and public shelters
- Manholes and gully gratings
- Planter boxes (indoor and outdoor use) for landscaping features

As an added testament to Tasblock's focus on sustainability, the company's products consume low amounts of energy during production, and the raw materials are similarly produced with lesser energy and give off lesser carbon emissions as compared to conventional building materials. The product also reaps productivity gains, with the product being easier to transport and install by virtue of it being lighter. Tasblock products also have longer lifespans and essentially require very little maintenance to upkeep, with certain product applications requiring no maintenance at all.

While its core product is not exactly new, Tasblock has poured years of effort into research and development to create the best possible variant of the fiberglass-reinforced thermoset. Each application of its core technology has been thoroughly experimented on and optimised for efficiency and efficacy - be it a stadium chair, park bench or light pole. What Tasblock has done – and will continue to do – is to reinvent the building blocks of a known built environment material and creating a version of it that is greener and aligned with the global focus on sustainability. ✔





Images courtesy of
Tasblock Composite Pte Ltd



"We are not looking to reinvent the wheel, but rather to constantly innovate and improve our solutions to produce the best possible version of a commonly-used built environment material that will lead to more environmentally-positive outcomes. We hope to do our little part in the larger scheme of things, helping the built environment become greener, healthier and more sustainable, one small building block at a time."

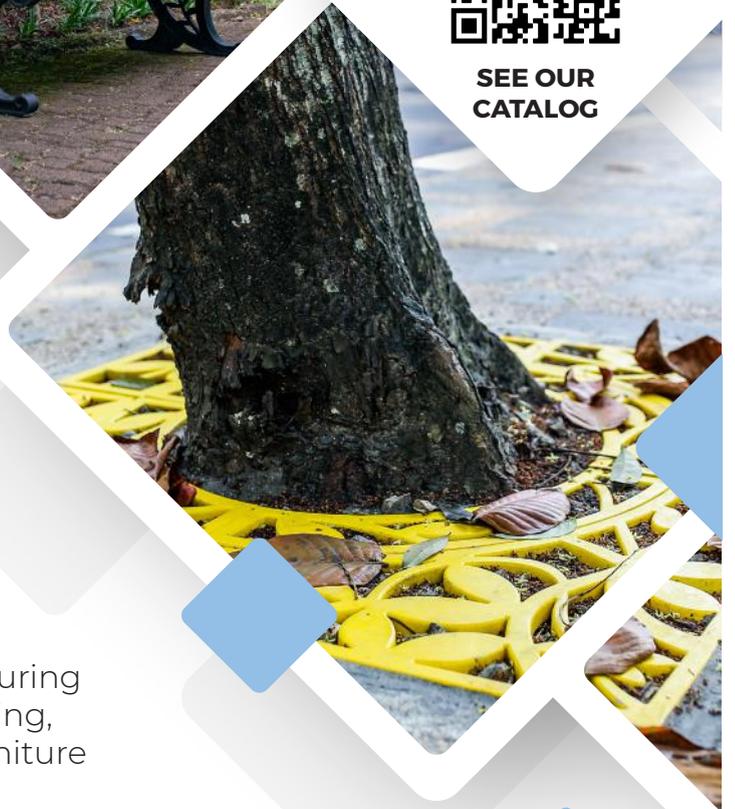
Mr. Sitki Kok
Director,
Tasblock Composite Pte Ltd



CERTIFICATE NUMBER: SCBP 3577



SEE OUR CATALOG



Tasblock is the leading composite manufacturing company specialised in compression moulding, providing high quality and unique street furniture and infrastructure products worldwide.



DURABLE & LONG-LASTING



ENVIRONMENTALLY FRIENDLY



RUST-FREE



WATER PROOF



EASY TO INSTALL



FLEXIBLE DESIGN



BUILDING OUR GREEN FUTURE TOGETHER

The Building and Construction Authority (BCA) and the Singapore Green Building Council (SGBC) are co-creating the Singapore Green Building Masterplan, part of the Singapore Green Plan 2030. Read on to find out what the industry and community are saying about green buildings.





As Singapore is a highly urbanised island state, buildings account for over 20 percent of the nation's carbon emissions. Green buildings are hence an important part of Singapore's climate change mitigation strategy. In 2005, the Building and Construction Authority (BCA) launched the Green Mark scheme to promote sustainable and environmentally friendly buildings in Singapore. Together with green advocates from industry and academia, the Singapore Green Building Council (SGBC) was formed in 2009 to advocate for and accelerate the adoption of green building products, technology and best practices. Since then, SGBC has played a key role in driving the green building movement in Singapore.

To-date, more than 40 percent of the built environment (by gross floor area [GFA]) has been greened. To green 80 percent of Singapore's buildings by 2030, BCA and SGBC are working with key stakeholders on the next Singapore Green Building Masterplan (SGBMP) to push the boundaries of energy efficiency and environmental sustainability in buildings.

To do so, all stakeholders need to be onboard. The co-creation of the SGBMP deeply involved a total of 82 industry stakeholders, from different points of the value chain such as architects, consultants, developers, engineers, contractors, suppliers, researchers and others, as part of the SGBMP working committee. Members of the Committee were involved in different taskforces that looked into developing the next vision and outcomes of the next lap of our green buildings journey, as well as the initiatives to get there. With a better understanding of the barriers faced by the built environment (BE) sector stakeholders and the industry's potential to stretch for higher targets, the Committee can collectively develop SGBMP initiatives that will effectively help drive the green building agenda forward.

To sustain this push for the green building agenda, a healthy ecosystem with enough demand drivers and enablers is required. Since the beginning of 2020, the Committee has been reaching out to the wider community and other stakeholder groups such as Financial Institutions in a concerted effort



to better understand their views on green buildings and generate a broader mindshare for the SGBMP. The key engagement outcomes are to:

- Raise awareness of the urgency to take climate action and how green buildings are a key strategy to mitigate climate change
- Build a shared vision for the SGBMP through stakeholder engagement
- Seek wider support on the benefits of green buildings

From March to November 2020, BCA and SGBC have reached out to more than 5,000 individuals through various engagement initiatives to gather insights for the development of the SGBMP. Read on to know about the key findings of the SGBMP engagement drive and read the full report on the SGBMP website.

SETTING THE VISION & KEY OUTCOMES

In the development of the SGBMP, views from an even wider group of stakeholders were obtained on

how Singapore can advance together in the next lap of our green buildings journey and push the boundaries of energy efficiency and environmental sustainability in buildings. Due to restrictions brought about by the COVID-19 pandemic, much of the engagement was done online after the organisation of a Visioning Exercise in early 2020, which set the vision and key outcomes ahead for Singapore's green built environment.

About 100 invited participants from the built environment took part in the Visioning Exercise, coming from a good mix of organisations active in the built environment, Trade Associations & Chambers (TACs), Institutes of Higher Learning (IHLs), public agencies, as well as future leaders and youths. The half-day session comprised a series of short sharing by industry leaders, focus group sessions with a good mix of industry, agency, academia and youth representation to encourage candid sharing of opinions and better appreciation of diverse perspectives, as well as a final panel discussion.



WHAT ARE PEOPLE IN SINGAPORE SAYING ABOUT THE FUTURE OF GREEN BUILDINGS?

SNAPSHOT ON PUBLIC ENGAGEMENT INSIGHTS FOR THE SINGAPORE GREEN BUILDING MASTERPLAN (SGBMP)



High level of awareness and strong sense of urgency for green buildings as a climate change mitigation strategy



9 out of 10 respondents recognise green buildings as a key strategy to fight climate change



More than 9 out of 10 respondents viewed that more urgent measures should be put in place for all new buildings to be Super Low Energy buildings

TOP 3 BENEFITS ASSOCIATED WITH GREEN BUILDINGS

ASSOCIATED WITH GREEN BUILDINGS

Lower Carbon Emissions (72%)

Environmentally friendly (61%)

Better health and well-being (51%)



TOP CHALLENGES SHARED BY PRACTITIONERS FOR GREEN BUILDINGS

SHARED BY PRACTITIONERS FOR GREEN BUILDINGS

Lack of capital/funds/ financial incentives (78%)

Lack of leadership buy-in (65%)

Lack of consumer demand (57%)



Strong agreement on collective and individual responsibilities to take climate action with green buildings



More than 9 out of 10 agreed that buildings' use of energy over its lifespan will negatively affect future generations if we do nothing

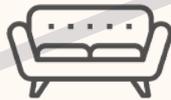


7 out of 10 would share the benefits of green buildings with their family, friends and colleagues

THE FUTURE OF GREEN BUILDINGS SHOULD:



Address climate change



Improve occupant comfort



Be cost effective



Be environmentally friendly



Enable better and smarter management of building operation

SGBMP TAGLINE
BUILD OUR GREEN FUTURE TOGETHER

POSSIBLE NEXT STEPS FOR SINGAPORE'S GREEN BUILDING JOURNEY

It is important to raise awareness on the benefits of green buildings to get all key stakeholders onboard.

We need to design and operate our buildings better.



We need stronger regulations to raise the minimum building standards while providing support for building owners to get there.



ONLINE ENGAGEMENT

With the limitations brought about by the pandemic, a mix of digital engagement initiatives were introduced from March to November 2020 to reach out to more members of the public. Digital-based engagement efforts allowed BCA and SGBC to reach segments of the population that were not engaged through more traditional means.

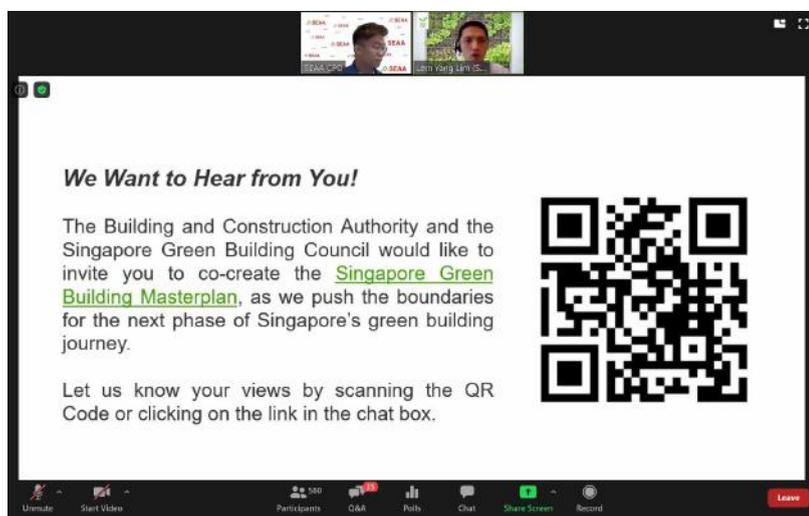
A public engagement survey, aimed at gathering preliminary insights on the public perception of green buildings and their readiness to take stronger action in mitigating climate change as well as ideas on possible initiatives to further our Green Buildings journey, was developed and ran from March to September 2020. Three different versions of the survey were developed with slight variations in questions to cater to different core groups: the public, built environment industry practitioners and students. Close to 3,500 responses were received, of which about 65 percent were youths under 35 years old.

To continue the conversation and engagement with stakeholders, a separate poll to seek built environment industry practitioners' views on

priority areas for green buildings to better respond to pandemic situations, and potential impact on carbon emissions from buildings ran from May to September 2020. Hosted on a dedicated SGBMP page on the SGBC website, the Mentimeter poll gathered more than 600 responses.

SGBC conducted a small-group online discussion to gauge the industry's views on what Singapore's green building aspirations should be. Held during the International Built Environment Week 2020, the session was attended by nearly 100 built environment representatives who aired their views and perspectives on Singapore's green building future through small-group discussions, putting forward many meaningful insights and food for thought.

In the final leg of engagement for 2020, a public poll was carried out to determine the tagline for the SGBMP. Gathered from public suggestions from the other digital engagement initiatives, five tagline options were shortlisted for polling and shared on the digital platforms of BCA, SGBC and other SGBMP engagement partners.



THE WAY FORWARD

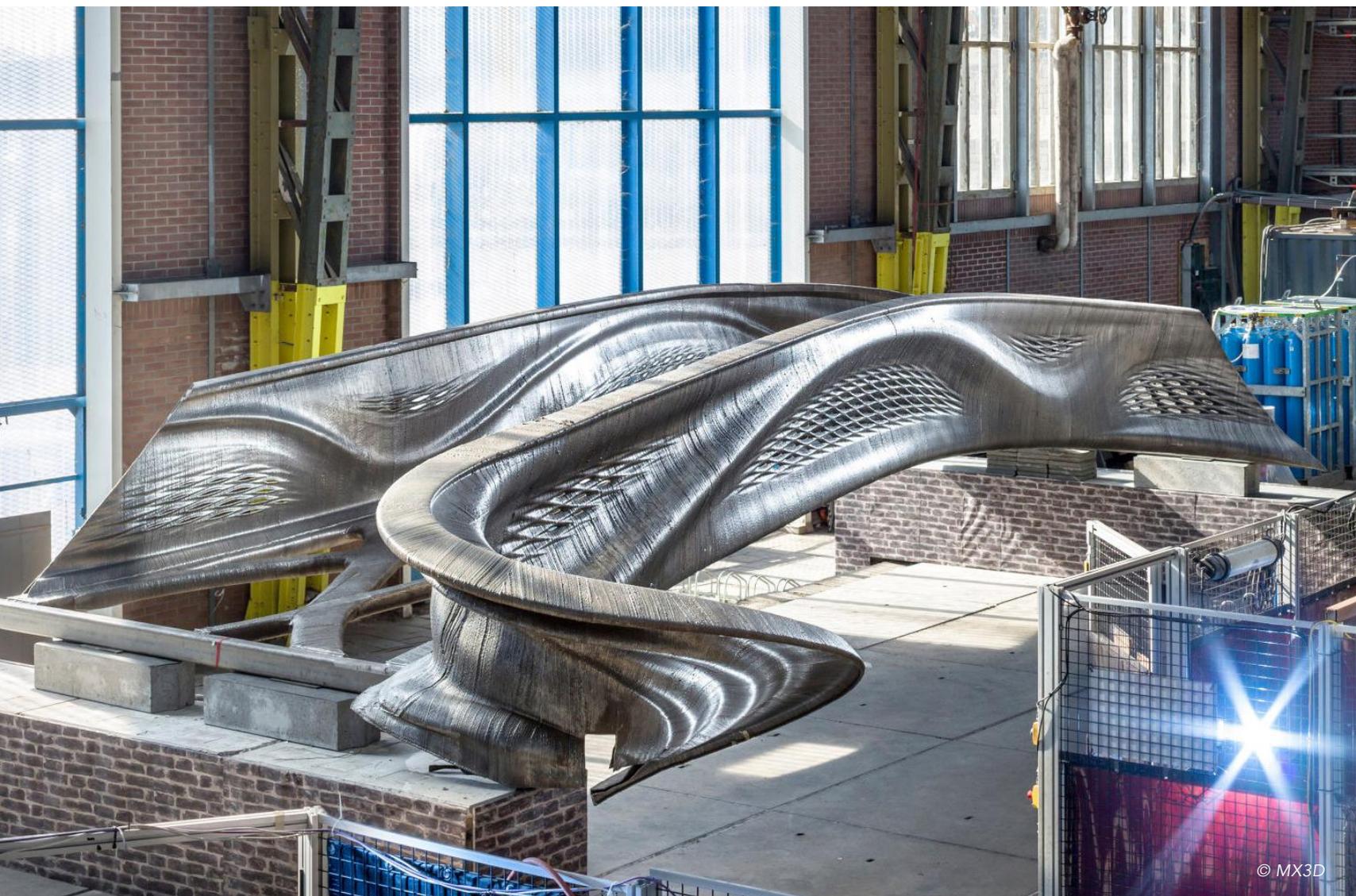
The feedback and insights gathered from the SGBMP engagement platforms showed strong public agreement and awareness on the need to do more to green the built environment, with a sense of urgency to take climate action through green buildings in the next 5-10 years.

The survey findings revealed a gap between awareness and agreement on individual responsibility to act. There were also greater calls for more public education and awareness on the benefits of green buildings to encourage behavioural change. BCA and SGBC will continue engagement initiatives with key stakeholder groups, including the youth and homeowners, on green buildings to close this gap. The industry and community can look forward to greater engagement initiatives as we Build our Green Future Together. ✓



BUILDING THE BUSINESS CASE ONE 3D-PRINTED COMPONENT AT A TIME

Additive manufacturing for the built environment can cost-effectively produce bespoke building components and nodes on-demand with lesser wastage and finer control



Additive manufacturing (AM) or 3D printing is using layers of material to create a three-dimensional (3D) object. Although its rise as a technology is relatively new, it has been around in the natural world for millennia: wasps, for example, have been 3D printing their nests for over 200 million years.

3D PRINTING FOR THE BUILT ENVIRONMENT

Although the aerospace and medical sectors have taken the lead for AM adoption, many other sectors are increasingly recognising the potential benefits. Many projects in the built environment sector have developed scaled-up concrete-based additive manufacturing. An example is the concrete printer

at the Housing & Development Board (HDB) Centre of Building Research. The use of the AM technology enables architects and designers to have greater design flexibility in bespoke components, and since AM is an automated digital production process, it reduces the dependency on manual labour. Going forward, HDB will be applying concrete printing to produce certain landscape furniture and architectural features in common areas at selected HDB projects in the Tengah and Bidadari housing estates.

Other building and construction components that can be viably 3D-printed, such as façade nodes and connections, have been demonstrated by



© MX3D

consultancy firm Arup. It used a powder-bed fusion-laser based (PBF) process to print topologically-optimised tensegrity lighting nodes that is 75 percent lighter than conventionally fabricated nodes. It is noteworthy to highlight that the topology optimised component fully utilises design for AM and it is not reproducible by conventional fabrication methods.

In addition to the AM nodes and connectors, the world's first additive-manufactured steel MX3D bridge is produced with funding support from Lloyd's Register Foundation. The 12-meter-long pedestrian steel bridge in Amsterdam, Netherlands is produced via the Wire Arc Additive Manufacturing

(WAAM) process, where it demonstrated an asymmetrical shape not bound by traditional forms, but yet conformed to the structural integrity and functionality without compromising on aesthetic considerations. WAAM produces large, complex and bespoke structures without the need for mould and manual assembly. In addition to the advanced AM process, a network of sensors installed on the bridge measures both structural data, such as strain, displacement and vibration as it is used by pedestrians and cyclists, as well as environmental factors including air quality and temperature. Together, this information will help engineers monitor the bridge's health in real-time and assess how it changes over its lifetime.

Building the Business Case One 3D-printed Component at a Time

CHALLENGES & OPPORTUNITIES

One of the biggest hurdles to the widespread adoption of AM has not only been the lack of standards but also that the existing standards do not cover AM manufacturing. With the knowledge being held by a small community of experts, it was clear that for AM to establish itself in the marketplace, a suite of standards would be required to enable widespread use. The larger organisations were able to develop their own requirements, but for smaller SMEs this has not been easy to achieve.

The early development of the standards was aligned to the sector uptake, so the early standards were biased towards the materials and processes used by both the aerospace and medical industries, but with more sectors joining the standard committees, a number of sector-specific working groups have been established, covering Oil and Gas, Retail, Marine and Construction amongst others. For construction, this will be a joint group 80 of the TC261/ASTM F42 committees.

When you think of AM, construction is not the first sector that comes to mind, but the use cases for AM in construction cover a greater variety than you would first think. The most familiar use is to print scale models of the designs, to enable the architect's vision to be created for end clients to evaluate. AM brings with it some challenges, but it can also help to overcome some of the challenges that the construction is currently facing such as the availability of skilled labour and systems which can produce products of a consistent quality. The marketplace for AM splits into three main areas:

- 1 Singular components produced and shipped to site
- 2 Modules printed in a facility and shipped to site for assembly - Design for Manufacturing and Assembly (DfMA)
- 3 On-site manufacture with a printer shipped to site, usually used to print the building exterior

Single components can range from simple plumbing manifolds and architectural detail, through to structural items such as steel nodes for linking steelwork together.

Modules tend to be more complex in nature and take advantage of the design freedom and potential weight/ material savings. This helps to reduce the overall carbon footprint of the building project. Modules can cover structural components such as concrete sections for bridges and tunnels, or completed pods such as a bathroom, which can be completed offsite. Other areas are sections of buildings, which in some cases may utilise polymers rather than the traditional concrete which has high embodied carbon rating, in some cases as high as 600 kgCO₂/m².

On-site manufacture has mainly considered concrete printing the shell of the building, using a system of pumped concrete which is mounted either onto a robot arm or gantry system. Around the world, there are many companies and universities working to make this technology viable, with many



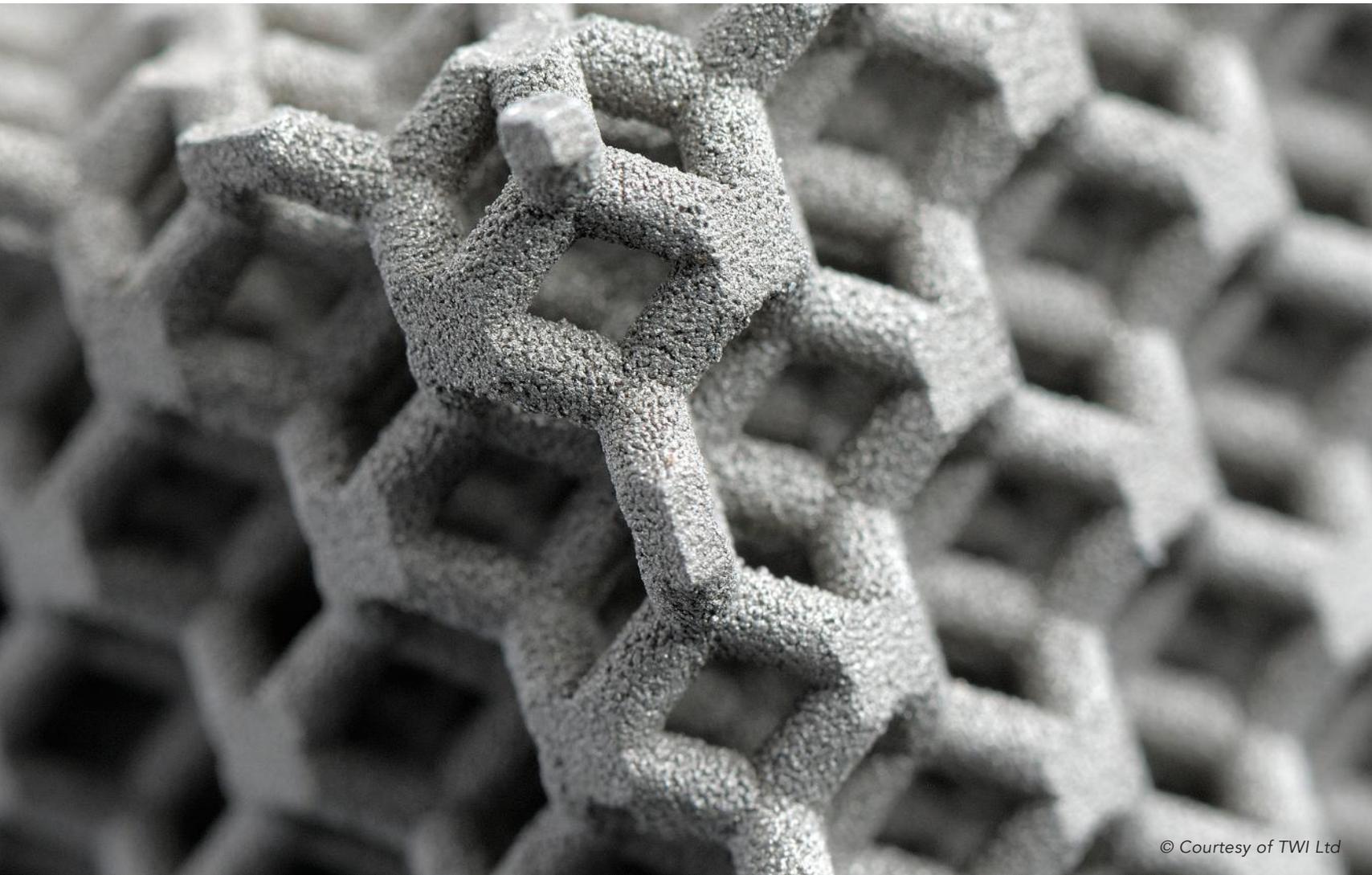
Building the Business Case One 3D-printed Component at a Time



© BAM

real-world concepts already in place. It is widely recognised that methods of construction have largely remained the same for the past century, and it is clear that if we are to meet our building requirements, a different approach is needed. The use of AM brings many advantages to the construction sector. The time to build a structure is significantly reduced, and the ability to print only the material you need, greatly reduces waste generated. It also allows for design freedom that traditional construction would struggle to embrace. The availability of skilled labour is now becoming a concern for many regions, and along

with making the workplace safer, AM is viewed as a way to support the automation of construction, increasing the repeatability and consistency of the process, while having the additional positive effect on reducing workplace accidents. It is not just the buildings themselves that are using AM: when we consider the plants and machinery on-site, a number of major manufacturers are printing parts for their service centres on-demand to reduce the downtime of on-site equipment, including making design changes to engineer out common failures on equipment.



© Courtesy of TWI Ltd

THE WAY FORWARD

SGBC Founding Member Singapore Polytechnic (SP) has been working with industry organisation Lloyd's Register (LR) to support industry adoption of AM across various sectors, including construction. Along with standards development, the collaboration arrangement also provides workforce training, AM Facility Qualification and Part Certification, with LR's technical advisory services readily available to advise on most aspects of AM.

SP also has a number of best-in-class AM short courses on the various aspects of AM to train and develop company competencies, facilitated by a state-of-the-art facility including PBF-laser based,

directed energy deposition-laser based, and other large-scale AM-centric facilities. SP is the only institution that has an AM metal powder production plant that enables AM materials development. With the materials development capability, SP is able to provide end-to-end AM solutions for the built environment sector. To transfer knowledge and expertise, SP imparts students with AM skills through student internships and final year projects (FYPs) aided by the highly-knowledgeable AM specialist team. With a wide variety of AM-centric resources and capabilities, SP is ready to support built environment organisations on their own AM journey. ✔

3M Building and Construction Solutions

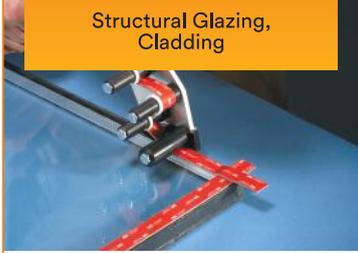
Whether it's new construction, renovation or demolition and clean-up, 3M has a wide range of reliable solutions for the building and construction industry to improve safety, productivity and efficiencies through each stage of the project. Our innovative and high performing products can be used for a variety of applications, and expert support is available.

Maintenance Repair Operations

<p>Concrete Repair</p> 	<p>Excellent Rust Prevention</p> 
<p>Mounting of Displays</p> 	<p>Sealing Gaps and Joints <i>Indoor and Outdoor</i></p> 

Fast and Seamless Facade

Structural Glazing, Cladding



3M™ VHB™ Tape

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No screws and rivets
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Immediate handling strength
- ▶ Proven since 1980
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HVAC Ducts, Vents, Pipe and Cable



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- ▶ Fire Rating of Up To 4 Hours
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Lamination Bonding

For insulation, lamination panels



3M™ Fast Tack Water Based/ Neoprene High Performance Contact Adhesive

- ▶ High Immediate Handling Strength
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- ▶ Fast Tack – Non-Flammable

Reclosable Attachment

For Panel and Graphic



3M™ Dual Lock™ Reclosable Fastener

- ▶ Durable - Up to 1,000 Openings and Closings
- ▶ Simple, Easy and Fast
- ▶ Reduce Vibration

Tough, Permanent Bonding

Panel to Frame, Trim Attachment



3M™ Scotch-Weld™ Structural Adhesives

- ▶ Structural Strength in about 20 Minutes
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- ▶ Low Odour

Sealing Cracks and Joints

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3M™ Polyurethane Adhesive Sealant

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- ▶ Very Flexible
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Long Lasting Insulation Protection

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3M™ VentureClad™ Tape

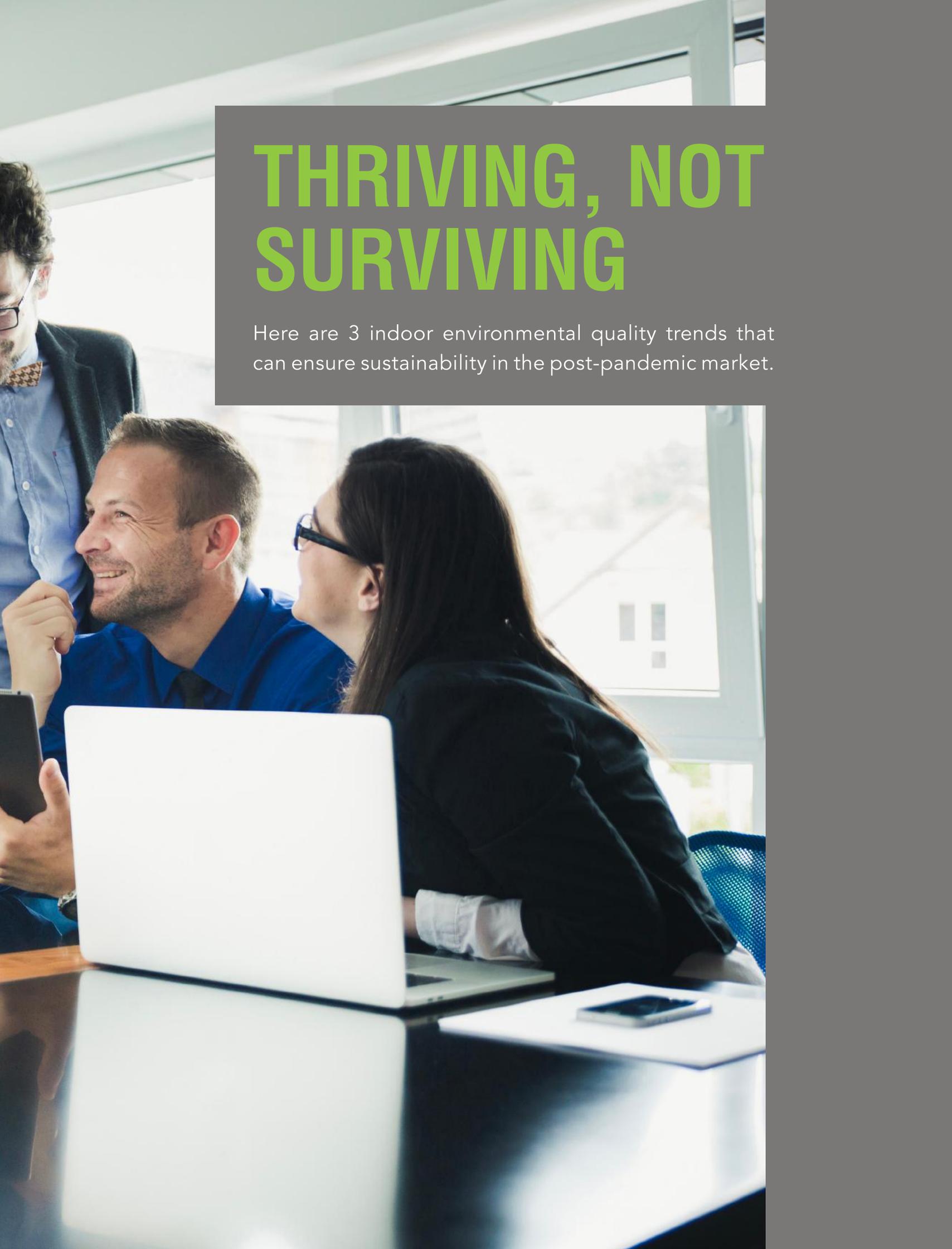
- ▶ Easy to Install – Cut and Paste
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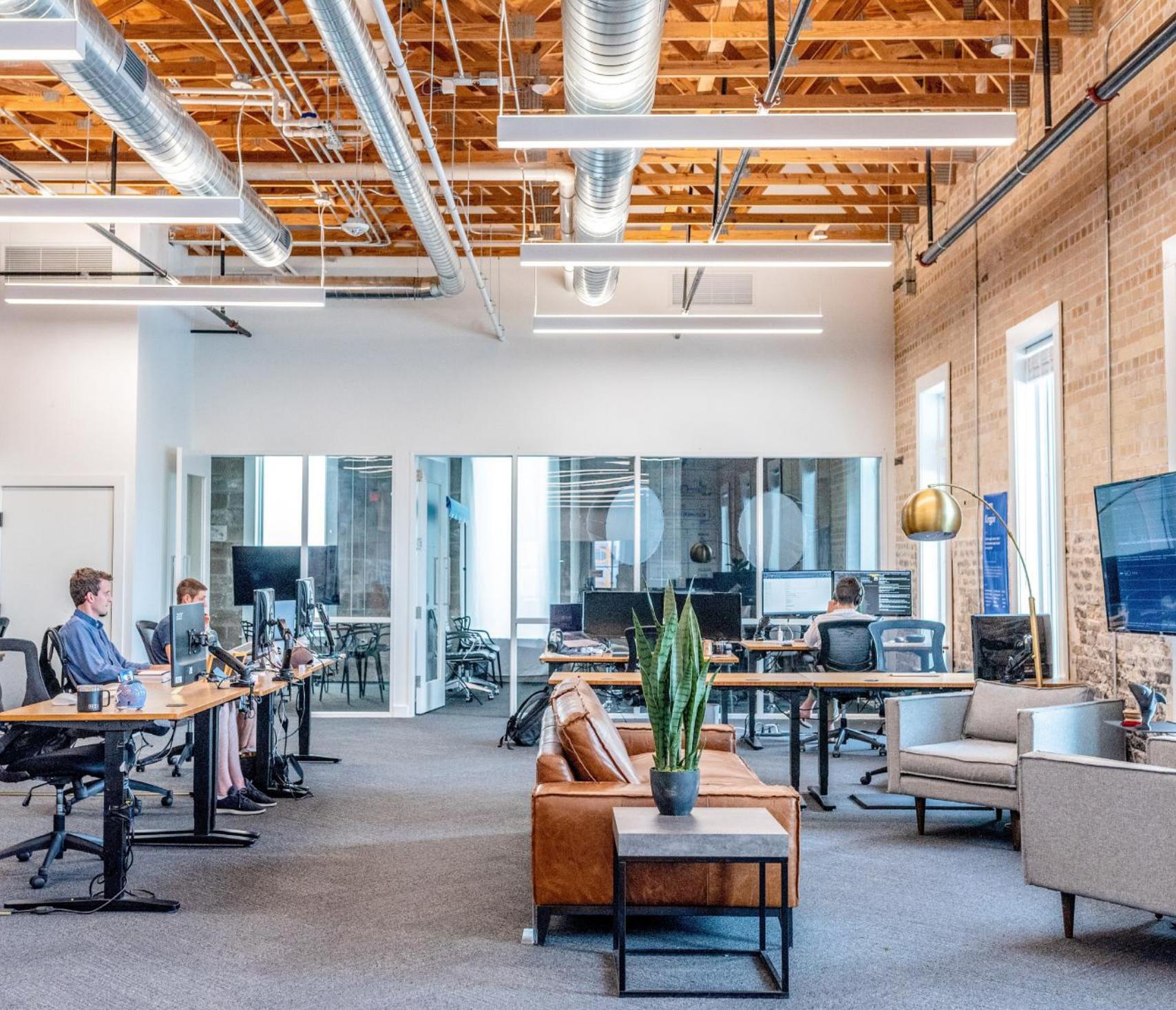
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THRIVING, NOT SURVIVING

Here are 3 indoor environmental quality trends that can ensure sustainability in the post-pandemic market.



As businesses around the world look to recover from the negative effects of the pandemic, there is a growing push towards sustainability - for companies to develop and integrate practices that will help them not only to survive but to grow and contribute to the improvement of people's lives. Sustainable practices that are intended to conserve resources and benefit life, health, and wellbeing are starting to gain traction as more leaders are realising the payback and how these could ultimately mean more than short-term survival in the post-pandemic world. According to CB Bhattacharya, H.J. Zoffer, chair of sustainability and ethics at the University of Pittsburgh's Katz Graduate School of Business,

"Profits are a consequence of value creation. And once this philosophy is internalised and articulated by leadership, businesses can take 'ownership' of sustainability for the well-being of the planet and its people."

In the built environment, one critical area of focus that is also gaining attention is indoor environmental quality or IEQ. IEQ impacts sustainability in concrete and measurable ways. The quality of the indoor environment affects the health, comfort, and performance of building occupants. Improvements to the indoor environment that result in a one percent productivity improvement could



be the financial equivalent of cutting energy use by 100 percent or more on an annual basis. Efforts to create optimal indoor environmental conditions enable building owners and managers to anticipate and avoid negative health effects, as well as costly liability issues and renovations often associated with IEQ problems. Moreover, providing optimal IEQ builds long-term value for the building and assists in maintaining a high level of occupancy and use.

So, what can businesses do to ensure viability amid disruptions caused by the pandemic and position themselves for viability and long-term growth? Here are 3 key sustainable practices that leaders can integrate into their strategies.

USING GREEN BUILDING MATERIALS AND EQUIPMENT

Adopting green and sustainable building materials and practices helps to conserve resources, leads to fewer toxin emissions that contribute to indoor and outdoor air pollution, and has a less adverse impact on occupant health and wellbeing. The last decade has seen more commitment in using greener building materials such as paints with low volatile organic compound (VOC) emissions and formaldehyde-free products. The industrial and manufacturing sectors are also heeding the call with factories that are committing to reduce harmful emissions and go carbon neutral.



MEASURING INDOOR ENVIRONMENTAL QUALITY

IEQ takes into account all the effects that the indoor environment has on health and performance. As people spend 90 percent of their time indoors, their health, safety and performance rely heavily on IEQ which is affected by a number of factors such as air quality, thermal comfort, lighting and acoustics quality. As the old adage goes “you cannot manage what you cannot measure”, measuring IEQ means being able to maintain these parameters in ideal conditions to ensure optimal IEQ and lead to higher occupant comfort and satisfaction levels. Measuring IEQ also helps companies understand the sources of specific problems and address them or implement practical guidance to improve indoor environmental conditions.



Thriving, Not Surviving

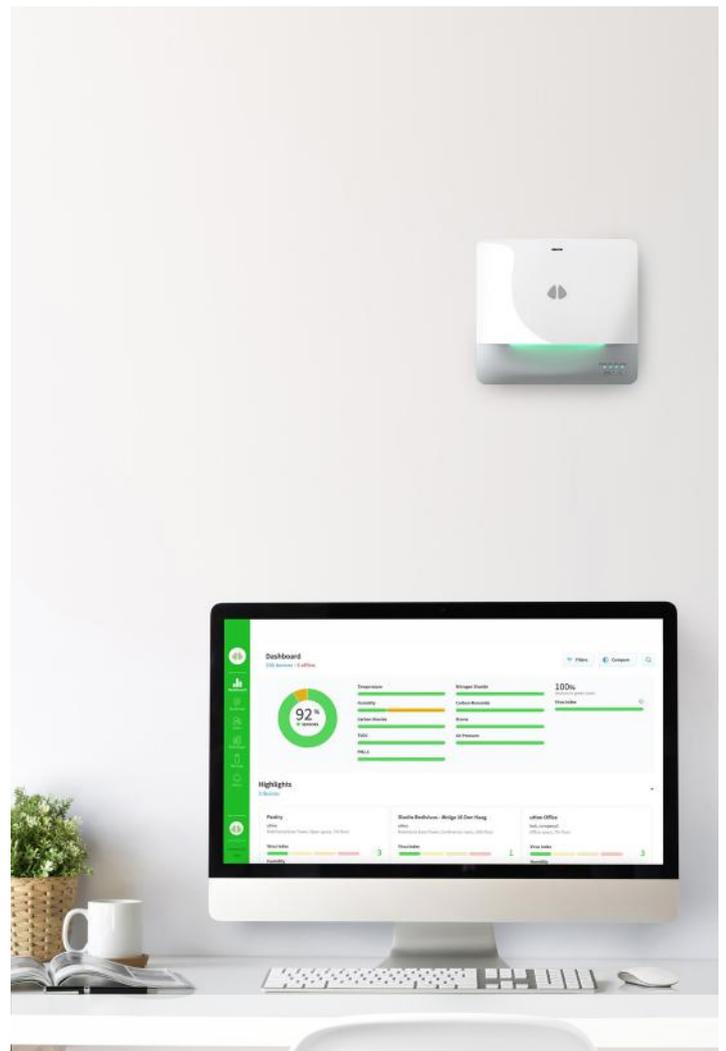
LEVERAGING TECHNOLOGY AND BIG DATA FOR SOLUTIONS

IEQ solutions that can help monitor and automate control of ventilation, air exchange, and filtration among others can help building owners and facility managers to have a more proactive, data-based strategy to create a sustainable building environment. Aside from the ease and convenience from the integration with other building systems and equipment, continuous real-time monitoring provides data that can lead to valuable insights to resolve issues and enhance IEQ. Big data refers to the ability to collate and analyse several data points and find correlations between them. IEQ devices that can provide data for specific parameters, a centralised view across different locations and indices that impact health, performance and

wellbeing are critical tools that may well provide the advantage to more forward-thinking property owners and business leaders.

The debilitating effects of the ongoing pandemic are undeniable, but a sustainability agenda at this time presents opportunities for businesses to learn how to become much more resilient and better prepared for future challenges. With the rise in interest in health and wellbeing, people are becoming more conscious of how indoor environments can have short and long-term effects. Those who can demonstrate that their buildings provide a happy, healthy and productive environment can distinguish themselves in the market while those who do not may consequently face more risks and challenges. ✓

Text and images courtesy of uHoo Pte Ltd.







SHADING FOR SUSTAINABILITY

Read about the importance of eco-friendly solar protection as the world accelerates its emphasis on sustainability.



As the world steadily moves towards a greener, healthier and low-carbon built environment, green building is rising up in the collective consciousness. While most people are aware of the more visible elements of green buildings such as rooftop greenery and renewable energy systems, i.e., solar panels, other less-tangible aspects of building green are also important.

One such area is shading: an instrumental element of our places and spaces, providing us with much-needed respite from natural elements. Apart from providing shelter, shading reduces a building's cooling load, improves thermal comfort as well as

lessens potential issues with glare. Shading can be achieved through a number of methods, such as natural landscaping or building features like awnings, trellises and overhangs. Certain shading devices also function as light shelf reflectors, bouncing natural light into the interiors of buildings.

In tropical Singapore, we have grown accustomed to the rain or shine. However, the onset of climate change has immensely affected local weather with Singapore's daily mean temperature projected to increase between 1.4°C to 4.6°C towards the end of this century, according to the National Climate Change Secretariat (NCCS). Rising temperatures



can compromise both public health and the environment, especially from 11.00AM to 3.00PM when the sun's intensity peaks and exposure to solar ultraviolet (UV) radiation is higher which can cause harmful effects to the skin and eyes. Increasingly humid weather also increases the energy demand for cooling, which in turn elevates carbon emission levels and raises utility bills. Putting in place proper shading measures in buildings that work with other green building and sustainability features would be able to help improve building performance as well as enhance occupant comfort.

As an example, the SGBC Office embraces daylighting to enhance the health and wellbeing of its occupants, which has been proven to support the circadian rhythm (body clock) of office occupants and help improve concentration. While the extensive high window glazing at the double volume main workspace allowed for generous daylighting and views of surrounding to nature, glare from the intense evening sun rays could be overly harsh and adversely impact the occupants' visual comfort, if left untreated.



A glare control design strategy was devised, comprising a combination of light shelves, translucent/patterned glass film and vertical fins to carefully filter and manage the sunlight penetrating the glazing envelope, while still permitting views to the exterior. This in turn results in a softer, more diffused, and more pleasant lighting quality in the workspace, while the sunshade elements themselves add further visual interest to the space. The use of light colours and matte finishes, especially above the desk plane, further ensures a visually soothing environment. Operable window rollers also help facilitate the individual user's control over their immediate work environment. The shading features in place work with the office's other elements to create a green and healthy workplace.

Locally-owned enterprise and SGBC Member Arc Floor Pte Ltd, while primarily dabbling in flooring solutions for the built environment, has diversified its portfolio of green building

Shading for Sustainability



solutions to provide more holistic coverage to address industry needs. One of these solutions is KristalBond, the first-ever liquid-form solar coating that provides a thermal insulation barrier against harmful rays and solar heat for a cooler indoor space and enhanced energy savings. The product, certified as a Singapore Green Building Product (SGBP ✓), was invented in Japan with patents in 16 countries, and utilises advanced Sol-Gel and nanotechnology to create a long-lasting product that is resistant to physical damage and fire.

The liquid-applied coating blocks up to 99 percent of UV rays while still allowing adequate visible light to pass through, protecting the skin against hyperpigmentation and forming a layer of protection against fading caused by direct sunlight exposure for home furnishings. Once applied, KristalBond` can absorb 90 percent of infrared heat, which helps reduce indoor temperatures by up to three degrees Celsius (3°C). A 3°C decrease in temperature can help to reduce a household's annual electrical consumption by 20 percent and

decrease carbon emissions by approximately 5.6 g/ m². The solution is also free from toxic ingredients and preserves window originality without any distortion, glare or obstructers because of its 7-micron thin coating, making it is easy to maintain and safe to use for all households.

KristalBond also has superior self-levelling properties that allow it to be coated seamlessly and smoothly regardless of contours and curves, making it suitable to be applied to residential and commercial buildings. The solution is installed in certain glazed areas within Changi Airport Terminal 3 as well as in Housing & Development Board apartments.

In line with Singapore's focus for greater environmental sustainability, using eco-friendly and sustainable cooling materials can help to improve energy efficiency and lower global carbon footprint while providing occupants with a safe and healthy indoor environment. ✓

Images courtesy of Arc Floor Pte Ltd.





MAKING THE WORKPLACE SMART, SAFE AND COMFY

Siemens equips Singapore office with its Smart Workplace technology to enable hybrid working model

Making the Workplace Smart, Safe and Comfy



The way we work has seen a fundamental shift in the past year, brought on by the global pandemic and the national lockdowns – such as Singapore’s Circuit Breaker period – instituted to curb community transmission of the virus. In order to keep business afloat during these times, companies had little choice but to adopt remote working arrangements for their employees, pivoting traditionally brick-and-mortar operations to the digital space.

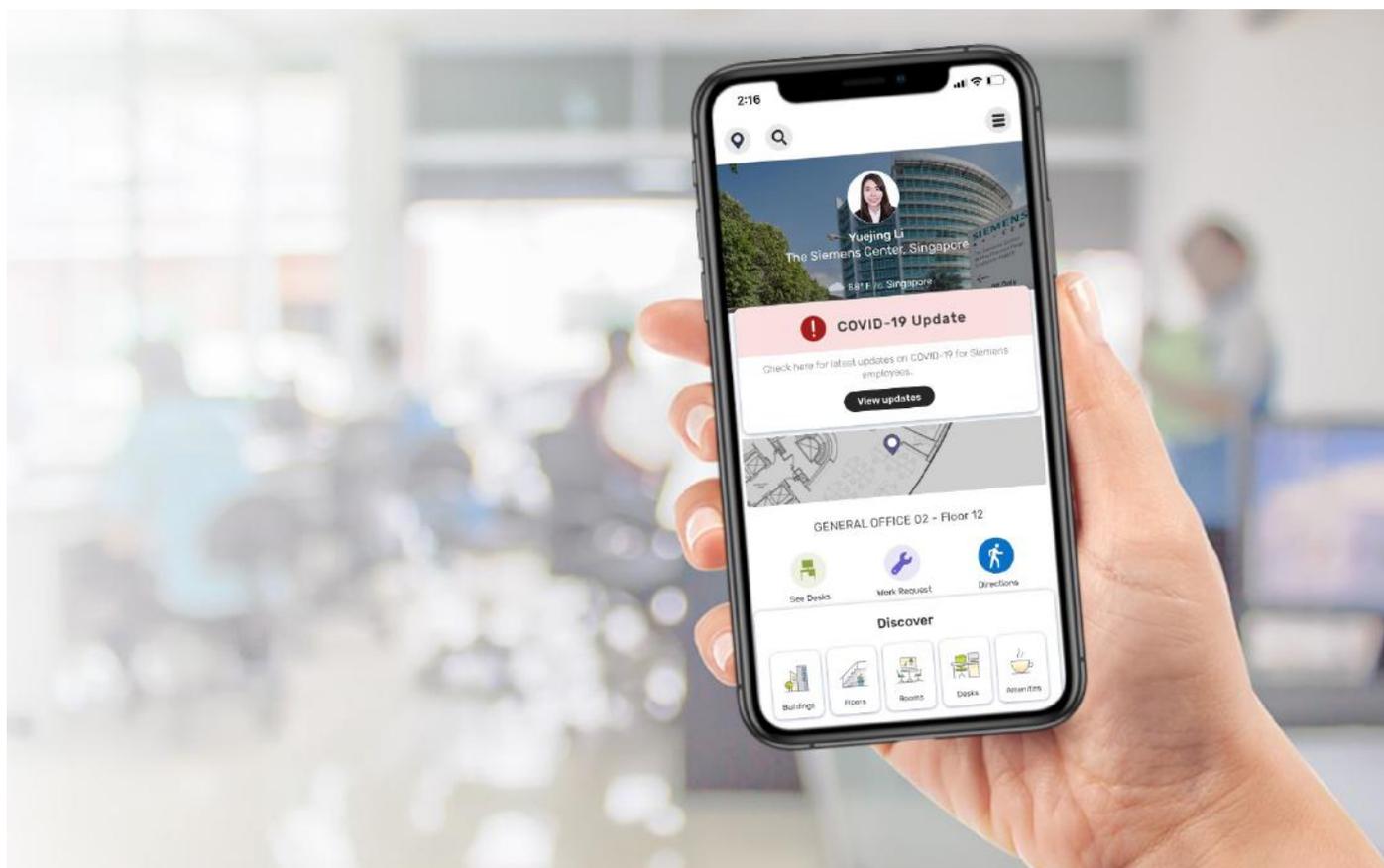
While the world is gradually easing pandemic-centric restrictions and regaining some semblance of life pre-pandemic, remote working arrangements are not going away anytime soon. In fact, a sizable number of companies want remote working arrangements to continue in some form even after the entire world has been vaccinated against the virus. A survey of 127 professionals in the human resources, legal & compliance and real estate roles by research & advisory firm Gartner found that more than 80 percent of company leadership plan to allow employees to work remotely at least part of

the time, with 47 percent saying that they will allow employees to work from home full-time. A separate survey of 669 CEOs by PwC also points to the affirmative, with 78 percent of leaders agreeing that remote collaboration is here to stay.

In light of the new normal and the future of work, companies will have to remodel, reconfigure and redefine the workplace to ensure that employees remain engaged, motivated and productive even when working away from the office.

To support the new normal and to ensure the health, safety and wellbeing of its employees in Singapore, SGBC Founding Member Siemens Pte Ltd has equipped its Singapore premises with an intelligent workplace platform to enable a hybrid working model. This supports a safe return to the workplace for Siemens’ 650-strong workforce and lays the foundation for more agile and future-oriented working.

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The backbone of the Smart Workplace solution is an integrated mobile application aptly named Comfy, which combines location, usage and building data with a wide range of features to connect employees to their office environment. App administrators can define daily occupancy limits to comply with the Singapore Government's work-in-office and Safe Management Measures at the workplace.

The Comfy app interfaces with a network of intelligent IoT sensors from Enlighted Inc, which collects a variety of environmental data including motion, ambient light, temperature and power consumption. When integrated with the Comfy app, the sensor technology enables employees to check the occupancy rate in the office and book a desk or meeting room, based on predefined thresholds. Through this, employees can register their intention to work in the office, receive company-related

updates, use indoor navigation, locate co-workers and submit facility issues to the Facilities Management (FM) or Sanitation teams. The app is also integrated with the Land Transport Authority's open-source platform Land Transport DataMall to allow users to get real-time bus arrival information.

The Intelligent Workplace Platform also provides a dashboard of historical, current and future data of employees returning to the office, eliminating a manual and time-consuming tracking process.

The platform also offers in-depth analytics in the form of dashboards and reports that provides insights on how spaces are being used, enabling a smarter, data-driven strategy for real estate right-sizing. This allows organisations to better maximise their space through redundant space management, leading to significant operational cost savings.

 Desk/Room booking

 Indoor navigation

 Submitting facilities maintenance issues

 Finding co-workers

 Facilitates social distancing





Smart/Human centric lighting



Insights for real-estate right sizing



Seamless 3rd party integrations

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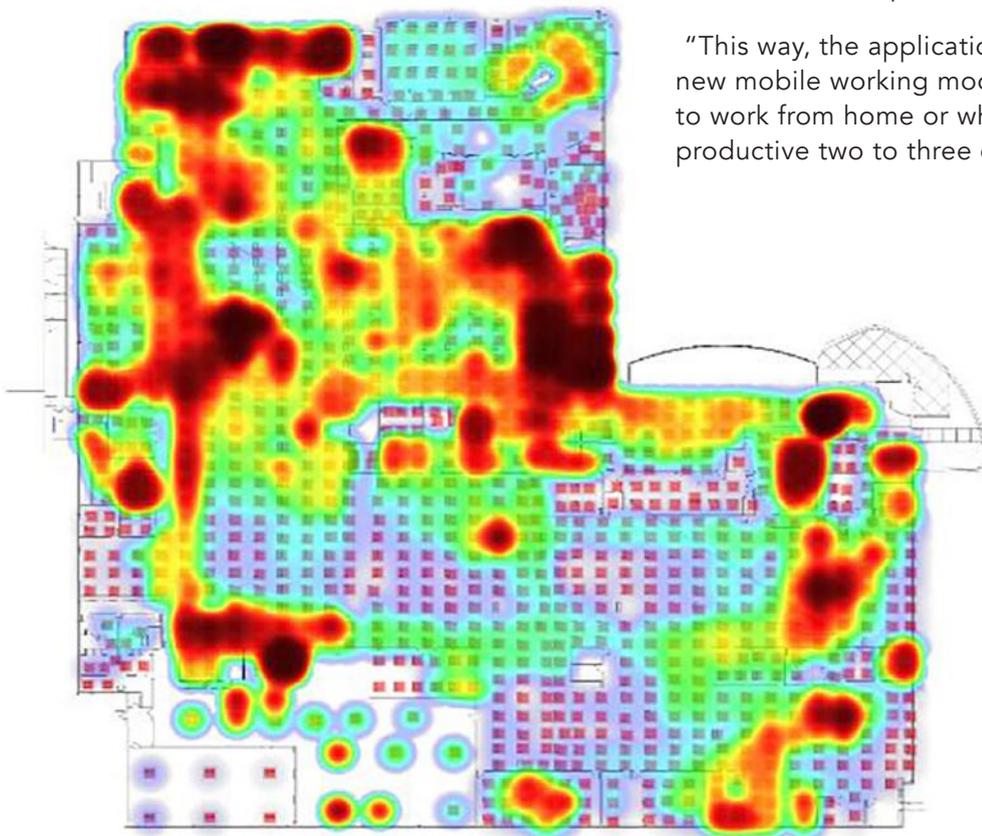
Space analytics can show which spaces are being used and when — by building, floor, room, and even desk. If there are too many people on a floor, the building manager can open new spaces to allow for greater social distancing. If there are too few people in an area, it can be closed off to conserve power and resources. Space utilisation can also inform cleaning schedules to make sure offices stay safe, healthy and productive.

Comfy's reporting dashboards also allows visibility of average and peak usage over specified time ranges, as well as utilisation across the entire floor visualised on a heatmap. The better the data, the better decisions building management can make. As Comfy collects so many cross-sections of workplace data, a complete picture of how real estate is being used can be obtained.

"The COVID-19 situation has not eased so we need to continue to be vigilant. Our priority is to protect our people. By rolling out our Smart Workplace solutions, we can provide more information to our employees, to help them make informed decisions about whether to return to the office or not, and if they do, they can do so with a peace of mind," said Dr Thai-Lai Pham, CEO of Siemens ASEAN.

"This way, the application is also supporting our new mobile working model which allows employees to work from home or wherever they are most productive two to three days a week." ✓

Images courtesy of Siemens.



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Accredited Green Building Professionals

The SGBC Green Mark Professional Qualification Scheme succeeds the BCA Green Mark Specialist programme and aims to uplift, upskill and recognise green building competencies of professionals in the built environment sector.

Certification Types

Green Mark AP

The Green Mark AP certification qualifies industry professionals with the knowledge and expertise needed for the development of Green Mark projects.

- Green Mark Accredited Professional (*Green Mark AP*)
- Green Mark Advanced Accredited Professional (*Green Mark AAP*)

Green Mark AP (FM)

The Green Mark AP (FM) certification qualifies industry professionals with the knowledge and expertise needed to maintain and operate green buildings.

- Green Mark Accredited Professional (Facilities Management) [*Green Mark AP(FM)*]
- Green Mark Advanced Accredited Professional (Facilities Management) [*Green Mark AAP(FM)*]

Continuing Professional Development

A key feature of the SGBC Green Mark Professional Qualification Scheme is the establishment of a Continuing Professional Development (CPD) framework for all Green Mark APs. Through a host of meaningful programmes and activities, Green Mark APs will be able to keep abreast of industry trends and stay ahead of sectoral developments.

Green Mark AP certifications are renewed annually upon fulfillment of the renewal requirements.

Renewal requirements
for **Green Mark AP** and
Green Mark AP (FM)



12 SGBC-GMAP
CPD Points

Renewal requirements
for **Green Mark AAP** and
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18 SGBC-GMAP
CPD Points



About the
scheme



Upcoming
CPD activities



Renewal
Requirements



Frequently Asked
Questions