

SG GREEN



INNOVATING FOR SUSTAINABILITY

**INSIDE:
SUSTAINABILITY SPOTLIGHT:
THE RACE TO ZERO**

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**EMBRACING NATURE IN THE
CITY: THE RISE OF WOODEN
STRUCTURES IN URBAN
LANDSCAPES**

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Can we stop ourselves?

1.5°C

Global warming of 1.5°C above pre-industrial levels will be disastrous. How to take steps to prevent this? Decarbonising the built environment would contribute significantly to managing global warming.

SP Digital GET™ (Green Energy Tech) is a sustainable utilities management experience. Our suite of solutions enables you to:



SMART INSIGHTS
ENERGY EFFICIENCY
OCCUPANT EXPERIENCE
SUSTAINABILITY

Monitoring & Analysis	GET™ Insights Analyse and optimise utilities to manage costs and carbon emissions
Forecasting AI	GET™ TenantCare Digitalise tenant utilities and billing to improve efficiency and revenue assurance
Alarms & Fault Detection AI	GET™ Control Intelligent IEG control system for enhanced occupant comfort
Distributed Energy Resources	GET™ Engaged Educate and engage stakeholders to advance sustainability
IEQ & Microclimate	GET™ Mobility Intelligent and reliable charging station management for a better EV experience
EV Charging Station Network	
User Engagement	



Optimise energy efficiencies and drive greater savings



Improve indoor air quality and boost occupant well-being



Gain utility insights and proactively reduce carbon footprint



Enhance tenant satisfaction and add value to your business



Encourage a green mindset and advance sustainability goals

Ready to decarbonise the built environment? Consult our team of experts now.

SGG GREEN

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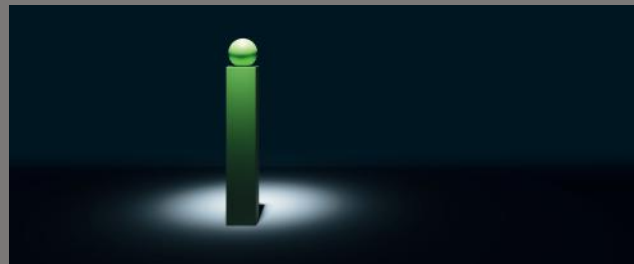
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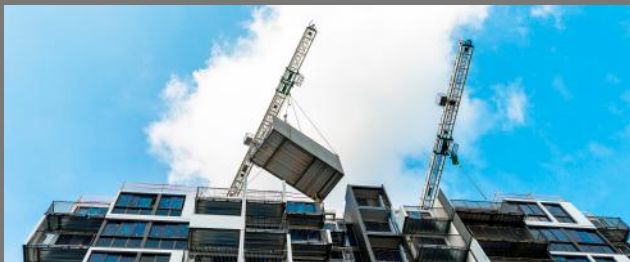
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MESSAGE FROM THE EDITORIAL TEAM

illustration by Freepik.com

As we stand at the crossroads of environmental challenges and limitless possibilities, the industry must explore the trailblazing innovations that are revolutionizing the way we design, construct, and inhabit our cities and buildings.

Our world is undergoing a profound transformation. The urgent need to address climate change has spurred a global awakening, driving us to rethink our approach to the built environment. The built environment, which encompasses everything from our homes to our workplaces, plays a pivotal role in our carbon footprint. It is both the source of many environmental challenges and the canvas upon which we can paint a more sustainable future.

In this edition of SG Green, we delve into the fascinating innovations that are driving the transition to a low-carbon built environment. It is inspiring to witness how the built environment is harnessing cutting-edge technologies, sustainable materials, and visionary concepts to shape our world anew.

Innovation is not limited to the physical aspects of the built environment; it also extends to the way we manage and interact with these spaces. Digitalisation, the Internet of Things (IoT), and artificial intelligence are enabling intelligent buildings that adapt to our needs, optimising

energy use and comfort while reducing waste. This issue, the sustainability spotlight is put on SGBC Member SP Digital, whose suite of tailored digital solutions can help organisations conceptualise, develop and implement a game plan for sustainability.

However, innovation in sustainability is not just about technology; it is about a fundamental shift in our mindset. It is about reimagining what's possible and challenging the status quo. It's about embracing principles of resilience, adaptability, and regeneration.

As we go through the pages of the magazine, let us be inspired by the industry players who are driving innovation for a greener, more sustainable, and low-carbon built environment. They remind us that every structure we create is a testament to our commitment to a better future for our planet and for generations to come. Together, we can build a world where our cities and buildings are not just shelters but also stewards of the environment, working harmoniously with nature to create a brighter, more sustainable future.

Yours Sincerely,
SG Green Editorial Team



THE RACE TO ZERO

The urgency for sustainability continues, exacerbated by harsher weather conditions in recent months. Find out how SGBC Member SP Digital can help conceptualise, develop and implement a game plan for sustainability.





Amid the urgent imperative to combat climate change, Singapore has set ambitious targets in a whole-of-nation effort to reduce carbon emissions, and the built environment is no exception. Responsible for 20 percent of the country's carbon emissions, buildings are instrumental to Singapore's climate change mitigation ambitions, and the Singapore Green Building Masterplan (SGBMP) was launched in 2021 to foster a greener built environment.

As part of the Singapore Green Plan, the SGBMP outlines three interconnected goals:

- **Stepping up the pace to green 80% of our buildings by 2030**
- **Having 80% of new developments to be Super Low Energy (SLE) buildings from 2030**
- **Achieving 80% improvement in energy efficiency for best-in-class green buildings by 2030**

These initiatives will help Singapore transit to a more sustainable, low-carbon built environment.

THE POWER OF ACCOUNTABILITY AND TRANSPARENCY

Singapore's dedication to sustainability extends beyond lofty aspirations to encompass rigorous accountability mechanisms. The Singapore Green Plan 2030 has accelerated Environmental, Social and Governance (ESG) reporting, recognising that change is most impactful when it is quantifiable and transparent.

Presently, Singapore mandates climate reporting aligned with the Task Force on Climate-related Financial Disclosures (TCFD) for listed companies in specific sectors such as finance, agriculture, food, forest products, and energy. For all other listed entities, compliance with TCFD standards is expected on a 'comply-or-explain' basis.



In accordance with a proposition put forth by Singapore's regulatory bodies - the Accounting and Corporate Regulatory Authority (ACRA) and the Singapore Exchange Regulation (SGX RegCo) - comprehensive climate-related reporting obligations will encompass all listed issuers, including those incorporated abroad, as well as business trusts and REITs. The stipulation mandates the initiation of climate-related disclosures from the fiscal year 2025. Furthermore, non-listed enterprises generating at least \$1 billion in revenues will be subject to these requirements starting from FY2027.

Additionally, the regulatory authorities have outlined intentions to evaluate, in 2027, the prospect of expanding climate disclosure mandates to non-listed companies with revenues exceeding \$100 million. If approved, the disclosure process for these companies would likely commence around FY2030.

ENABLING EFFECTIVE ESG REPORTING

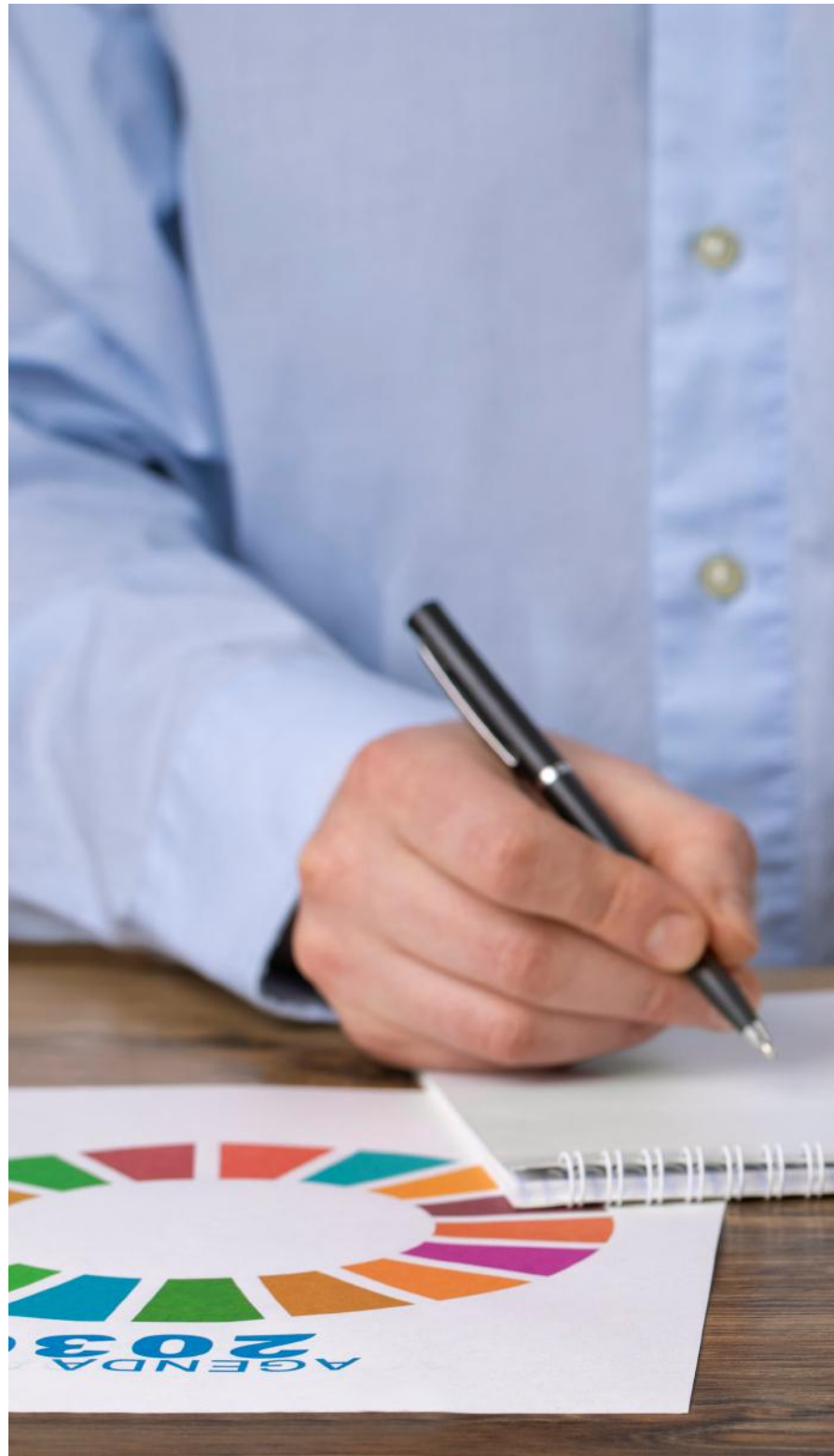
At the vanguard of Singapore's sustainability revolution is SGBC Member SP Digital. SP Digital, a wholly owned subsidiary of SP Group, leads the digital transformation for the group, with a remit that covers residential, commercial, industrial and national needs.

To help organisations foster a culture of sustainability from within, SP Digital has introduced an intuitive ESG reporting platform to streamline reporting processes, uncover latent cost-saving opportunities, and enhance overall business performance. The platform leverages evidence-based ESG disclosure and steers clear of greenwashing with an indisputable chain of data custody and calculation methodologies, ensuring a quality ESG report.

The Race to Zero

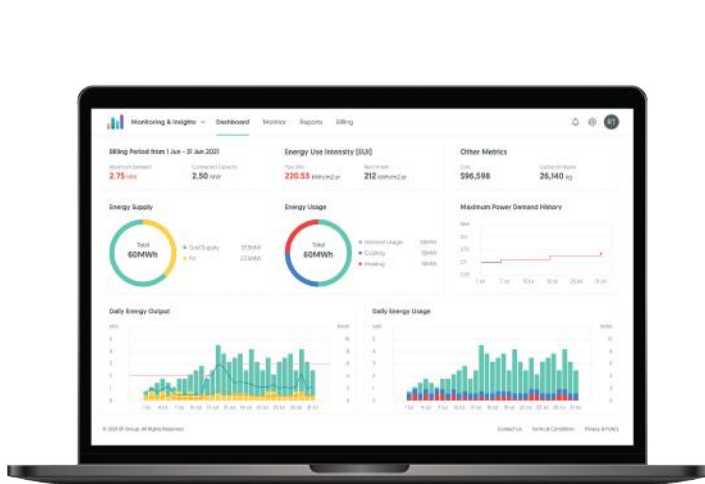
The platform enables effective ESG reporting for the organisation through a five-pronged process:

- **Performance Evaluation** – provides an understanding of baseline performance to help organisations map out and track sustainability objectives that are aligned with recognised frameworks.
- **Competitive Insight** – provides industry sustainability benchmarks and performance to enable effective tracking and benchmarking to better identify growth opportunities.
- **Materiality Assessment** – provides a structured process to identify and prioritise key ESG issues for the organisation to focus on, and aggregates qualitative and quantitative data to enable more informed business decisions.
- **Risk Advisory** – provides information on risk across the organisation’s supply chain, identified in order of priority with recommended mitigation action. The platform monitors risk in real-time to enable complete transparency and a clear roadmap towards ESG compliance.
- **Framework Alignment** – provides a checklist of the necessary steps involved in a five-year roadmap towards set sustainability objectives, which can include organisation decarbonisation or achieving net zero by 2030.

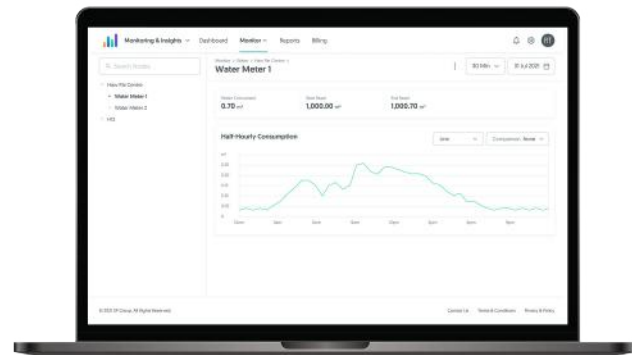




The Race to Zero



GET™ Insights Dashboard Overview



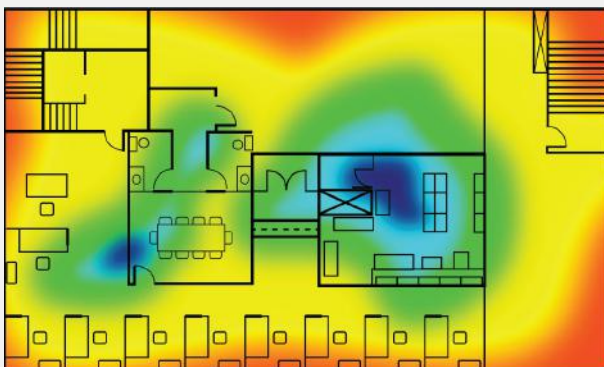
Real-time monitoring and visualisation of utilities consumption

PAVING THE WAY WITH DIGITAL SOLUTIONS

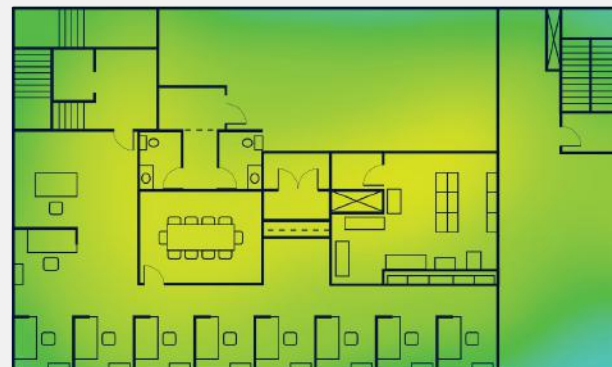
Reducing carbon emissions pivots on efficient utilities management, and SP Digital's Green Energy Tech (GET™) emerges as a potent agent of change. Harnessing the potential of the Internet of Things (IoT) and Artificial Intelligence (AI), GET optimises energy consumption within buildings, striking an optimal balance between occupant comfort and environmental preservation. The versatility of this solution is noteworthy – GET integrates different building systems and diverse data sources to present accurate, comprehensive and timely information, creating a seamless, sustainable utilities management experience.

The implementation of the GET platform is adaptable to various building types. While it is feasible to integrate GET during the construction phase of new buildings, transitioning from an older system to GET does not necessitate extensive retrofitting efforts. The system effectively addresses common challenges faced by building owners, including the manual tracking of electricity and water usage, report generation, Energy Use Intensity (EUI) benchmarking, and identifying energy inefficiencies. Concurrently, GET facilitates real-time monitoring and assessment of consumption patterns, allowing for prompt corrective actions and opportunities for cost reduction.

GET™ Control optimises occupant comfort



Before implementation:
Hot and cold spots in office space



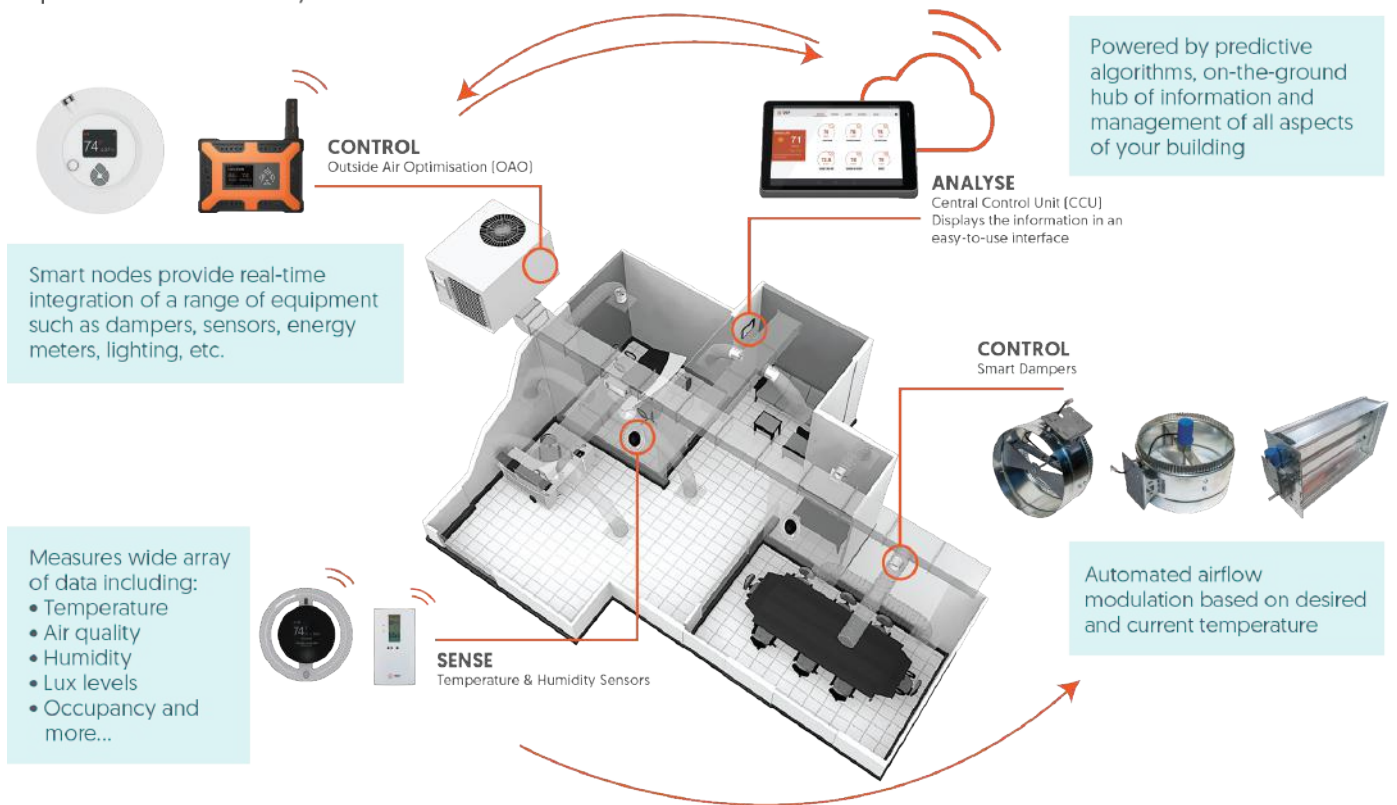
After implementation:
Office space is evenly cooled



Energy consumption holds substantial importance in the manufacturing operations of a global coatings producer, and the reduction of this consumption translates to substantial financial savings and a decreased environmental impact. SP Digital undertook the digital transformation of the prevailing metering system and introduced the utilisation of GET™ Insights. This deployment equipped the manufacturer with an informative dashboard that provided real-time data spanning the entire manufacturing facility that enabled optimisation for utilities consumption.

Dynamic Airflow Balancing (DAB)

Dynamic Airflow Balancing (DAB) is a proactive zone control system that remotely monitors and controls conditions in individual spaces for superior comfort and efficiency. Predictive machine learning algorithms optimise cooling capacity by redirecting conditioned air to the spaces that need it most, a strategy which is proven to lower utility costs.



The Race to Zero



Similarly, a leading real estate company in Singapore made use of GET™ Control – an intelligent Indoor Environmental Quality (IEQ) control system for enhanced occupant comfort – to achieve 18 percent in energy savings. Deployed in an office space spanning 15,000 square feet, GET Control integrates smart devices to manage temperature, humidity and

airflow, creating a conducive environment for happy and productive occupants.

An institute of higher learning making use of the platform achieved 30 percent average energy savings on air-side operations, with the system maintaining the recommended air temperature of 23°C - 25°C for 94 percent of the time.

EMBRACING A SUSTAINABLE TOMORROW

As the world converges in a unified effort to combat climate change, SP Digital stands as a steadfast partner, offering holistic solutions that empower organisations to be architects of meaningful change. Singapore's resolute stance and comprehensive approach embody the power of collective action, serving as an inspiration to nations worldwide.

The responsibility to shape a sustainable legacy rests with this generation, and organisations like SP Digital are poised to usher in an era defined by ecological harmony, resilience, and a brighter future for all. ✔

**Sustainability Spotlight by:
SP Digital**





ENABLING POTENTIAL FOR SUSTAINABILITY IN THE BUILT ENVIRONMENT

To better address contemporary challenges in the business environment, SGBC Member Exceltec Property Management Pte Ltd leveraged Workforce Singapore's Career Conversion Programme for Sustainability Professionals (Built Environment) to make its first sustainability hire.

Enabling Potential for Sustainability in the Built Environment



As the world's attention pivots towards sustainability and as more businesses aim to embrace more sustainable practices, numerous current jobs might change to include sustainability elements. Simultaneously, fresh positions like those focused on carbon management and carbon accounting will emerge. Consequently, there is an increasing necessity to provide Singaporeans with the skills required to assume these new environmentally conscious roles, empowering them to contribute to their companies' endeavors towards sustainability.

The Career Conversion Programme (CCP) for Sustainability Professionals was launched by Workforce Singapore (WSG) in September 2022, aimed at supporting Singaporeans in acquiring in-demand cross-sectoral skills relating to sustainability as the country transits to a low-carbon economy. The CCP for Sustainability Professionals supports the reskilling of workers to take on business functions such as carbon management, sustainability reporting and implementation and development of carbon projects, as well as the creation of new job roles such as Sustainability Officer and Carbon Analysts and enhances the current scope of work in areas such as finance, procurement, human resource, logistics and operations.

Further, WSG has collaborated with the Singapore Green Building Council (SGBC), the Building and Construction Authority (BCA), Singapore Polytechnic (SP) and industry players to tailor a CCP for Sustainability Professionals to the Built Environment sector. This industry-centric CCP will support individuals to reskill and take on sustainability

business functions such as carbon management and sustainability reporting which are growing in demand, as well as support companies to bring in new sustainability job roles to support their green transition.

NO LONGER A QUESTION OF WHY, BUT HOW

SGBC Member Exceltec Property Management Pte Ltd was one of the first adopters of the built environment-centric pathway of the CCP for Sustainability Professionals. For Exceltec, sustainability was no longer a question of why, but how. The company is determined to do its part to reduce environmental impact and help create a more sustainable future in support of national initiatives like the Singapore Green Plan 2030 and the Singapore Green Building Masterplan. It has also become critical for Exceltec to stay ahead in a highly competitive facilities management (FM) industry.





Exceltec kickstarted its sustainability journey in 2022 with the forming of a Sustainability Steering Committee to formulate the company's sustainability strategy, provide strategic direction to staff and track the progress of sustainability initiatives and projects. The Committee subsequently identified a few areas for Exceltec to focus on, including developing its inaugural Sustainability Report, implementing sustainability best practices to reduce organisational carbon footprint, obtaining sustainability-related certification and expanding the business into the provision of sustainable solutions to our clients. To do all these (and more), Exceltec would need the relevant expertise, which necessitated the creation of a new Sustainability Executive role to support the company's burgeoning sustainability efforts.

ENABLING POTENTIAL

Mr. Stevyn Zeng had been hit hard by the COVID-19 pandemic but had the opportunity to complete a two-month attachment stint with Exceltec which equipped him with relevant property management skillsets. While initially hesitant about the offer to join Exceltec as its first Sustainability Executive due to his lack of related experience and seemingly steep learning curve, Stevyn was reassured when he was placed on the CCP to acquire the necessary skills and guidance to smoothen his transition into the new sustainability role.

Enabling Potential for Sustainability in the Built Environment



The CCP is structured into three main components:

- Attending a minimum of one programme from WSG’s pre-approved course list
- An optional mentorship component guided by an industry expert
- Structured On-the-Job Training (OJT)

Stevyn was first sent on sustainability-related training programmes relevant to his new job role, which allowed him to acquire foundational sustainability skills that are required and provided him with a better understanding of key sustainability topics such as sustainability reporting and carbon emissions management. An industry mentor was then assigned to Stevyn to support his transition into the role and had been an invaluable resource person to consult on sustainability queries or to seek views on his green proposals.

Stevyn is now facilitating the creation of Exceltec’s first sustainability report, on track to completing and publishing it by the end of 2023. He serves as the main point of contact for consultants, colleagues, and management, providing information on the company’s environmental, social and governance (ESG) framework development as well as material footprint towards the report.

He also analyses multiple datasets and tracks key sustainability metrics within Exceltec to assess the effectiveness of their sustainability initiatives to identify areas for improvement. Stevyn makes it a point to stay updated on industry trends and best practices to ensure Exceltec remains at the forefront of sustainable property management.

Additionally, Stevyn conducts workshops to educate and inspire his colleagues on integrating sustainability practices into workplace culture. The topics he covers include the importance of switching off and unplugging devices when leaving the office and reducing the usage of single-use plastics.

TOWARDS A GREENER FUTURE

Even with Stevyn onboard to spearhead green efforts, Exceltec’s pursuit of sustainability is ongoing. The company has recently been certified by SGBC as a Green Facilities Management service provider under the Singapore Green Building Services (SGBS) certification scheme and will continue to implement initiatives that can further reduce its environmental impact and costs. Sustainable procurement will also be a key strategy for Exceltec’s supply chain management.

Enabling Potential for Sustainability in the Built Environment

As a key player in the FM industry, Exceltec will continue to work closely with its stakeholders to ensure the alignment of sustainability efforts with broader strategic goals. There is immense value in working closely with clients to explore and implement sustainability solutions on their premises, such as duct cleaning for enhanced indoor air quality, energy-efficient lighting, smart green soil sensors for landscaping and unique tri-gen solutions that all contribute to greener built environment.

Looking ahead, Exceltec will explore the addition of new green roles within the company to drive and support its growing sustainability plans, done in tandem with national and industry developments on built environment sustainability. ✔

For more information on the WSG Career Conversion Programme for the Sustainability Sector (Built Environment), visit: <https://go.gov.sg/sustainabilityprofessionalsccp>



PARTNERING FOR CARBON NEUTRALITY

Find out how SGBC Member Climate Asia helped make the International Green Building Conference 2023 a carbon neutral event.

An aerial photograph of a lush green forest. A path of trees winds through the landscape. In the center of the path, the letters 'CO2' are formed by a dense cluster of trees, standing out against the blue sky and white clouds visible through the canopy.

CO₂

Partnering for Carbon Neutrality

The International Green Building Conference (IGBC) 2023, organised by the Singapore Green Building Council (SGBC) on 26-27 June 2023 at the Raffles City Convention Centre, showcased Singapore's efforts and achievements in developing a sustainable city in the tropics, highlighting the latest trends, developments and technology in built environment sustainability.

From the planning stage, IGBC 2023 was organised as a carbon-neutral event, and SGBC Member Climate Asia, also IGBC 2023's official Carbon Accounting Partner, supported this endeavour through the implementation of various sustainable practices and initiatives. With a structured approach that consists of carbon footprint assessment, reduction strategies and steps taken to offset carbon emissions, IGBC 2023 was successfully organised as a carbon-neutral event.

OVERVIEW AND KEY PRINCIPLES

Being carbon neutral typically refers to reducing emissions where possible and compensating for the remainder by investing in carbon offset projects to achieve net zero overall emissions. Offsets are generated from an activity that prevents, reduces or removes greenhouse gas emissions from being released into the atmosphere.

The principles for calculating a carbon account are vital for achieving carbon neutrality for events, and these are:

- Relevance
- Completeness
- Consistency
- Transparency
- Accuracy



All offsets used for IGBC 2023 met stringent integrity principles, including being additional, permanent, measurable, transparent, leakage-addressing, independently audited, and registered.

BOUNDARIES AND EMISSION SOURCES

IGBC 2023 was held over two days and attracted more than 900 unique attendees. To help with the event's carbon accounting, references were taken from both the U.S. EPA Center for Corporate Climate Leadership – GHG Inventory Guidance and The Climate Active Carbon Neutral Standard for Events (Event Standard).

The criterion of relevance (adapted from the GHG Protocol – Corporate Standard (WBCSD and WRI, 2004)) ensures that the carbon accounted for appropriately reflects the emissions of the event, which includes Scope 1, Scope 2 and Scope 3 emissions.

What does it mean to be carbon neutral?

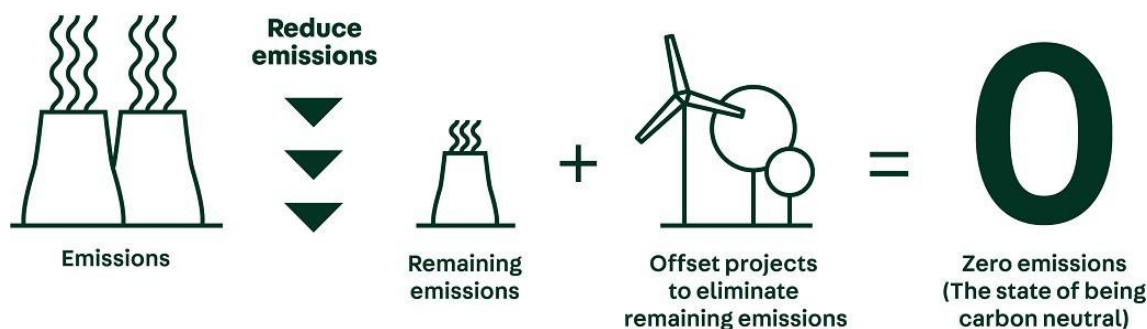


Image source: <https://www.climateactive.org.au/be-climate-active/tools-and-resources/climate-active-carbon-neutral-standard-events>

A REDUCTION FIRST APPROACH

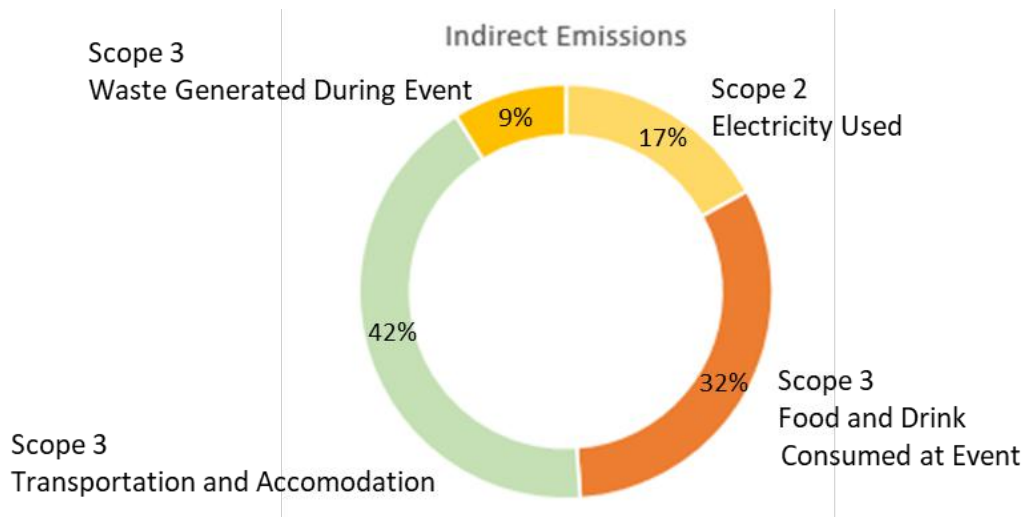
When planning an event of this scale, implementing a proactive emissions reduction strategy is crucial to minimise its carbon footprint. Some strategies that focus on emissions reduction during the pre-event calculation phase include:

- 1. Sustainable Venue Selection:** Choosing an event space with a commitment to sustainability is important. An event space with high energy efficiency and environmentally conscious practices was chosen, with close proximity to the national public transportation network. The event space was situated conveniently above the City Hall Mass Rapid Transit (MRT) station, and its prime location facilitated reduced carbon emissions from attendees by encouraging the utilisation of public transportation options to attend the event.
- 2. Sustainable Catering:** Implementing sustainable practices during catering operations includes the utilisation of reusable cutlery such as plates, utensils, and cups. To further enhance these efforts, Raffles City Convention Centre partnered with Lumitics, a Singapore-based food technology company. Lumitics employs artificial intelligence (AI) and computer vision technology to assist commercial kitchens in curbing food waste. Additionally, the event’s catering kitchen offered an array of plant-based and vegan food options throughout the entirety of the event.



- 3. Attendee Engagement:** Attendees were made aware of the event’s sustainability efforts before and during the event to encourage their participation and assistance towards carbon neutrality goals. Information about the event’s emission reduction goals was also widely shared with attendees during appropriate segments in the programme.
- 4. Resource Management:** Emphasis was placed on responsible resource utilisation during the event, leading to a reduction in the usage of single-use plastics, as well as a deliberate reduction in the distribution of flyers, brochures, pens and paper.

By implementing these strategies, the event’s carbon footprint was significantly reduced, showcasing SGBC’s commitment to sustainability, and to inspire others in the event industry to adopt eco-friendly practices.



Bulk of the Emissions are from Transportation and Accommodation from the event attendees.



CARBON ACCOUNTING - POST EVENT

For IGBC 2023, the post-event carbon account information was gathered early to identify any changes in the emissions boundary and sources as compared to the pre-event account.

Post-event, measured data was used whenever possible, with conservative estimates used only where data is unavailable. For example, operational energy data was not available for the total duration of IGBC 2023. As such, data on the average electricity per square metre of venue space was used, which was obtained from the SLEB Smart Hub website maintained by the Building and Construction Authority (BCA). The SLEB Hub provides energy consumption data based on building types, and these factors were multiplied by the event venue’s floor space and the event duration (per day) to quantify the venue’s electricity consumption (Scope 2 emissions).

For Scope 3 emissions, these are indirect emissions generated from the activities of the event but occur from sources not owned or controlled by the responsible entity or event organiser. For IGBC 2023, the following sources relevant to the Carbon accounting of the event were identified:

Emission Type	Carbon Dioxide Equivalent (tCO ₂ e)
Scope 1 Direct Energy Use – covers all direct emissions from burning of fuel	0.0
Scope 2 Indirect Energy Use – covers all electricity consumed from operating the event	1.53
Scope 3 Transportation & Accommodation – covers attendee travel and accommodation (e.g., ground and air transport of staff, volunteers, speakers and participants)	2.87
Scope 3 Food & Drink Consumed during Event	3.80
Scope 3 Waste Generated During Event	0.80
Total	9.01

The bulk of emissions for the event are related to the travel and accommodation arrangements of the attendees. ✔



CARBON OFFSETS

To offset the emissions generated by the Conference, suitable carbon offset projects had to be identified. Projects were chosen based on their credibility, environmental impact, vintage, location, and type (e.g., reforestation, waste reduction projects). The selected project for IGBC's carbon offsets was a Gold Standard-certified solar farm in Rajasthan, India - one of the largest solar parks in the world.

After calculating the event's total carbon emissions, verified carbon offset units equivalent to that amount were purchased. By purchasing these carbon offsets, the IGBC 2023 event achieved carbon neutrality, meaning that the greenhouse gas emissions produced during the event were essentially balanced out.

Solar panels offset carbon emissions by generating electricity that is exported to the grid. This replaces electricity that would otherwise be generated by conventional fossil fuel power plants, reducing greenhouse gas emissions.

The procurement of carbon offsets for IGBC 2023 demonstrates a strong commitment to sustainability. This action not only helped to offset the event's carbon footprint, it also contributed to worthwhile projects that promote positive environmental change.

Through this carbon offset exercise, a working example for the built environment sector was presented, helping the industry to begin navigating the challenges and ambiguities of carbon accounting. With accurate and more complete reporting, built environment organisations can be empowered to have a more positive environment impact through their operations, and work towards the vision of a greener, more sustainable future. ✔

**Article contributed by:
Climate Asia Pte Ltd**

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SUSTAINABLE ENERGY THAT LOOKS GOOD

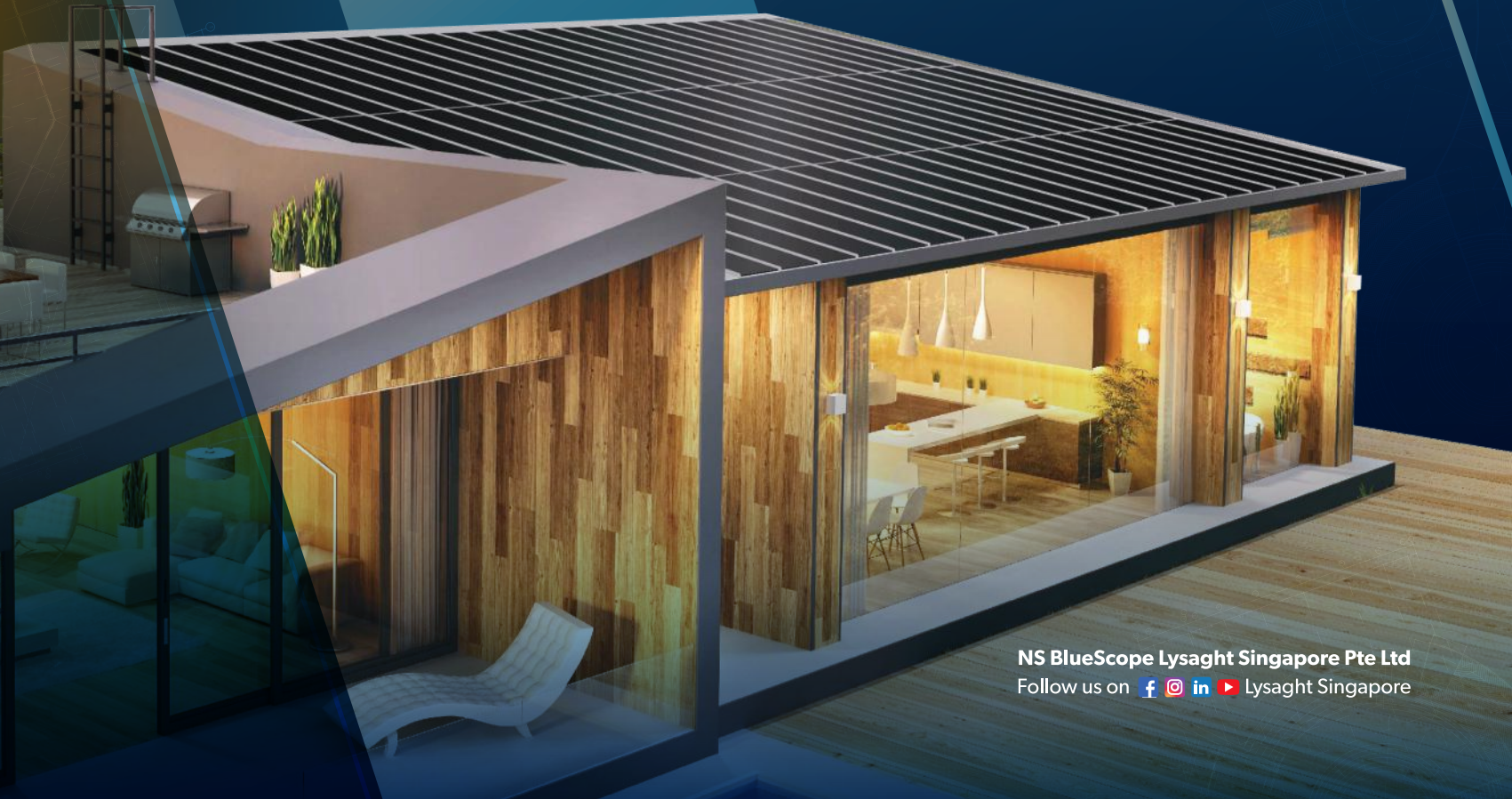
The smart integration of solar panels into your roof's surface helps transform your rooftops, facades, and structures into energy sources that enhance both aesthetics and functionality. Our sleek LYSAGHT® BIPV roofing panels make a bold statement for modern roofing solutions, flaunting an elegant approach to sustainable energy.

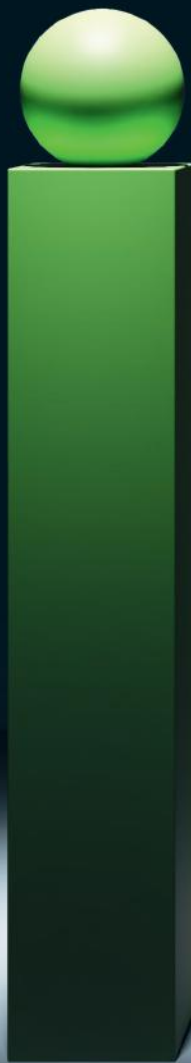
As your trusted roofing partner, we tailor our designs to your building's visual and practical needs. Speak with us today and learn how Lysaght® BIPV Solar Solutions can score in aesthetics, sustainability and roof performance.

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THE PATH TO SUSTAINABLE LIGHTING

By considering and incorporating four pillars of sustainability into lighting planning and decision-making processes, it is possible to create more environmentally friendly and efficient lighting solutions.



Figure 1. The Sydney Observatory is a heritage listed building converted from a fort to an astronomical observatory in the late 19th century. Now, it is part of the Powerhouse Museum of applied art and science, with telescopes to bring the cosmos closer to its visitors. The Powerhouse Museum received a 6 Star Green Star rating and is the first museum in Australia to join the World Green Building Council Net Zero Carbon Buildings Commitment. As an observatory, it is important to keep the light level low and keep the night sky dark for optimum star gazing. © ERCO GmbH, www.erco.com, photographer: Jackie Chan

With rising world population and rapid technological advancements, sprawling megacities and skyscrapers have become symbols of our modern world. However, in an era marked by growing concerns about climate change and the need for sustainable development, the importance of sustainable development in the built environment has never been more crucial.

In response, there is an increasing demand for sustainable buildings that mitigate environmental impact. This demand stems from a combination of environmental legislation, tenant preferences, and shareholder interests. Developers and building owners who embrace sustainability and develop buildings with recognized labels can gain a competitive edge in the market.

Lighting constitutes a significant portion of the energy consumption in buildings, particularly for

commercial spaces that operate continuously around the clock. The path to sustainable lighting is still dimly lit, but important due to its multifaceted benefits, encompassing environmental, economic, and social aspects. These advantages include enhanced energy efficiency, resource conservation, cost savings, preservation of our natural dark skies, and the promotion of health and collaboration.

In general, lighting comprises both natural daylight and artificial illumination. While daylight offers a cost-free and energy-efficient lighting source due to its natural occurrence, it may not be sufficient in terms of illumination levels and duration for many indoor spaces, necessitating the use of electrical lighting. However, artificial lighting comes with energy consumption, which, in turn, leads to carbon emissions.

The Path to Sustainable Lighting



Figure 2. CapitaSpring is a multi-award-winning skyscraper designed by Bjarke Ingels Group (BIG), in collaboration with Carlo Ratti Associati and RSP. Located in the heart of Singapore's Central Business District, visitors are met with the City Room, an 18-metre-high, open public space at the foot of the tower. The space illuminated by ERCO showcase the high ceilings and different materials on the wall surfaces while using the least possible number of light fixtures to achieve this effect. The building received the BCA Green Mark Platinum award, the highest rating for sustainable buildings in Singapore. Read more about the project: <https://www.erco.com/sg/erco-singapore/capitaspring/> © ERCO GmbH, www.erco.com, photographer: Raphael Olivier

ERCO

Greenology® for sustainable lighting

Four consideration pillars

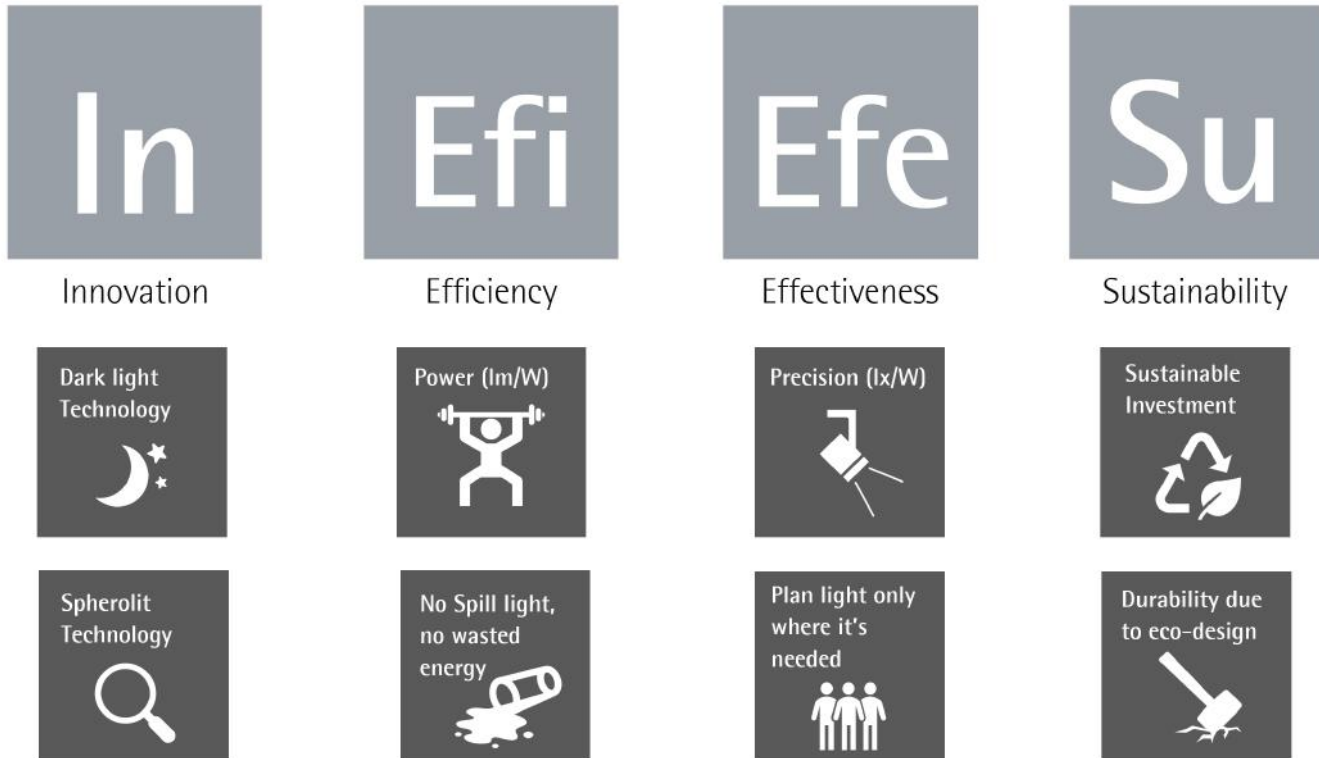


Figure 3. By considering and incorporating these four pillars of sustainability into lighting planning and decision-making processes, it is possible to create more environmentally friendly and efficient lighting solutions. Image courtesy of © ERCO GmbH, www.ercoco.com

When considering and planning for sustainability, there are four key aspects to consider:

1. Innovation:

This involves utilizing new materials and technologies to achieve greater energy efficiency. By embracing innovative approaches, such as using advanced materials or implementing cutting-edge technologies, it becomes possible to enhance the sustainability of lighting solutions.

2. Efficiency:

It is important to assess the number of lumens (light output) that can be obtained from a given amount of wattage (energy input). By focusing on efficiency, we can ensure that lighting fixtures are optimized to provide the maximum amount of light while minimizing energy consumption.

3. Effectiveness:

This pillar focuses on evaluating how effectively the light reaches the intended surface area. It involves considering factors such as light distribution, utilization, and usage patterns. By optimizing effectiveness, we can ensure that light is directed where it is needed most, reducing waste, and improving overall lighting performance.

4. Sustainability:

This pillar emphasizes the use of durable luminaires with long product lifespans. By selecting lighting solutions that are built to last, we can reduce the need for frequent replacements, thereby minimizing material usage and reducing landfill waste. Sustainable lighting options contribute to a circular economy and help minimize environmental impact.

The Path to Sustainable Lighting

When it comes to selecting light fixtures, technical specifications frequently prioritize the lumen/watt level, which measures the amount of light emitted from the luminaire (efficiency). However, it often overlooks the importance of measuring the lux within the designated area (lux/watt) to assess the actual effectiveness of the lighting. Therefore, during the design and specification process, it is essential to consider both effectiveness and efficacy simultaneously.

Lighting tools that utilize projection techniques rather than reflection techniques offer more precise and targeted light beams. This means that they can project a higher lux level onto the intended surface area, which makes them 60% more effective compared to reflectors, which tends to create spill light. Additionally, these projection-based tools help reduce spill light, which refers to light that scatters into the surrounding space and often causes glare. Spill light is most noticeable near the bulb, giving the impression of glaring lighting. It's important to note that spill light represents wasted light, resulting in wasted energy that does not effectively contribute to the overall light levels within the room.

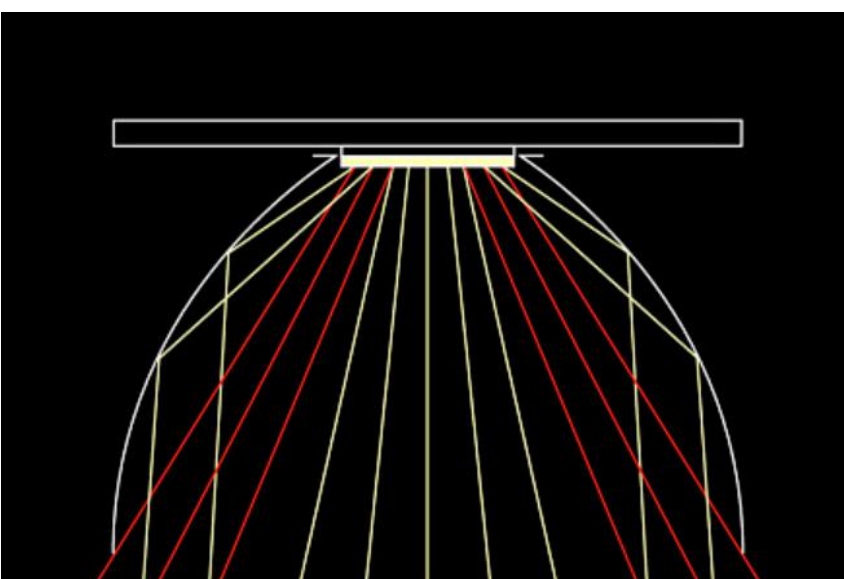


Figure 4. Traditional luminaires that use COB LED and reflector technology often experience losses due to spill light.

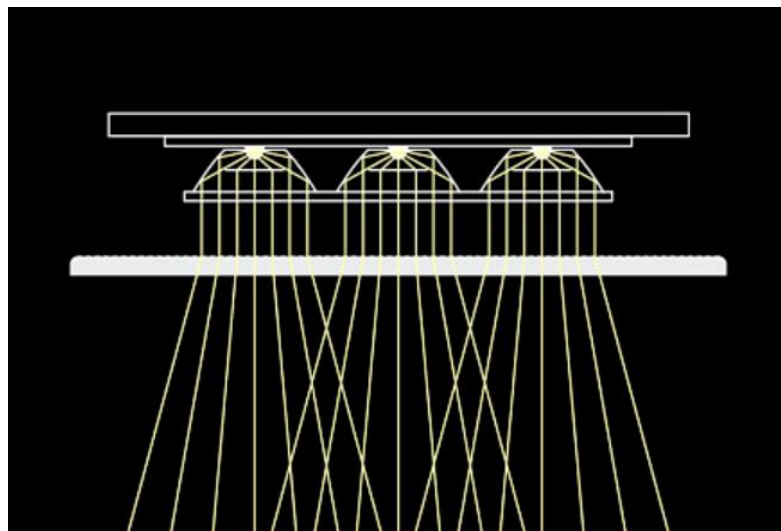


Figure 5. The utilization of ERCO LED optics with projection technology enhances the precision of light beams, resulting in reduced spill light and glare.

This is further developed with ERCO's Spherolit and Darklight lighting technology. Spherolit lenses consist of a micro-structure of free-form surfaces that enables precise light control with extremely flat lenses, achieving an improved light output ratio due to transmission, resulting in higher luminous flux. Darklight technology projects light of multiple LEDs through a focal point, prioritizing user's visual comfort by reducing glare. Both technologies utilize projection mechanisms to achieve high precision levels for ERCO luminaires.

In sustainable lighting, it is essential to consider not only the lighting tools but also the overall concept of lighting design. The strategic application of light is crucial, ensuring that it is used only where necessary. Building upon concepts such as Richard Kelly's Language of Light and William Lam's perception-oriented qualitative lighting design, ERCO has further expanded the notion of Human Centric Lighting (HCL) by incorporating architectural design principles, resulting in the AAA concept - Architecture, Atmosphere, and Activity.



Figure 6. The AAA theory for Human Centric Lighting. Image courtesy of © ERCO GmbH, www.erco.com



HCL-oriented architectural lighting goes beyond basic illumination, taking into account factors such as the visual perception of architecture, the specific visual tasks at hand, as well as the emotional and biological aspects of lighting, which supports both the visual and non-visual effects of light on people. In addition to cones and rods, the two photoreceptors for vision, our eyes also have another light-sensitive receptor type that adopt the role of synchronising of our day-night rhythm.

To enhance the perception of space within architectural environments, emphasis should be placed on making vertical surfaces more visible. Consider the types of activities happening within the space and consider provide appropriate lighting conditions. Additionally, creating the right atmosphere can be achieved by utilizing suitable lighting that aligns with the specific time of day.

Through applying the various lighting principles and understanding the activities and usage of the space, ERCO believes it will elevate user comfort and experience, all while enhancing the architectural design of the space and achieving an energy efficient solution.

Additionally, sustainability can be attained by extending the lifespan of products. By prioritizing durability, adaptability, and reparability in product design, it is possible to prolong their usefulness and minimize waste. ERCO, for instance, emphasizes the functional and architectural aspects of lighting in their luminaire design, allowing them to outlast decorative lamps that may be driven by short-lived design trends. Furthermore, ERCO offers flexible products that incorporate modular components like lenses, filters, and expandable track lights, enabling easy customization and adaptability.

Overall, sustainable lighting is an essential component of broader efforts to promote environmental stewardship, conserve resources, and create a more sustainable and equitable future for all. 🌱

**Article Contributed by:
ERCO**





TOWARDS A LOW- CARBON BUILT ENVIRONMENT

SGBC Member Tectus SA carried out two studies to quantify the impact of modern construction technologies on upfront carbon emissions in buildings

INTRODUCTION

Global warming is one of the most pressing environmental issues of our time. The past decade (2011-2020) has been recorded as the warmest, and carbon dioxide (CO₂) is the primary contributor to this phenomenon. Of all global CO₂ emissions, almost 40 percent is generated by the built environment, with embodied carbon expected to be responsible for around half of total new construction emissions between now and 2050¹. Remarkably, the cement industry would rank as the third-largest carbon polluter globally, trailing only China and the USA, if it were a country².

THE CALL FOR SUSTAINABLE CONSTRUCTION

As the world confronts the challenges of climate change and its profound consequences, businesses are under mounting pressure to adopt tangible and transparent Environmental, Social, and Governance (ESG) related Key Performance Indicators (KPIs). The collective objective is to demonstrate a firm commitment to attaining a net-zero economy by 2050. To this end, minimising embodied carbon — the majority of which is accrued in the early stages of a structure's lifecycle² — is vital to reaching global emission reduction targets.

Asset owners are increasingly recognising the financial advantages of green buildings. Studies have shown that LEED-certified buildings command an average rent premium of 31 percent as

compared to non-certified buildings³. Additionally, a direct correlation exists between a company's value and its ESG score; a recent report found that there is a direct correlation between a company's value and its ESG score. Specifically, a 10 percent better ESG score is associated with a 1.2x higher EV/EBITDA ratio, a common benchmark for valuing companies⁴.

By incorporating green construction technologies, companies can significantly reduce CO₂ emissions during the construction phase. This not only aligns with global sustainability goals but also yields financial benefits for asset owners and listed companies. The adoption of sustainable construction practices can contribute substantially to combatting global warming and foster a more environmentally conscious business landscape.

¹Carbon Leadership Forum, *Climate, Carbon, and the Built Environment* (<https://carbonleadershipforum.org/the-carbon-challenge/>)

²The Economist, *How to make low-carbon concrete from old cement*, 2023

³World Business Council for Sustainable Development, *Net-zero buildings: Where do we stand?*, 2021

⁴CBRE Research, *Green Is Good: The Enduring Rent Premium of LEED- Certified U.S. Office Buildings*, 2022

⁵Deloitte, *Does a company's ESG score have a measurable impact on its market value?*, 2022

Towards a Low-Carbon Built Environment



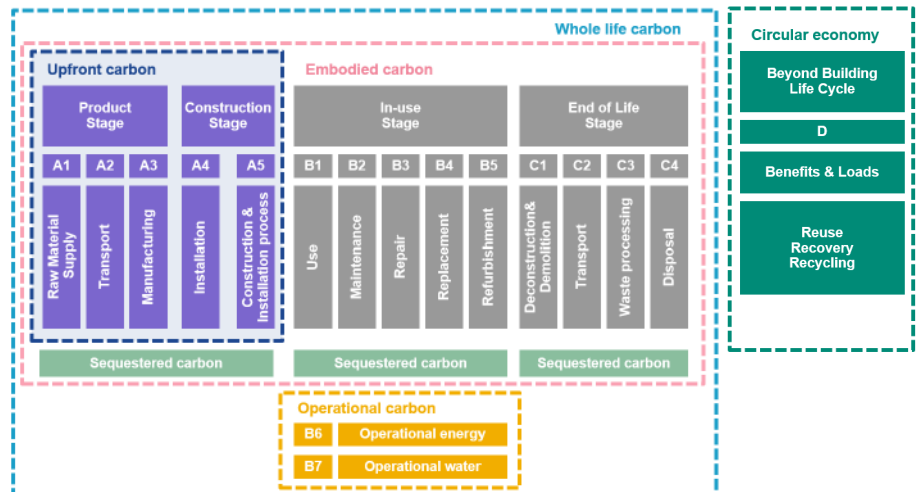
Comparing CO2 Emissions of Reinforced Concrete and Steel Hybrid PPVC modules



Comparing various CO2 Emissions of PT versus other construction methods (combined with regular /recycled materials)

SGBC Member Tectus SA carried out specific studies in partnership with Singapore-based decarbonisation specialist, Terrascope, to assess the impact of two unique green technologies on the upfront CO2 emissions (i.e. those emissions incurred until the built asset becomes operational):

- Analysing post-tensioning system advantages over traditional construction methods.
- Evaluating the benefits of constructing PPVC modules in Steel-Hybrid compared to prefabricated concrete elements.



Towards a Low-Carbon Built Environment

In each case “Upfront Embodied Carbon” was consistently evaluated following the European Standard EN 15978, specifically within the scope of Life Cycle Assessment categories A1 through A5. This approach encompassed the utilization of both standard and recycled materials, in addition to various construction methodologies.

ANALYSING POST-TENSIONING SYSTEM ADVANTAGES OVER TRADITIONAL CONSTRUCTION METHODS

Post-tensioning (PT) systems are a form of prestressed concrete that enhances strength and performance. Benefits include improved structural efficiency, larger span capabilities, reduction in concrete and steel usage, control over deflections, and superior resistance to external forces, making it ideal for complex structures.

A comprehensive analysis was conducted to assess the impact of post-tensioning (PT) technology on CO2 emissions compared to other construction methods. For this purpose, three different applications for concrete slabs in residential, commercial, and industrial buildings were evaluated. The comparison was conducted with three different construction methods: traditional reinforced concrete slab, post-tensioning (PT) flat slab, and pre-fabricated hollow core slab.

The CO2 emissions of utilised materials were calculated, incorporating factors such as the country of origin and the distance to the project site. Emission factors were obtained from publicly available databases, notably including the Singapore Building Carbon Calculator, a tool maintained by the Singapore Green Building Council. Whenever possible, company-specific Environmental Product Declarations (EPDs), conforming to ISO 14025, were also employed.

THE IMPACT OF POST-TENSIONING TECHNOLOGY

The utilisation of post-tensioning technology was associated with the lowest emissions of all considered slab construction methods, achieving up to a 50 percent reduction compared to the traditional reinforced concrete slab method. By introducing voids (through tubes or balls) into the



	1 Residential	2 Commercial /Offices	3 Industrial
Load (SDL & LL) [kN/m ²]	2.5 + 2.0	2.5 + 3.0	2.5 + 7.5
Span length [m]	7.5 x 7.5	8.0 x 8.5	8.0 x 12.0
Column height [m]	3.0	3.0	6.0
Column size [mm]	250 x 250	300 x 300	500 x 500
Deflection [mm]	15-20	20-30	30-40
Fire rating	R60		

slabs, the carbon content could be reduced by an additional 5 percent, resulting in a total reduction of up to 55 percent. The use of recycled materials like recycled PT strands, Eco Concrete, and recycled steel rebar significantly lowered CO2 emissions across all cases. This highlights the importance of sustainable materials in construction to mitigate environmental impact.

The study revealed that combining PT technology with recycled materials and voids led to a remarkable aggregated CO2 emission reduction of up to 73 percent. This highlights the potential of adopting environmentally-friendly construction methods for a more sustainable future.

With expanding carbon tax regulations, companies in the construction industry must embrace technologies that reduce carbon footprints. Ignoring the importance and urgency to decarbonise the built world will eventually lead to negative economic impacts and hinder progress towards a greener future.

EVALUATING THE BENEFITS OF CONSTRUCTING PPVC MODULES IN STEEL-HYBRID COMPARED TO PREFABRICATED CONCRETE ELEMENTS

Prefabricated Prefinished Volumetric Construction (PPVC) involves constructing free-standing, fully equipped 3D modules off-site, and later installing them on-site. It offers several advantages over traditional in-situ construction, including improved productivity, a more controlled construction environment, enhanced quality control, and lower environmental impact.

COMPARATIVE ANALYSIS BETWEEN STEEL-HYBRID AND PREFABRICATED CONCRETE MODULES

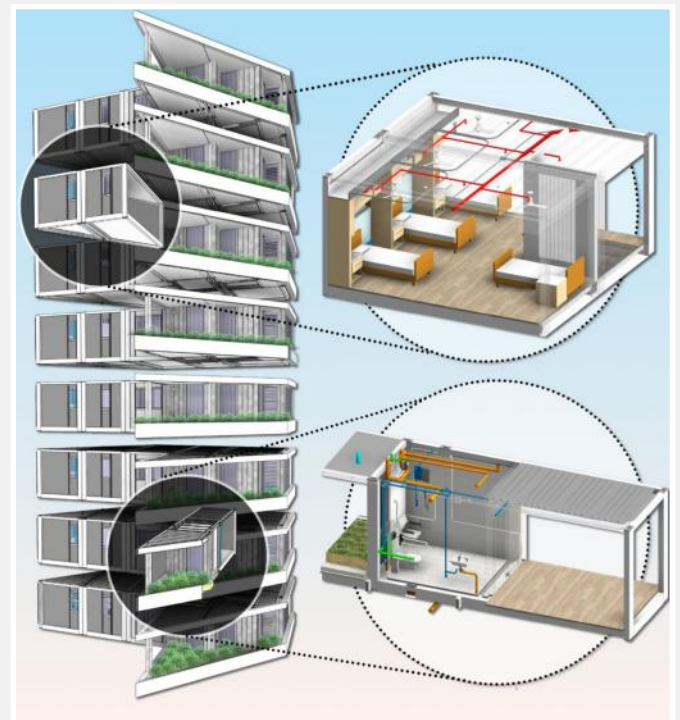
The study evaluated two methods for PPVC construction systems: Steel-Hybrid and prefabricated concrete modules, both having a dimension of 3.2m width, 7.0m length, and 3.5m height. The Steel-Hybrid modules weighed 16 tons, considerably less than the 41 tons of the prefabricated concrete modules.

Materials used for this comparison included ready mix concrete, steel rebars, and steel screeding sourced from Malaysia, and steel frames, connectors, gypsum boards, doors, and windows imported from China. For the Steel-Hybrid and



The additional comparison of carbon emissions between regular and recycled materials showed that the incorporation of recycled steel sections and rebars were able to further reduce the Steel-Hybrid PPVC module's upfront carbon by over 45 percent. Furthermore, the combination of Steel Hybrid PPVC with recycled materials was found to avoid over 60 percent of the emissions compared to Reinforced Concrete PPVC technology using regular materials.

Reinforced Concrete PPVC modules, embodied carbon emissions were calculated for both the regular and recycled materials. Compared to the Reinforced Concrete module, the Steel-Hybrid module demonstrated emission reductions of 16 percent, 58 percent, and 56 percent in the Product, Transport, and Construction stages, respectively. In total, the Steel-Hybrid module produced 19 percent less upfront carbon than the Reinforced Concrete PPVC module.





CONCLUSION

The studies respond to the urgency to decarbonise the built environment by highlighting the potential of specific sustainable construction technologies to contribute to a sustainable built environment through minimizing upfront carbon. Post-tensioning systems and Steel-Hybrid PPVC modules were investigated for their CO₂ emission reduction capabilities, proving their effectiveness in significantly reducing material use and curbing carbon footprints.



KEY FACTS TO REMEMBER:

- **Post-Tensioning** in building slabs can **decrease** CO2 emissions by **up to 73 percent** when integrated with recycled materials.
- **Steel Hybrid PPVC modules** with recycled materials can achieve carbon **reductions of approx. 60 percent** compared to Reinforced Concrete PPVC modules.



THE TRANSFORMATIVE POWER OF POST-TENSIONING AND STEEL-HYBRID PPVC

Post-Tensioning in building slabs and Steel Hybrid PPVC modules are innovative technologies capable of significantly reducing embodied carbon. Notably, when integrated with recycled materials, post-tensioning can decrease CO2 emissions by up to 73 percent, emphasising its game-changing potential. Steel Hybrid PPVC modules, particularly those incorporating recycled materials, can achieve impressive carbon reductions, approximately 60 percent when compared to Reinforced Concrete PPVC modules. These findings illustrate the significant role these technologies can play in meeting decarbonization objectives across asset life cycles, with the added benefit of immediate results, addressing urgent environmental demands.

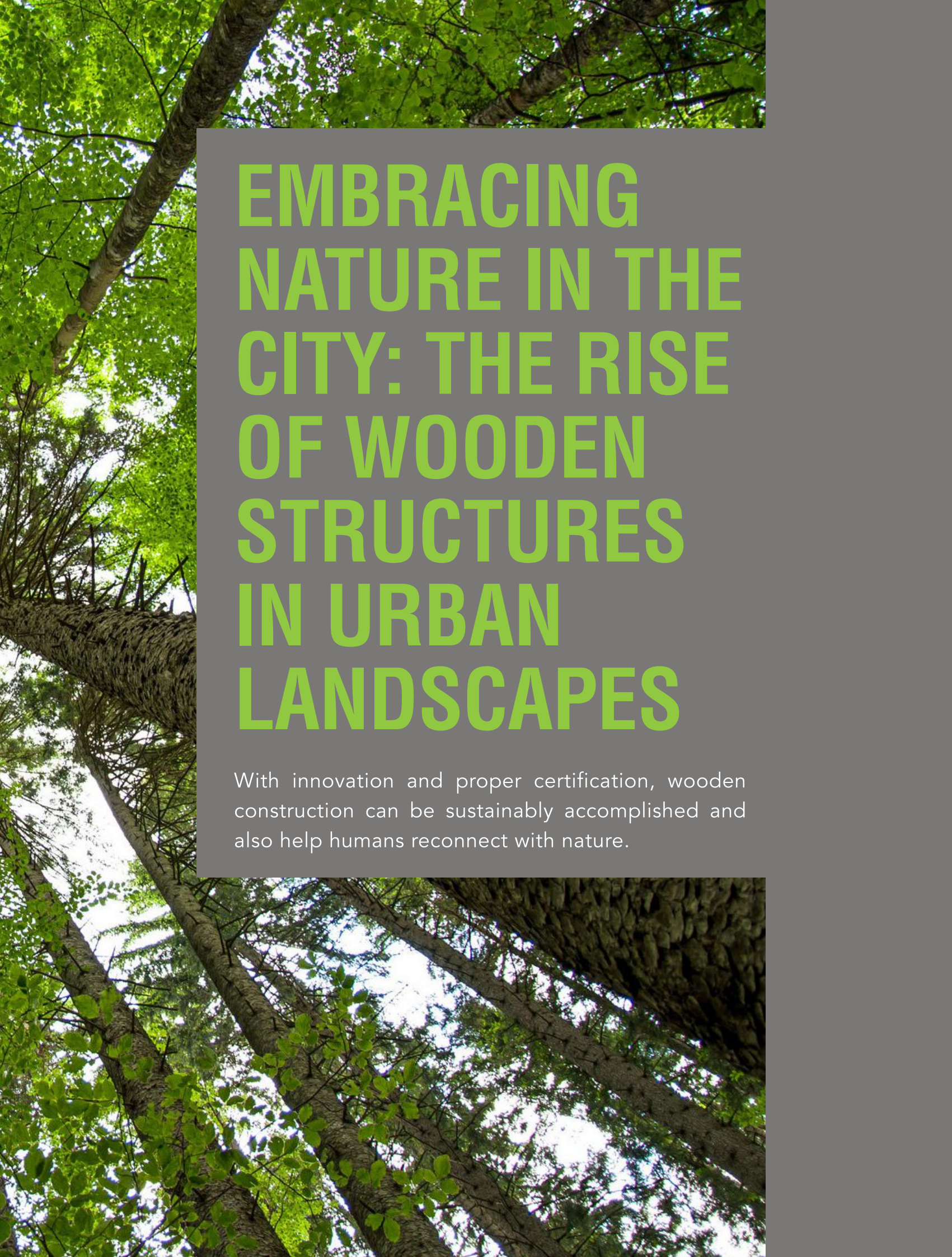
THE ESSENTIAL SHIFT TOWARDS SUSTAINABLE CONSTRUCTION

Confronting the realities of climate change, intensifying regulations, and escalating pressure from the public and investors, it is essential for all

players in the construction ecosystem to embrace green technologies. Utilising sustainable materials and innovative construction methods aligns not only with global sustainability goals but also yields substantial economic benefits. The referenced studies provide practical examples illustrating how employing established construction technologies and thoughtful supply chain considerations can substantially reduce embodied carbon. This is especially true when such measures are incorporated early in the structure's design and engineering process, creating benefits to industry stakeholders and the planet alike. ✔

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EMBRACING NATURE IN THE CITY: THE RISE OF WOODEN STRUCTURES IN URBAN LANDSCAPES

With innovation and proper certification, wooden construction can be sustainably accomplished and also help humans reconnect with nature.

Embracing Nature in the City: The Rise of Wooden Structures in Urban Landscape



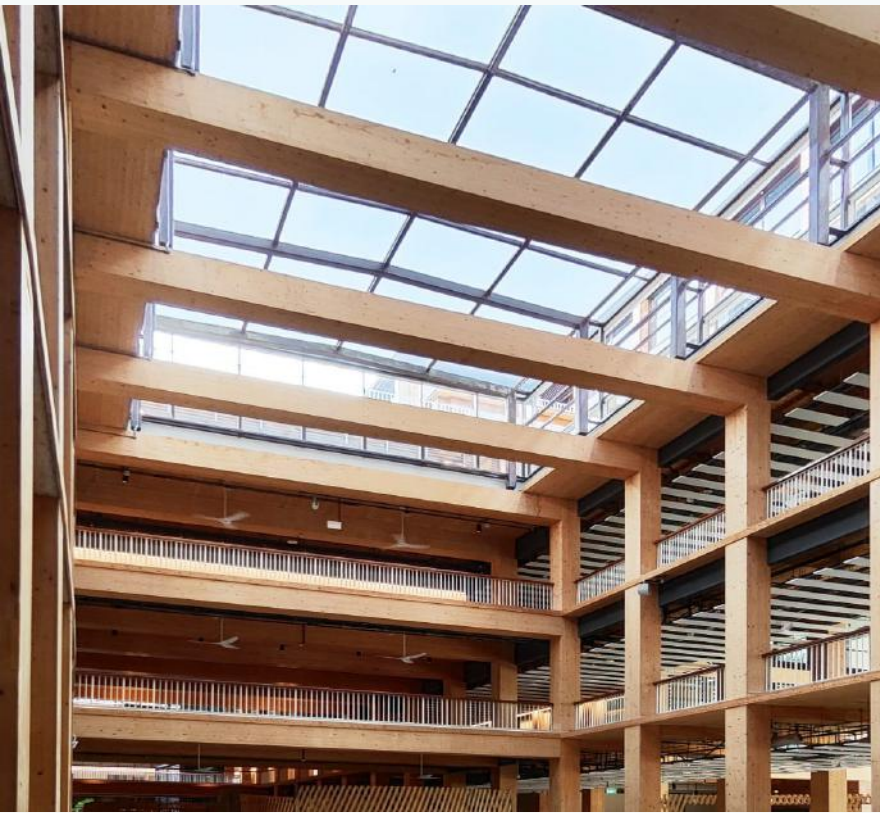
For centuries, architecture has looked to nature for inspiration. Take a look at the impressive, stalactite-style designs in the Alhambra to the nature-mimicking structure of Delhi's Lotus Temple and countless others. These grand designs show how powerful nature can be when inspiring buildings. But in today's world, just imitating nature is not enough anymore. The climate crisis is looming larger than ever, and it is time to rethink how humans and nature interact. Architects are no longer asked simply to create buildings that resemble nature – the real challenge now is to design structures that genuinely engage and interact with the natural world around them.

Around the globe, architects are rediscovering the beauty of building with wood. It is being used everywhere, from homes and schools to hotels, theatres, and even supermarkets. There is something inherently comforting about wood – maybe it reminds us of time spent outdoors, surrounded by nature. Are architects turning to wood to bring nature-inspired peace and rejuvenation back into our everyday spaces?

Triodos Bank's new office in the Netherlands, seamlessly blended with its surroundings, is a groundbreaking example of large-scale timber construction. The brainchild of architect Thomas Rau, this impressive building was recently awarded the international BREEAM Award in the Commercial – Post Construction category.

A real team effort, the project was brought to life by EDGE Technologies and Triodos Bank, with design expertise from Ex Interiors and landscape architects Arcadis. Construction company J.P. van Eesteren joined forces with Derix Group, a timber manufacturer, to create the building's wooden heart. This involved using 3,200 m² of cross-laminated timber (CLT) for the walls and 1,700 m² of CLT for the floors. Thanks to an innovative technique known as triple finger jointing, they crafted a structural framework made entirely of timber – a stunning testament to wood's creative and sustainable potential in construction (Rau B.V. 2019).

Embracing Nature in the City: The Rise of Wooden Structures in Urban Landscape



Built entirely from sustainable materials, the design incorporates 2,000 m³ of PEFC-certified timber. The buildings make clever use of glass to draw in natural light, which floods into the heart of the structure, creating a sense of warmth and openness. The spacious rooms, teamed with exposed laminated timber trusses, cores, and floors, make for a striking contrast against the building's muted colour palette, proudly showcasing its unique, timber-centric construction. It's more than a building – it's a space designed to spark interaction and engagement between employees, visitors, and the public.

But the real question is, does spending time in a structure constructed primarily of wood lead to personal health benefits? A collaborative study between Stora Enso and the Technical University of Munich uncovered the health and wellness perks of wooden interiors. The survey, spanning multiple research areas, discovered that wood is not only easy on the eyes, but it might also do wonders for our stress levels and productivity (Stora Enso 2021).

Findings showed that being in a wooden environment can actually help lower cortisol, our main stress hormone. Students were found to be less anxious in classrooms made of wood. But it is not just about mood – wood also has practical benefits. It is excellent at maintaining the right humidity levels, which can reduce allergens and even limit the spread of bacteria and viruses. With the world more conscious of cleanliness than ever, another discovery from the study stood out – coronaviruses were found to survive for a much shorter time on wooden surfaces than on other common materials (Domig and Wimmer 2020). Who knew that wood could be so beneficial?

The Programme for the Endorsement of Forest Certification (PEFC) safeguards forests by promoting sustainable forest management through certification. Forest certification is crucial in providing evidence of sustainable forest management. It enables forest owners and managers to demonstrate that the practices they apply in the forest today are sustainable and that their forests meet both our needs and those of future generations (Programme for the Endorsement of Forest Certification 2023).



Embracing Nature in the City: The Rise of Wooden Structures in Urban Landscape

PEFC highlights that wood, when responsibly sourced, is an extraordinary building material. It is quick to work with, beautifies any project, and does not require as much energy to produce as concrete, steel, cement, or glass. But it is not just good for the environment but also for people. Thanks to its excellent ability to regulate heat and humidity, wooden buildings often need less artificial temperature control, making them comfortable places to be while also being kind to the planet (Programme for the Endorsement of Forest Certification, 2023).

Earlier this year, the stunning “Gaia,” a zero-energy mass engineered timber building, was unveiled at Nanyang Technological University (NTU) in Singapore with the goal of bringing people closer to nature. This architectural marvel, the largest mass timber building in Asia and a PEFC-certified project, is the result of a partnership between RSP Architects and Toyo Ito & Associates Architects. Spanning a staggering 220 metres, Gaia’s design uses a modular timber frame system. This innovative twist means that most components can be made off-site, dramatically speeding up the construction process and reducing the number of workers needed.

Gaia is the eighth NTU campus project to be honoured with the Green Mark Platinum (Zero Energy certification). In a year, it emits about 2,500 tonnes lesser carbon dioxide than a typical building. Gaia’s environmental achievements do not stop there. Its rooftop is decked out with solar panels, creating



roughly 516,000 kilowatt-hours (kWh) of clean energy annually.

Gaia’s construction strategy used Cross-Laminated Timber (CLT) for slabs and Glued Laminated Timber (Glulam) for beams and columns. These materials supplied by Stora Enso all come from sustainably managed forests and are all PEFC certified, testifying to their planet-friendly origins.

The inside of the building is equally impressive. Exposed timber and large windows create a warm and inviting space. Glazed skylights add an extra touch of nature indoors. As NTU’s President, Professor Ho Teck Hua puts it, “The building was designed to connect humans to their natural surroundings. Students and faculty benefit from the extensive open spaces for study and collaboration” (Wood Central 2023).

Undoubtedly, forests, the lungs of our planet, are vital for our environment and improve our health and wellbeing. But what if we could bring those benefits into our daily spaces, like our homes and offices? Could buildings thoughtfully made with materials that stay true to their natural roots, like wood, offer the same perks?

Scientific research has started to confirm what forest bathers have long known, that we can bring many of these benefits into our daily spaces with thoughtfully constructed buildings made from materials close to their natural state, such as wood.

Stepping out into the great outdoors is a wonderful break, but most of our time is spent indoors. As the philosopher of architecture Gaston Bachelard

Embracing Nature in the City: The Rise of Wooden Structures in Urban Landscape



suggests, every space we inhabit for a significant amount of time has a touch of 'home' about it (Bachelard 1958). While no building could replace the natural environment, the materials with which we create our living spaces are at the core of our lives. Connecting us as closely as possible to nature is the mission of biophilic architecture – a design principle that aims to connect us to the natural world by incorporating elements of nature.

As resources become increasingly limited and needs continue to grow, several progressive cities are gearing up to strengthen their ties with nature. Biophilic Cities, a network of cities joined in the mission to infuse urban landscapes with more nature, champions the cause of integrating natural elements to improve urban living. With thirty cities worldwide now on board, they're leading the way

References:

1. Rau B.V. 2019, viewed 3 July 2023, <<https://anewdawn.rau.eu/>>.
2. Stora Enso 2021, viewed 3 July 2023, <<https://info.storaenso.com/wood-house-effect>>.
3. Domig and Wimmer 2020, "Coronavirus on wood surfaces- Is there a risk?" viewed 3 July 2023, <https://www.timber-online.net/wood_products/2020/03/coronavirus-on-wood-surfaces-is-there-a-risk.html>.
4. Stora Enso 2021, viewed 3 July 2023, "New study highlights 10 wellbeing benefits of building with wood" <<https://www.storaenso.com/en/newsroom/news/2021/4/study-on-wellbeing-benefits-of-wooden-buildings>>.
5. Programme for the Endorsement of Forest Certification (PEFC) 2023, What is sustainable forest management?, PEFC, viewed 6 July 2023, <<https://www.pefc.org/what-we-do/our-approach/what-is-sustainable-forest-management>>.
6. Programme for the Endorsement of Forest Certification (PEFC) 2023, Celebrating our forests on Forest Day, PEFC, viewed 3 July 2023, <<https://www.pefc.org/news/celebrating-our-forests-on-forest-day>>.
7. World Green Building Council (WGBC) 2023, The Circular Built Environment Playbook, WGBC, viewed 3 July 2023, <<https://worldgbc.org/article/circular-built-environment-playbook/>>.
8. Programme for the Endorsement of Forest Certification (PEFC) 2023, Designing the future with sustainable timber, PEFC, viewed 3 July 2023, <<https://pefc.org/what-we-do/our-collective-impact/our-campaigns/designing-the-future-with-sustainable-timber>>.
9. Wood Central 2023, NTU Singapore: Asia's Largest Mass Timber viewed 3 July 2023, <[Buildinghttps://woodcentral.com.au/the-met-revolution-begins-in-se-asia-starting-with-ntu-singapore/](https://woodcentral.com.au/the-met-revolution-begins-in-se-asia-starting-with-ntu-singapore/)>.
10. Bachelard 1964, The Poetics of Space.
11. Biophilic Cities, viewed 4 July 2023, <<https://www.biophiliccities.org/>>.

towards a future where the health and wellbeing of city-dwellers are seamlessly intertwined with practices that nurture and sustain both people and the environment.

These exemplary buildings show how, with certification and innovative design approaches, wooden construction can be sustainably accomplished and, perhaps, help us reconnect with nature. ✔

Article Contributed by:
Programme for the Endorsement of Forest Certification (PEFC)
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All Images of Gaia by:
Don Tan, Tan Hui Qin, Eileen Tan







A STEP TOWARDS A GREENER FUTURE

How can High-Performance Fenestration help to improve building energy efficiency?

DO WE KNOW WHERE THE HEAT GAIN IS COMING FROM?

Ever paused to ponder the sneaky source of uninvited warmth infiltrating your cozy corner while you are seated right by the grand windows of an esteemed commercial building, offering a sweeping view of Singapore's vibrant cityscape? Yet, amidst this urban spectacle, an intriguing question emerges: where exactly is this uninvited heat making its entrance from? Let us embark on a quest to unravel this mystery.

In Singapore's commercial structures, double-glazed windows fortified with low-emissivity (low-e) coatings which effectively reduces heat gain through the glazing, are often used. Now shift your gaze to the thermal image shown in Fig.1 below, it's a canvas alive with hues of yellow, green and blue, suggesting that the glazing area is indeed relatively cool with little heat gain. But what about the intense red regions seen in the image?

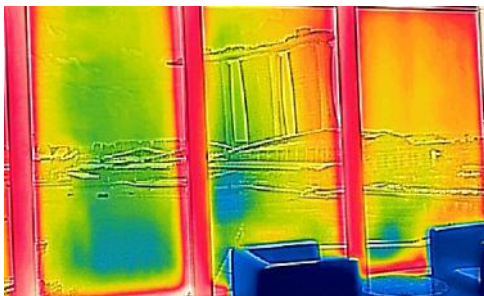


Figure 1: Image captured with FLIR Thermal Imaging Camera

The red regions unveil a different narrative, one of audacious heat invasion and hint at a compelling reality: relentless heat seeping through aluminium frames and the edge of glass, pushing air-conditioning systems into overdrive. The consequence? A surge in cooling demands, spiralling energy consumption, and an inadvertent uptick in our carbon footprint.

In a world where energy efficiency is paramount, improving the thermal performance of building envelopes poses a challenge for us as we strive to reduce the overall building energy consumption. A pressing question beckons: How then can our industry address this predicament?

REDUCING HEAT GAIN THROUGH ALUMINIUM FRAMES

Fenestration frames are predominantly made of aluminium, a good conductor of heat with a material thermal conductivity of 160W/mK. To put things into perspective, that's a staggering 160 times more conductive than glass! As a result, there is considerable heat gain into buildings through the fenestration frames, which constitute a substantial proportion (up to 10 percent, and could be even more in certain cases) of a building's total fenestration area. This ushers in an array of challenges for both maintaining desirable indoor temperatures and ensuring thermal comfort for building occupants. The familiar heat you feel when sitting beside a window that is not well-insulated? Now the puzzle pieces are falling into place!

With this, it is important that fenestration frames should be taken into account when looking at the overall thermal performance of the façade. Recognizing their significance, some countries have accounted for fenestration frames in their building regulations, and notable examples include H1 Energy Efficiency under the Building Code in New Zealand, Section J of the Building Code in Australia and the Saudi Building Code in Middle East.

The solution to this conundrum? Thermal break technology – a solution which revolves around a simple yet transformative concept, whereby a profile made of low-conductivity material is placed between the aluminium frames (as illustrated in Fig. 2), separating the interior and exterior aluminium sections. An insulating barrier is thus created, preventing the direct flow of heat, substantially reducing heat gain through the frames.

The thermal break profile is made of glass-fibre reinforced polyamide (PA66GF25), and it is an engineering plastic with low thermal conductivity of 0.3W/m²K (over 500 times lower than aluminum) and excellent mechanical properties.

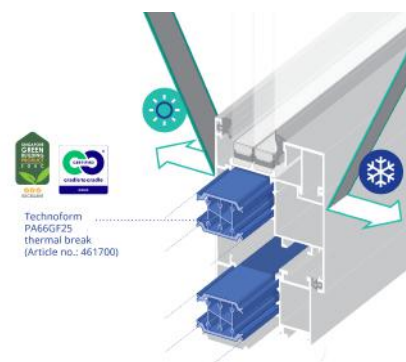


Figure 2: Cross section of window system with thermal break profile

A Step Towards a Greener Future

Thermal simulation of a stick curtain wall frame using THERM software, it was found that (as illustrated in Fig. 3) between a typical aluminium frame and a thermally broken aluminium frame with a basic thermal break, there is over 70 percent reduction in frame U-value from 17.1W/m²K to 3.0W/m²K. As for the Solar Heat Gain Coefficient value, there is a 83 percent reduction from 0.309 to 0.053.

To accommodate diverse architectural and performance demands, it may at times call for the adoption of specialised solutions. For instance, situations that demand enhanced thermal insulation might necessitate the use of wider, more complex insulating profiles, while the incorporation of low conductivity foam presents another tailored solution to tackle other heat gain mechanisms such as convection and radiation.

DEBUNKING THE MISCONCEPTION: ARE THERMAL BREAKS EFFECTIVE FOR TROPICAL CLIMATES?

Speaking with Professor S.K. Chou, founding executive director of the National University of Singapore's (NUS) Energy Studies Institute, he noted: "Many have the misconception that thermal breaks are only used in other climatic regions and there is no need for its use in tropical climates such as in Southeast Asia. In the tropical regions, there is no escaping the intense heat gain arising from sunlight impinging on the building fenestrations. When buildings need cooling, the heat transmission through the fenestration frames and edge of glass determines the magnitude of the cooling load and cooling energy consumption. Laboratory and in-situ studies have been conducted to shed light on the performance and benefits of this unique key technology solution, dispelling the misconception that thermal breaks are relevant only to cold climatic regions. In actual fact, adoption of the technology, supported by standards, is already widespread in the tropical belt where cooling is required all year round."

To determine the effectiveness of thermal break technology in tropical climates, a study was conducted at the Building Construction and Authority (BCA) SkyLab, a state-of-the-art testbed

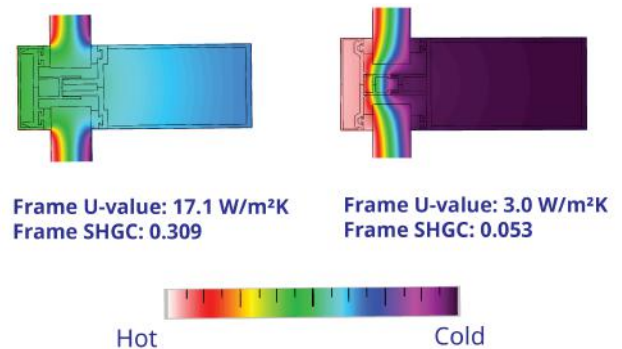


Figure 3: Thermal simulation of a stick curtain wall frame using THERM software

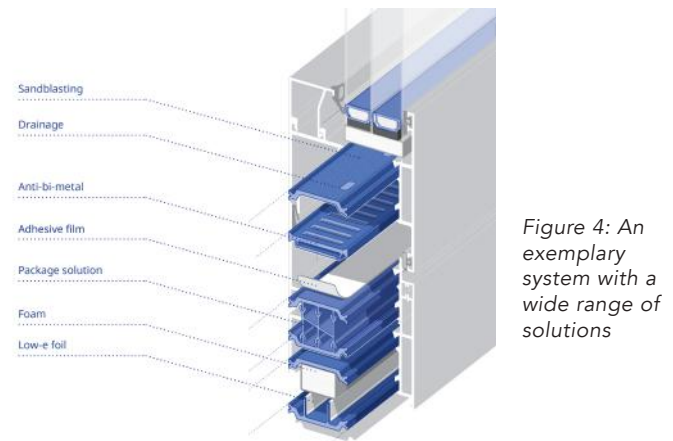


Figure 4: An exemplary system with a wide range of solutions

facility which allows technologies to be tested under real-world conditions at different building orientations. The study, which was conducted by BCA, NUS, and Technoform (as the industry collaborator), and funded by National Environmental Agency (NEA) under the Green Building Innovation Cluster (GBIC) project, found that a thermally broken window system reduced peak heat flux by 59 percent.



Figure 5: BCA SkyLab

A Step Towards a Greener Future



Figure 6: Thermally broken frame (left), Aluminium frame (right)

In a quest to delve deeper into this issue, Technoform conducted a building energy modelling in collaboration with a third-party consultant, which yielded an impressive revelation: there is a 28 percent cooling energy consumption reduction when comparing thermally broken and non-thermally broken systems. These findings are not just a statistic – they serve as a real-world testament to the tangible benefits that can be realized through the adoption of thermally broken frames, as opposed to the common belief that its impact may be limited. For more information on the studies, please contact Technoform directly to find out more: info.tesg@ap.technoform.com

Through such efforts, Technoform hopes to pave the way for more informed decision-making by developers, architects and consultants in building design, ensuring stakeholders do not underestimate the amount of heat entering the building. The application of thermal break in tropical climates is not only viable but also essential in the pursuit of greener, more energy-efficient buildings.

WARM EDGE, CUTTING EDGE: OPTIMISING THE EDGE OF GLASS PERFORMANCE

Beyond the aluminium frames, heat will also enter through the edge of the glass. Typically, double glazed units are separated by aluminium spacers, which have high thermal conductivity, resulting in substantial heat transmission at the edge of glass.

A warm edge spacer, which is a thermally improved hybrid spacer, can help to overcome this challenge.

The improved spacer has a linear thermal transmittance almost 2 times better than traditional aluminium spacers. Hence, when a warm edge spacer is used in place of an aluminium spacer, the edge of glass heat transfer will be substantially reduced. Technoform Warm edge spacers can be found in notable building projects such as the Apple Store in Bangkok (Fig. 8) and Suntec City in Singapore (Fig. 9)



Figure 7: Technoform Warm edge spacer in black



Figure 8: Apple Store in Bangkok, Thailand



Figure 9: Suntec City in Singapore

CASE STUDY: PSA TUAS PORT MAINTENANCE BASE

Amidst the backdrop of Singapore's relentless pursuit of sustainable architecture, one notable case study is the PSA Tuas Port Maintenance Base, which consists of 8 buildings that serve various aspects of maintaining the port facilities. One of them is a 6-storey Administrative Building, which is the first major building to be completed in Tuas Port. It has been awarded the Green Mark Award (Platinum) under the Super Low Energy Building (SLEB) category by Singapore's BCA, highlighting its best-in-class energy performance and stands as a testament to the building's exceptional energy conservation achievements.

PSA Corporation Ltd championed the implementation of a high-performance curtain wall system, targeting for an overall U-value performance of less than 1.8W/m²K, which on top of the glazing, also includes the performance of the frame and edge of glass in accordance to international standard ISO 12631. In pursuit of this demanding requirements, Technoform thermal insulation solutions were adopted, seamlessly meeting this exacting standard.



Figure 10: PSA Tuas Port Maintenance Base, a SLEB project.
Photo credit: ID Architect

A STEP TOWARDS OUR GREENER FUTURE

As the world continues to grapple with the challenges of climate change and the emphasis

Overall configuration of the curtain wall

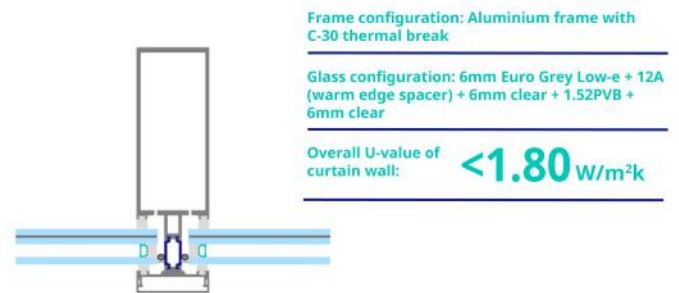


Figure 11: Drawing of a typical curtain wall section used in PSA Tuas Port Maintenance Base project

on greener buildings continues to grow, high-performance fenestration systems are poised to play an increasingly vital role in making buildings around the world more energy efficient. This also closely aligns with the goals set forth in Singapore's Green Building Masterplan, as the adoption of high-performance fenestration systems contributes to substantial building energy savings, lower greenhouse gas emissions, and overall, a more sustainable built environment. "The adoption of high-performance fenestration, a key component of any building, is no doubt an essential strategy in the pursuit of our net zero future." Benjamin Teoh, Technical Specialist of Technoform Bautech Asia Pacific, noted.

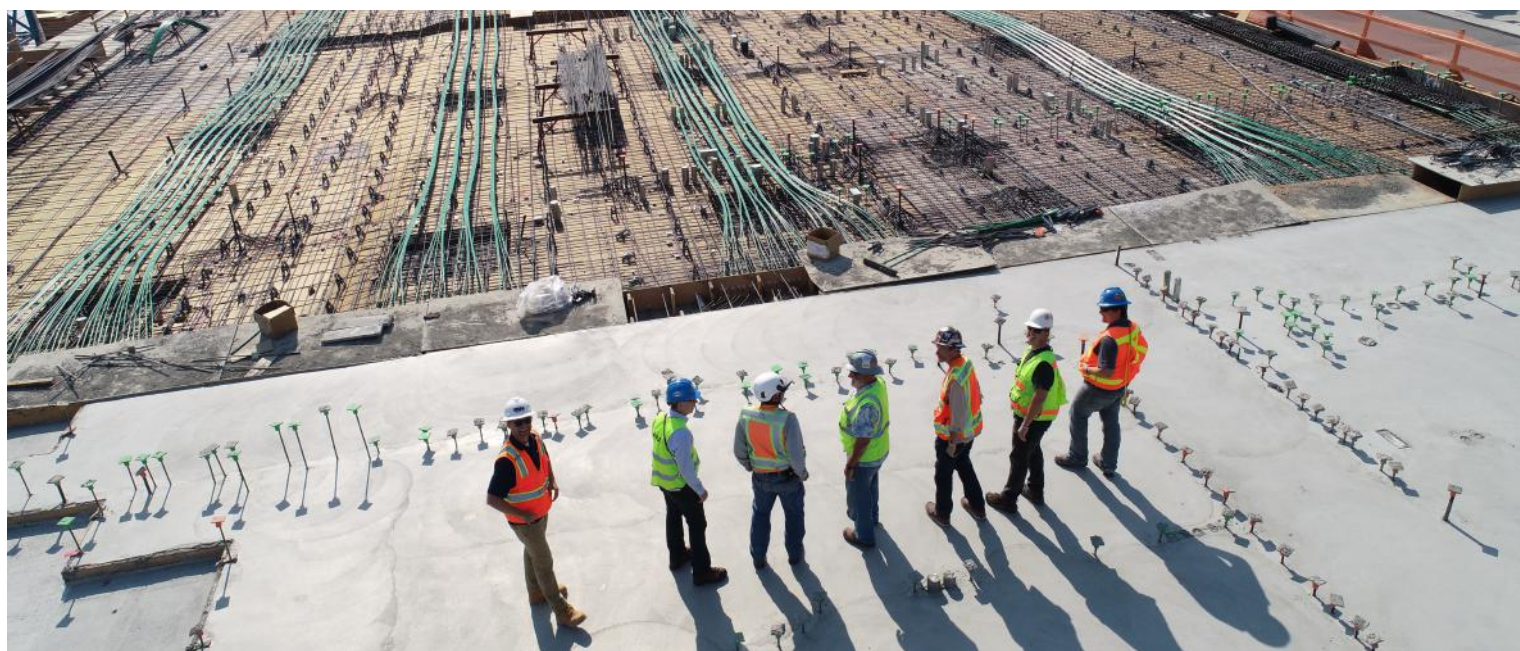
Article Contributed by: Technoform

Technoform Thermal break and Warm edge spacer solutions are certified 3 ticks (Excellent) under the Singapore Green Building Product (SGBP) and are featured as an enabling technology in the SLEB Smart Hub Technology Directory. The solutions have also attained international certifications including Cradle to Cradle Gold and Passive House Component phA and phB, as well as Environment Product Declarations (EPDs). 🌱

ENABLING SUSTAINABILITY IN THE BUILT ENVIRONMENT

Sustainable development remains a worldwide focus, and green construction is well-positioned to aid in this shift. Yet, determining whether the fundamental components of our built environment is still a priority.





In order to achieve the vision of a low-carbon and energy-efficient future, the environmental performance of each and every building product cannot be left to chance since buildings are permanent structures in place for decades at a time. As such, the materials used in its construction play important roles in ensuring that the building's footprint and impact on its surrounding environment is as small as possible. Green building materials certified for their environmental performance, coupled with sound green building design and technology along with an emphasis on sustainability, will definitely go towards creating buildings which are greener and healthier for both occupants and the environment.

The Singapore Green Building Product (SGBP) scheme, managed by the Singapore Green Building Council (SGBC), is a certification for green building products and materials. It is based on scientific and engineering principles and built upon the collective knowledge and expertise of the building and construction industry. The SGBP certification scheme advances the built environment to one that is greener and more carbon-efficient while facilitating sustainable procurement. The certification ensures that sustainability is integrated throughout the design and manufacturing process of green building products.

METHODOLOGY & ASSESSMENT CRITERIA

The SGBP covers a wide range of products and assesses them based on their sustainability performance. Environmental and health impacts can occur across a product's lifecycle, from raw material extraction or cultivation, through manufacturing, use and end-of-use management. The scheme looks at the whole lifecycle of products to account for the full impact and assesses products and materials on their sustainability performance.

The SGBP's assessment criteria is categorised into common criteria which apply to most products and specific criteria which apply only to relevant products. The SGBC Certification team will identify for each applicant which assessment criteria are most suitable for their products. For some products, the assessment against criteria covers the whole product lifecycle, while for other products, the assessment criteria focus on a select few lifecycle stages across raw material extraction or cultivation, manufacturing, distribution, use, and end-of-use. This grounded methodology enables building products to be impartially evaluated for their relevant, noteworthy qualities, benchmarked against similar products in its category.

Enabling Sustainability in the Built Environment

SGBC will assess the degree to which the certifying product meets the assessment criteria. For some products, the applicant will need to show proof of laboratory test results or other documentation to verify the product's alignment with some criteria. SGBC works with a selection of lab partners to assist applicants on any third-party tests required for certification. After the assessment, the certified product will be awarded a rating between 1 and 4 ticks, based on its performance. 1 tick indicates good attributes, while 4 ticks indicate leading industry performance.

For both the common and specific assessment criteria, some are mandatory, and others are optional. The assessment criteria have been drawn up by SGBC in close collaboration with industry professionals and experts. SGBC continually reviews the criteria to ensure they reflect the current science, engineering and best practice.

As the enabler of built environment sustainability, SGBC has been working on decarbonisation initiatives, programmes and pathways for the better part of the past decade. To achieve the highest-possible Leader (4-ticks) rating, SGBP certification requires a product's carbon footprint data (amongst other criteria) across the whole product lifecycle: from raw material extraction all the way to its end of life.

In the drive towards low-carbon construction, the SGBP certification scheme will now assess concrete and steel products based on their carbon footprint and Global Warming Potential (GWP) instead of clinker/ recycled content, which necessitates the provision of environmental product declarations (EPDs) for each product undergoing certification. An EPD is a standardised quantification of environmental information on the life cycle of a product, similar to nutrition labels found on the packaging of food products. EPDs provide comprehensive and standardised information about the environmental impact of a product throughout its lifecycle, offering data on energy consumption, greenhouse gas emissions, water usage, and waste generation.

To ensure that Singapore manufacturers have the ability to develop internal capabilities to report on the carbon emissions of their products in accordance to international standards, SGBC is collaborating with One Click LCA, a global building lifecycle assessment platform, to pilot a Concrete EPD Generator in the Singapore market. This digital

WHAT THE SCHEME IS AND HOW IT WORKS



tool will provide another avenue for local concrete manufacturers to obtain consistent carbon data, identify decarbonisation opportunities and generate accurate, verifiable EPDs.

ENVIRONMENTAL SUSTAINABILITY

With the advancement of built environment sustainability over the years, many Singapore green building services firms have developed deep and specialised capabilities, and have a strong track record in delivering excellent Green Mark projects. To better reflect the deepening and maturing of firms' capabilities, SGBC has revised the certification criteria and categorisation of both the Environmental Sustainability (ES) and Energy Performance Contracting (EPC) categories for the Singapore Green Building Services (SGBS) certification scheme.

Environmental Sustainability (ES) services complement traditional built environment professional services disciplines, such as architecture and engineering, by integrating multi-disciplinary considerations to achieve environmental sustainability outcomes and goals.

ES firms typically possess expertise in specialised areas such as energy modelling, Computational Fluid Dynamics (CFD) for natural ventilation studies, energy audits, chiller plant optimization and decarbonisation strategies. The result is a high-performance, energy and resource-efficient building that is both healthy and comfortable for occupants. They can also help projects achieve SLE,

Enabling Sustainability in the Built Environment

Zero Energy and Zero Carbon targets. ES firms have deep capabilities in optimising overall building performance, for both new and existing buildings, to achieve higher ratings in Green Mark and other Green Building rating schemes. This includes certification to Super Low Energy and Zero Energy certification standards.

The SGBS certification scheme for ES services was developed to support the needs of project owners seeking professional services to meet the sustainability goals for their buildings and building projects. The tiering of ES firms corresponds generally to the following project needs:

Environmental Sustainability Services

- L1** Building projects with international stakeholders that seek to attain ambitious Green Mark ratings and certifications to other international or sectoral programmes
- L2** Building projects that seek to attain ambitious Green Mark ratings and other sustainability objectives
- L3** Building projects that seek to meet statutory requirements or modest Green Mark ratings
- L4** Simple building works or interior fit-out projects with aspirational targets, where project owners may be corporations from beyond the built environment industry

SGBS-certified ES firms have highly trained staff with Green Mark Accredited Professional (GMAP) and Green Mark Advanced Accredited Professional (GMAAP) qualifications. GMAPs serve as leads for Green Mark projects as Responsible Persons, whilst GMAAPs are required for the endorsement of Energy Modelling and CFD reports.

ENERGY PERFORMANCE CONTRACTING

Energy performance contracting (EPC) is an effective approach for the retrofitting of existing buildings to meet present-day standards and to raise energy efficiency performance. It is a contractual model supported by the Building and Construction Authority (BCA) under the Green Mark certification scheme.

Under the EPC model, the building owner enters into an energy performance contract with an EPC firm to achieve and maintain a certain level of Building or Chiller Plant energy efficiency performance level, or to deliver a guaranteed quantum of energy savings. The terms of an EPC contract are to be determined by both parties to meet appropriate goals and objectives. EPC firms

are also able to take on the full upfront cost of energy retrofits by offering a Zero Capital Partnership (ZCP).

Similar to ES firms, SGBC accredits EPC firms under the SGBS certification scheme. The appointment and involvement of SGBS-certified EPC firms in Green Mark projects is accorded specific credits under the Green Mark 2021 certification scheme. Up to 1.0 point can be scored in Resilience Section RE 2.1b Procurement for the appointment of SGBS-certified Energy Performance Contracting (EPC) firms to implement and deliver energy efficiency projects that guarantee operational system efficiency for a minimum of three years.

INDUSTRY RECOGNITION

The SGBP and SGBS are the key standards and benchmarks for green building products and services in the built environment sector. Products and services certified by SGBC are highly recognised under the Green Mark Scheme, Singapore's national green building rating tool administered by the Building and Construction Authority (BCA), which allows for the accrual of bonus points that count towards a project's Green Mark rating. The more highly rated a product is under the SGBP scheme (i.e., the more ticks it has achieved), the more points are awarded towards the Green Mark rating.

The SGBP is also widely accepted by regional green building rating tools for its coverage of a building product's sustainability performance. Key examples include GreenRE, a rating tool set up by the Real Estate & Housing Developments' Association (REHDA) of Malaysia, and the LOTUS programme administered by the Vietnam Green Building Council. The SGBP complies with many of the requirements in ISO 14024 Environmental labels and declarations — Type I environmental labelling. ✓

Read on to find out more about industry-ready green building solutions put forward by SGBC Member organisations, on display at the SGBC Pavilion @ BEX Asia 2023.



Airmaze Corporation Pte Ltd

Airmaze Corporation Pte Ltd was incorporated in 2015 as a world-class air quality management innovator, specialising in air filtration, air treatment and green technologies, meeting air-related needs and challenges. With vast experience and technical knowledge, Airmaze’s dedicated team supports clients regionally with effective solutions, efficient production, top-class products made in compliance with international testing methods, coupled with friendly and quality customer service.

Airmaze provides one-stop air filtration solutions, ranging from case studies on air-related issues, manufacturing and supplying full range of air filters (pre to high range products), to installation works and after-sales services.



Azendian Solutions

Azendian Solutions is an AI, Data Science and Operations Technology company that empowers businesses to make informed decisions applying the cutting-edge technology of Data Analytics, Artificial Intelligence (AI), and Machine Learning to achieve sustainability, ESG and productivity goals.

Azendian’s smart building and energy optimisation solutions for a lower carbon, more sustainable built environment is game changing in its approach, methodology and integration of Machine Learning data driven techniques with Operations Technology engineering systems. It works and collaborates with customers and partners from offices in Singapore, Japan, Australia and Malaysia.

bbp

Heating, ventilation, and air conditioning (HVAC) systems contribute up to 60 percent of energy consumption in commercial buildings, data centers, industrial facilities and infrastructure like airports and hospitals.

Founded in 2012, bbp offers patented energy optimisation technologies that reduce HVAC energy consumption. Using proprietary software algorithms, Internet of Things and industrial controllers, bbp has enabled multiple blue chip and Fortune 500 companies across 9 market to achieve energy and cost savings of up to 40 percent. With bbp's unique business model, asset owners or operators pay from actual savings delivered, allowing uninterrupted focus on their core operations.

The infographic features a dark blue background with the bbp logo in the top right. The main text reads: "bbp is an award-winning & accredited energy efficiency company that enables businesses to achieve carbon neutrality". Below this are four circular icons: a green circle with "\$0 investment", a teal circle with "pay with actual savings", a blue circle with "savings verified by 3rd party auditor", and a light blue circle with "save up to 40%". Below the infographic is a photograph of a control room with several people working at desks with multiple monitors displaying data. Text at the bottom of the photo reads: "Access your chiller plant data anytime, anywhere Using bbp's chiller plant management system" with the bbp logo in the bottom right corner.



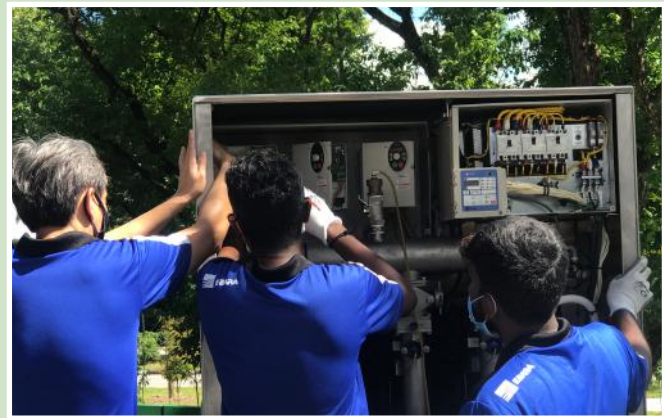
Belimo

Belimo is the global market leader in the development, production, and sales of field devices for the energy-efficient control of heating, ventilation and air-conditioning systems (HVAC). Founded in 1975, the company employs over 2,200 people and has been listed on the Swiss Exchange (SIX) since 1995.

Consistent focus on market and customer needs makes Belimo a partner which offers customers unsurpassed added value. The customer-oriented CESIM method developed by Belimo for optimising building technology with sensors, control valves and damper actuators ensures that its products have a major influence on comfort, energy consumption, safety, installation and maintenance in buildings.

Ebara Engineering Singapore Pte Ltd

Ebara Corporation started operations in Singapore with a branch office in the early 1980. Ebara Engineering Singapore Pte Ltd was registered officially in 1983 and started to provide pump overhaul business, system engineering design and custom design pumps.



The Precision Machinery division was started in early 1992 with the aim to service the growing semiconductor industry. It has since grown from a small section to a full division with overhaul facilities for dry vacuum pumps. This business now covers the whole of South East Asia and Oceania.



ENGIE

ENGIE strives to accelerate the transition towards a carbon-neutral world, through reduced energy consumption and more environmentally-friendly solutions, reconciling economic performance with a positive impact on people and the planet.

Leveraging globally leading technologies, ENGIE creates innovative energy and smart solutions that enhance the performance of homes, businesses, and communities. From strategy, financing syndication and design, to engineering, energy-efficient asset construction, operations management and outcome assurance, ENGIE acts throughout the value chain to help clients decarbonise today, for a better tomorrow.

With a geographical focus in Singapore, Malaysia, and the Philippines, ENGIE brings efficient energy solutions spanning from integrated energy performance services and low-carbon infrastructure (district cooling, EV charging, onsite solar, etc.) to large-scale renewables across the real estate, and data centre sectors.

G-Energy Global Pte Ltd

G-Energy stands at the forefront as an ESCO, boasting an expert team of energy specialists and certified Green Mark consultants. With more than 17 years of industry experience, G-Energy actively partners with diverse sectors to spearhead sustainability through innovative practices.

Its comprehensive one-stop solution covers design, construction, and certification attainment, enabling clients to meet stringent Total System Efficiency criteria. Through the optimisation of HVAC systems, G-Energy empowers clients to achieve substantial energy savings while bolstering environmental sustainability efforts, assisting clients to design, build and achieve Total System Efficiency (TSE) for the Air-Conditioning and Mechanical Ventilation (ACMV) system in their buildings as part of the green building certification process.



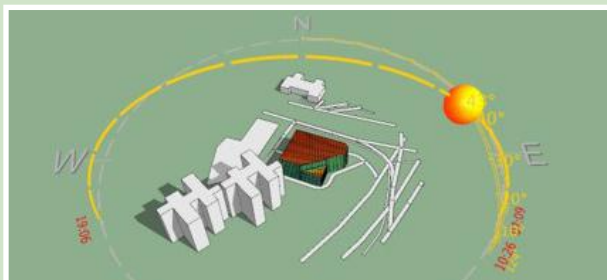
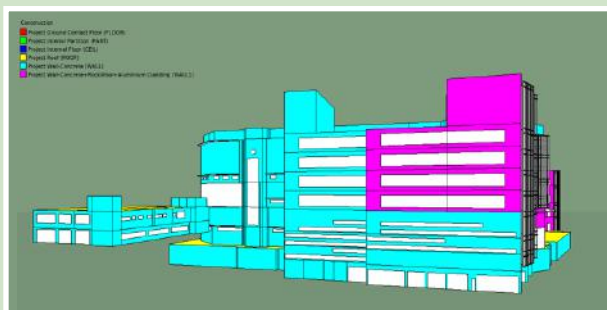
BCA has **significantly tightened the Energy Efficiency Requirements** for its Green Mark certification scheme on November 1, 2021.



For a building to be classified as **Net Zero or Positive Energy**, it must meet **Super Low Energy (SLE)** rating.



Assist building owners in **accelerating their sustainability efforts** by providing a **Zero Capex Energy Efficiency-as-a-Service business model** to help them accomplish their green building objectives.



HY M&E Consultancy

HY M&E Consultancy Services is a Professional Engineering Company that provides Mechanical and Electrical Consultancy Service to Building and Infrastructure Developers. Its services include Mechanical & Electrical service planning, authority submissions, project management, technology applications, drafting and design. HY M&E has two subsidiaries: Commodore and BeeCon.

Commodore specialises in the testing & commissioning of electrical assets (such as transformers, switchgear, cables, batteries, LPS, EV, PV, across different voltage levels to monitor equipment health condition, ensure protection integrity and proper functionality. It also performs power quality assessment for electrical load profiling, anomaly checks and troubleshooting and energy consumption measurements.

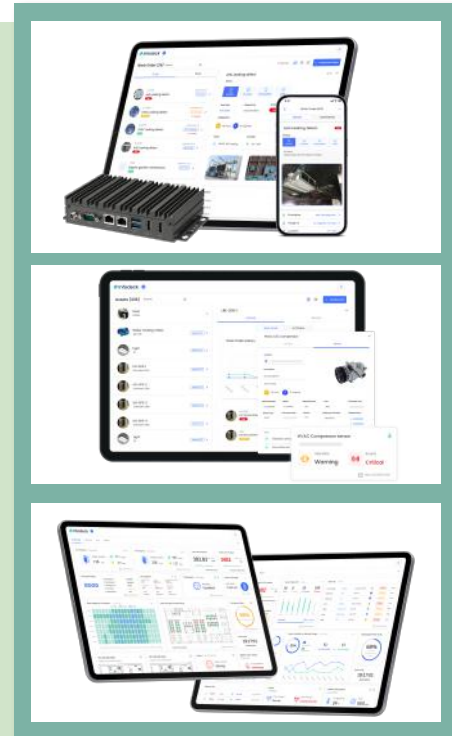
BeeCon provides sustainability services including but not limited to Green Building certifications, energy management studies with optimisation, solar studies energy storage systems and microgrids.

Infodeck Technology

Infodeck Technology is dedicated to bridging the divide between isolated systems and the data from emerging IoT devices. It provides a robust solution to optimise efficiency, minimise manual effort, and boost productivity through data-driven decision-making. Infodeck's cutting-edge solution empowers smart and sustainable buildings to achieve their ESG goals.

Infodeck offers an advanced facility operations management and smart workflow solution that harnesses the power of IoT techniques. It empowers maintenance and operations teams to streamline the day-to-day maintenance life cycle efficiently, enhance asset utilisation, and gain valuable insights from real-time data.

Moreover, Infodeck's edge computing enables resilient real-time data processing, it supports integrations such as LoRaWAN, Modbus, BACnet, MQTT and RESTful APIs, enabling the effortless connection of isolated systems and new IoT devices' data. With Infodeck, organisations unlock the seamless potential of optimised facility management, making operations smoother and more efficient than ever.



Intellihub Pte Ltd

Established in 2011, Intellihub Pte Ltd specialises in smart control solutions with a core emphasis on IoT sensors. Offering consultancy, integration, development, installation and project management services under its portfolio, Intellihub strives to be a complete solution house.

In the era of intelligent buildings, sensors play a pivotal role in data collection, sending it to IoT software for data analytics. Information is necessary for true building intelligence and helps businesses have more well-informed and better decision-making.

Intellihub remains committed to advancing building intelligence and efficiency with reliable yet innovative sensor technology. Its sensor solutions support seamless integration with BACnet, MQTT, and RESTful APIs.

Enabling Sustainability in the Built Environment



Nanyang Polytechnic

Established as an institution of higher learning in 1992, Nanyang Polytechnic's (NYP) academic schools offer quality education and training through 40 full-time diploma courses and common entry programmes. NYP's School of Design & Media (SDM) nurtures innovative and enterprising learners through a powerful combination of art, design, technology and expertise. NYP's hallmark is an educational model co-built with some of the industry's biggest names, leading to

additional mentorship programmes, certifications and valuable opportunities for its learners.

NYP's close industry partnerships enables its schools and enterprises to learn and update each other with industry best practices, explore and experiment new ideas and solutions, as well as induct students to the real world. NYP SDM's industry partners include CPG Consultants, DBS Bank, National Healthcare Group, ONG&ONG Group, Singapore Green Building Council, Urban Redevelopment Authority, and many more.

Signify

Signify is the world leader in lighting for professionals and consumers and lighting for the Internet of Things. Its Philips products, Interact connected lighting systems and data-enabled services, deliver business value and transform life in homes, buildings and public spaces.



In 2022, Signify had sales of EUR 7.5 billion, approximately 35,000 employees and a presence in over 70 countries. Signify achieved carbon neutrality in its operations in 2020 and have been in the Dow Jones Sustainability World Index since its IPO for six consecutive years and were named Industry Leader in 2017, 2018 and 2019.

Signify has been leading the lighting industry with innovations that serve professional and consumer markets for more than 125 years. Its energy efficient lighting products, systems and services enable customers to enjoy a superior quality of light, make people's lives safer and more comfortable and businesses more productive.

Enabling Sustainability in the Built Environment



Tectus Group

Tectus Group, a family-owned multinational operating in diverse industries globally, has a particular focus on embodied carbon within its construction, real estate and specialised engineering and inspection businesses.

Tectus' mission is to protect, maintain and responsibly grow the built world using technology. By adopting a holistic view on the emissions impact of asset lifecycles, Tectus contributes to minimising embodied carbon through employing carbon-

efficient construction methods, promoting use of maintenance, repair and retrofit technologies and enabling stakeholders to proactively inspect, monitor and maintain structures to maximise longevity, asset health and Net Present Value (NPV).

Tectus provides post-tensioning technology, modular construction with prefabricated and prefinished volumetric steel hybrid units, Asset Management digitisation, Maintenance Repair and Retrofit technology as well as building materials and Greentech.



YiTac(S) Pte Ltd

Navigating Towards Sustainability

YiTac(S) Pte Ltd

YiTac is dedicated to providing sustainability solutions with attributes in being environmental friendly, energy efficient and as well as productivity. Through its pioneering solutions, YiTac leads the market in propelling eco-friendly technologies while maximising energy conservation in the built environment.

YiTac's wide range of sustainable products and solutions includes:

- "Twenty80" Passive Displacement Ventilation (PDV) System
- "Kingspan" Pre-insulated Duct System
- "Grundfos" Distributed Pumping System
- "York" Air-cooled Chillers
- "Troidtekt" Green Acoustic Panels
- Measurement and Verification System for Variable Refrigerant Flow (VRF) System



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 to learn more about what you can do for your home.





For more information, please contact Grace Chua at 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