SG Green I Issue 19.0

SEPTEMBER 2024

SG GREEN

SINGAPORE GREEN BUILDING COUNCIL

CATALYSING INNOVATION IN THE BUILT ENVIRONMENT

INSIDE:

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

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MESSAGE FROM THE EDITORIAL TEAM

illustration by Freepik.com

The built environment, a cornerstone of modern society, is also a significant contributor to global carbon emissions. As the world grapples with the urgent need to decarbonise, the pressure on the construction industry to innovate and transform has never been greater. Singapore, a city-state renowned for its forward-thinking approach, has an opportunity to lead the charge by fostering an ecosystem that nurtures groundbreaking solutions for a sustainable built environment.

To achieve meaningful decarbonisation, we must shift our focus beyond incremental improvements and embrace radical innovation. This requires a paradigm shift in how we design, construct, and operate buildings. Emerging technologies, such as advanced materials, artificial intelligence and digital twinning, hold immense potential to revolutionise the industry. For instance, sound application of AI to optimise energy consumption can drastically reduce a building's environmental impact.

Collaboration between industry stakeholders is also essential for driving progress. Architects, engineers, contractors, material suppliers, and building owners must work together to develop and implement innovative solutions. Public-private partnerships can also play a crucial role in funding research, developing new standards, and scaling up successful projects.

Within the pages of SG Green Issue 19.0, read a collection of stories on how Singapore built environment organisations are pushing the envelope on decarbonisation. Find out how the Singapore Land Tower makes the case for adaptive reuse, and how homegrown environmental sustainability consultancy DP Sustainable Design is innovating sustainable design. The magazine also showcases a selection of sustainable solutions put forward by SGBC Member organisations, each playing its own role in the quest for greater built environment sustainability.

By embracing new ideas and technologies, we can create a built environment that is not only environmentally friendly but also economically prosperous and socially equitable. The time for action is now. Let us work together to build a greener and more sustainable future.

Yours Sincerely,
SG Green Editorial Team


Battery Rd

MAKING THE CASE FOR ADAPTIVE REUSE

Find out more about Singapore Land Tower, a Winner of the SGBC-BCA Leadership in Sustainability Awards 2024 under the Building Project Leadership in Sustainability for Carbon Performance.

When it comes to revitalising the urban fabric of a dense city like Singapore, two solutions usually present themselves: buildings are either demolished and redeveloped or they undergo an extensive asset enhancement initiative (AEI). In reality, the latter is a rare occurrence in Singapore, especially when it comes to office buildings. But even though refurbishing an existing development is not the easiest undertaking, the benefits of doing so sometimes outweigh the challenges that come with it. Singapore Land Tower is a case in point.

TRANSFORMING AN ICON

Located in Raffles Place, Singapore Land Tower is Singapore Land Group's (SingLand) flagship building and has been an anchoring presence in the heart of the Central Business District (CBD) since it was completed in 1982. The 42-year-old office building has been catering to businesses in Singapore's rapidly growing economy for decades and is home to the likes of financial institutions and multinational companies.

Over the years, the business environment has been constantly changing, but it was not until the Covid-19 pandemic that the most significant shifts in the workplace occurred. It quickly became apparent that there was a need to cater to new workplace realities and changing business needs. With that, an ambitious endeavour to rejuvenate Singapore Land Tower commenced in 2021, led by the late architect and Pritzker Prize winner, Fumihiko Maki from Maki and Associates.

Aimed at transforming the building with green, human-centric design, the AEI was also an opportunity for the building to reestablish itself as a modern presence in the CBD. What resulted is an exemplary case study of how building owners can breathe new life into existing structures.

REESTABLISHING A MODERN PRESENCE

One of Maki's key design interventions is the renewal of the building's façade. Originally characterised by thick concrete bands, the tower is now defined by a pristine glass curtain wall that envelopes the building. The advantages of the new façade are not merely cosmetic. With the original perimeter parapet walls on each floor removed to make way for the new glass skin, there was also an opportunity to increase the usable floor area on each level. The fully glazed façade now also introduces more daylight into the interior spaces, augmenting the tenant experience for the better.

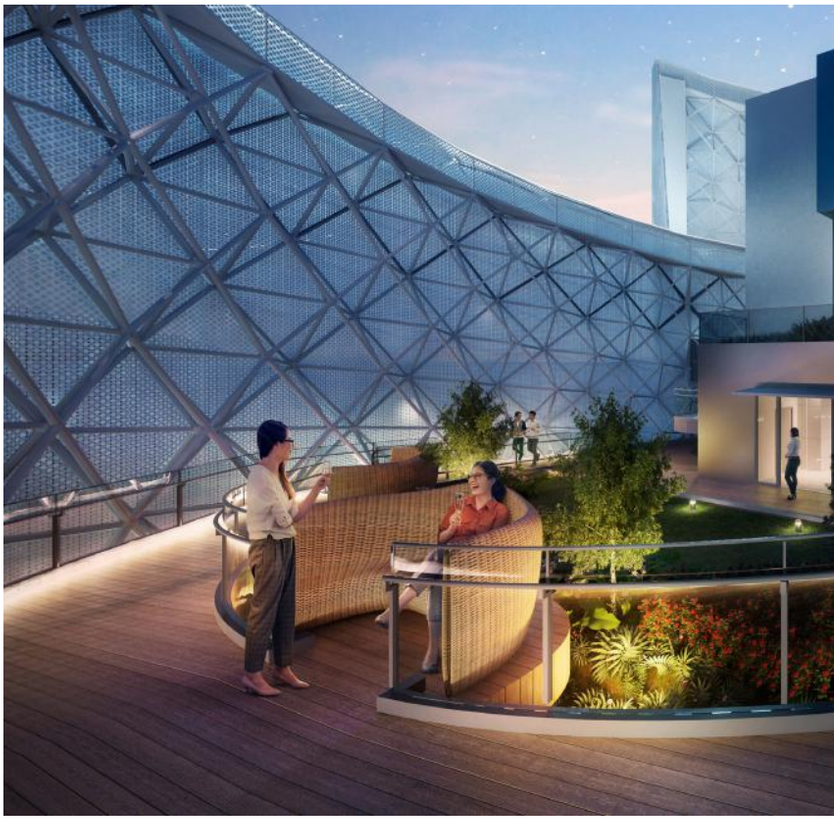
Perched right at the top of the building where a city observation deck offers panoramic views of the Marina Bay waterfront area, a metallic mesh crown curves upwards in a spiral form, referencing the circular geometry of the spaces on the lower floors and raising the tower's overall height to 214 metres. The ascending sweep of the crown is also a nod to the building's locale with Raffles Place once sitting atop a hill in the 1800s before it became Singapore's business district.

Image Credit: National Archives of Singapore

SEEKING SUSTAINABLE SOLUTIONS

A central pillar of the project was the implementation of green solutions that would optimise energy and water efficiencies in the building. The new façade, which is made of low-emissivity glass to reduce heat transfer into the building, is but one solution that was adopted. Other interventions include upgrades to the air-conditioning and mechanical ventilation system, the adoption of a full-destination control system for the lifts, the installation of LED lighting for common spaces as well as the implementation of auto-irrigation systems for landscaped areas.

Enhancements extend beyond the building's hardware and take into consideration digital solutions to improve the efficiency of building operations. This has resulted in the deployment of a smart micro-climate control system that optimises energy usage and enhances occupant comfort.



Bringing nature into the building was yet another strategy for creating a sustainable work environment. Landscape features have been added across multiple floors, including the roof with its two tiers of botanical sky gardens. Such green spaces not only help to temper heat, but also offer tenants moments of reprieve and further the case for wellness at the workplace.

Collectively, these efforts have led to the building receiving a higher recertification of Green Mark Platinum by the Building and Construction Authority (BCA) in 2022. Singapore Land Tower is also a Winner of the SGBC-BCA Leadership in Sustainability Awards 2024 under the Building Project Leadership in Sustainability for Carbon Performance award category.

A NEW WAY TO WORK

The world of work has changed drastically since the pandemic, resulting in a resounding call for flexibility, wellness and community in the workplace. With this in mind, a more holistic approach was taken in the enhancement of Singapore Land Tower.

Notably, the building addresses a growing demand from companies for dynamic real estate solutions with the introduction of The Exchange – an offering of flex space solutions and a comprehensive suite of event facilities across two floors. This allows tenants to complement their core office leases with flexible spaces and amenities as their business needs evolve. At the same time, an end-of-trip facility, bicycle park and electric vehicle-charging stations were added as more occupants adopt low-carbon modes of transport.

It is not all about the hardware when it comes to creating an office building where people can thrive. Connection and community are equally important and placemaking through art, design and events is a key component of SingLand's renewed commitment to provide an optimal experience for its tenants. A monumental artwork that sweeps across the refreshed main lobby creates an elevated sense of arrival, while regular engagement activities are organised for tenants, including initiatives that raise awareness on community causes.

HARNESSING THE PAST FOR A BRIGHTER FUTURE

To be sure, there are benefits to be had when a building undergoes an AEI. In the case of Singapore Land Tower, the building was kept fully operational throughout the refurbishment period, allowing it to continue as an income-producing asset. Still, the decision for the AEI was largely propelled by SingLand's commitment to place sustainability at the heart of its business decisions. By adopting an extensive AEI over a demolish and rebuild approach, a study conducted in 2023 revealed that over 50 percent of embodied carbon emissions were avoided for the project.

Mr Jonathan Eu, Chief Executive Officer of SingLand says, "As a real estate company, we are committed to doing our part to decarbonise the built environment and mitigate climate change. This has seen us take steps to optimise the resource efficiency of our buildings and consider the embodied carbon impact of our redevelopment and regeneration projects. Our asset enhancement initiative for Singapore Land Tower will serve as a viable model for how older commercial office buildings can be transformed and futureproofed through innovative sustainable solutions to meet evolving workplace demands."

The lessons learnt throughout the AEI are aplenty. More importantly, they are of great value – not only for SingLand but for others too. Recognising this, SingLand hosts guided tours for industry stakeholders, offering insights into the project as it heads towards completion in December 2024. The hope is that such sessions will encourage greater openness to adaptive reuse as a viable and dare we say, preferred path for urban development.

Article contributed by:
Singapore Land Group

Image Credit: The Executive Centre


CERTIS

INNOVATING SUSTAINABLE DESIGN

As one of the winners of the SGBC-BCA Leadership in Sustainability Awards 2024, under the Business Leadership for Sustainability – IMPACT category, DP Sustainable Design is committed to advancing a greener built environment through sustainability innovation.

Image Credit:
Certis & Lendlease Property Trust


Image Credit: DP Architects

A full-fledged environmental sustainability consultancy arm within the DPA group (DP), DP Sustainable Design (DPSD) was established in 2013 and has over the last decade become a leading organisation committed to advancing a greener built environment. Its multidisciplinary team of dedicated professionals, comprising architects, engineers and in-house assessors proficient in Green Mark, LEED, WELL, WiredScore and SmartScore certifications, effectively equips DPSD to tackle complex issues across a range of building projects and positions it to take the green design process further than its counterparts.

GREEN AT HEART

The work goal of DPSD is singular: to develop and deliver innovative sustainable design solutions that are environmentally, socially and economically responsive to local climatic conditions, site context and end-user needs. Their repertoire of services ranges from green building and wellbeing design certification, energy performance modelling & analysis, whole life carbon accounting, environmental building CFD simulations and smart solutions integration platform; all of which is anchored on the ethos of getting design

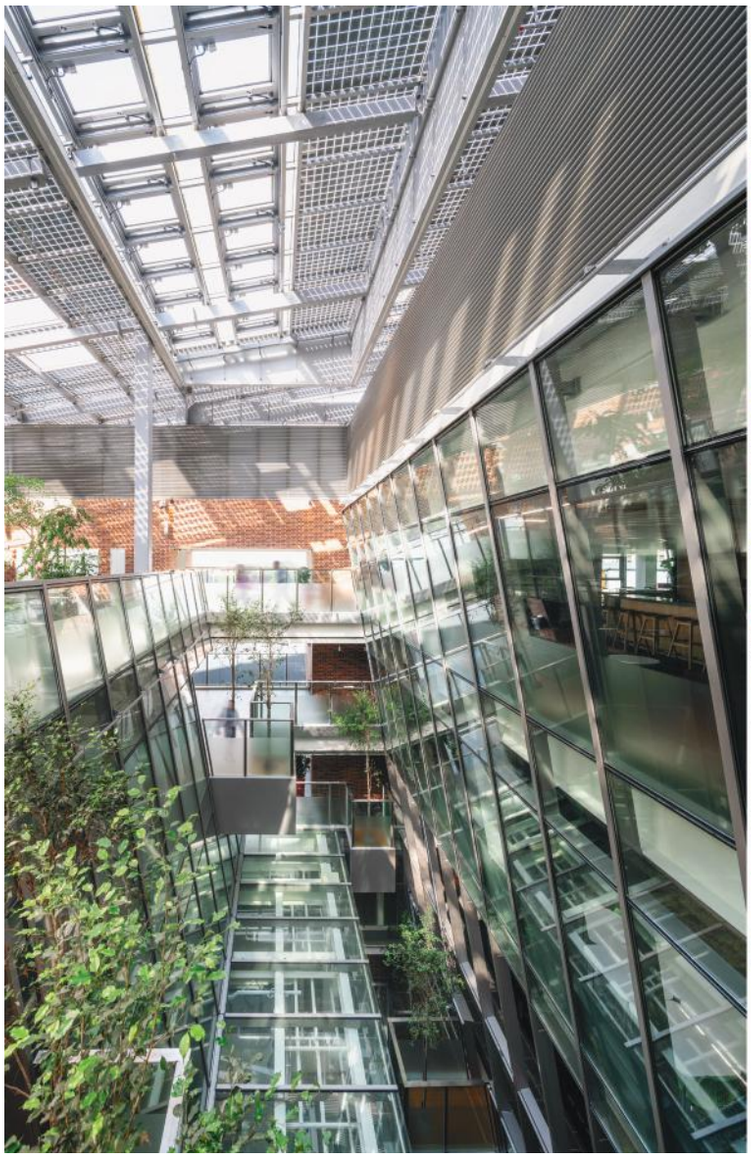
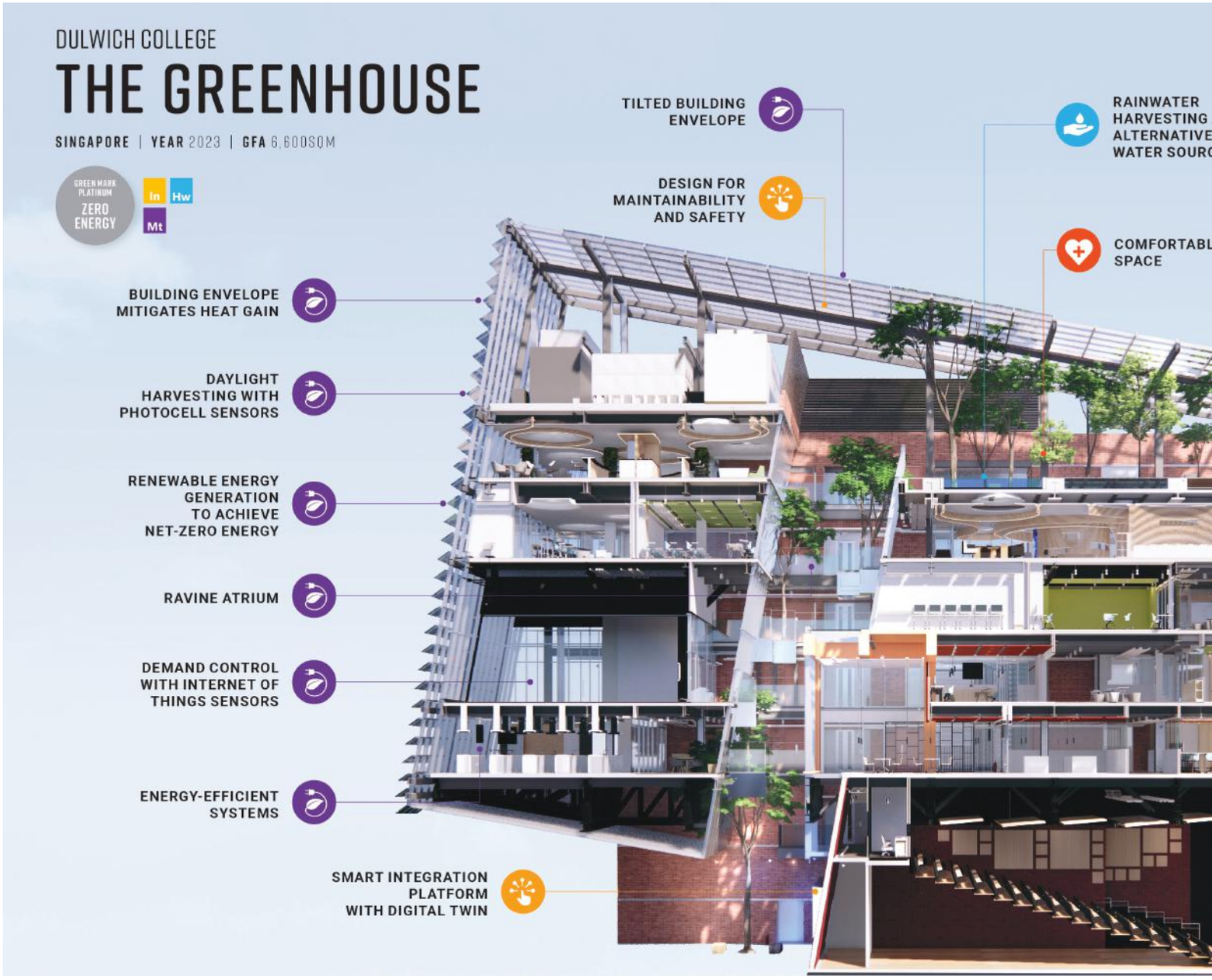


Image Credit: DP Architects

fundamentals right from the outset of a project and to optimise these through detailed design. This makes their process a pragmatic one of integrated, iterative work approach fundamental to green design, that is informed by evidence-based environmental simulations and grounded in empirical data; which enables the team to ensure that the development of green building system goes hand in hand with the overall concept design of the building.

As part of its commitment to sustainability and DPA's group-wide goal of achieving net-zero carbon for its projects, DPSD is advocating for the adoption of Whole Life Carbon Assessment (WLCA). WLCA involves evaluating the carbon emissions associated with a building or infrastructure project throughout its entire lifecycle; and by championing it, DPSD aims to shift the industry focus beyond operational carbon to include embodied carbon. This comprehensive approach allows stakeholders to make more informed decisions during the design and construction phases, selecting materials and construction method with lower carbon footprint.



Exemplifying this is some of DPSD's notable forward-thinking and environmentally-conscious projects, namely Paya Lebar Green and The Greenhouse at Dulwich College (Singapore). Paya Lebar Green is the first office building in Singapore conferred the Building and Construction Authority (BCA) Green Mark Platinum – Super Low Energy certification with all five badges in the areas of Health & Wellbeing, Whole Life Carbon, Resilience, Intelligence and Maintainability. A whole life carbon assessment was conducted to quantify the carbon emissions of the new Paya Lebar Green South building. Paired with low-carbon design, the adoption of low-carbon building materials such as carbon cure technology, SGBC-certified concrete and SGBC-certified fit-out finishes, the building successfully reduced its upfront embodied carbon emissions. (See infographic on Page 18).

Infographic by DP Architects

The Greenhouse at Dulwich College (Singapore) is the first international school in Singapore to receive the BCA Green Mark Platinum – Zero Energy, with three badges in Health & Wellbeing, Intelligence and Maintainability. Its standout design feature is its eco-envelope lined with building-integrated photovoltaics (BIPV), which offset 40 percent of the building's annual energy consumption, The remaining 60 percent is offset by PV installations

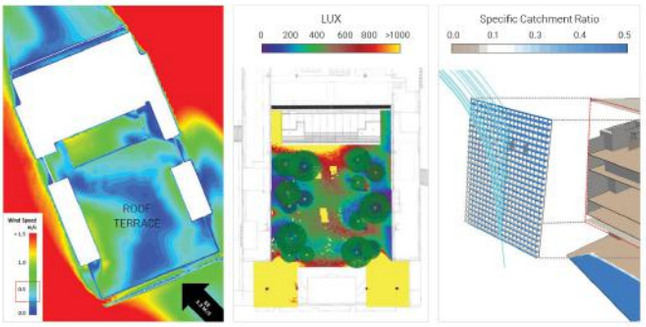


Image Credit: DP Sustainable Design

within the campus. Solar radiation and shadow hours were studied during the early design stages to estimate the renewable energy generated from the BIPVs as well as to inform the envelope's ten-degree tilt to optimise energy harvesting, and prevent self-shading by BIPV fins. Further to this daylighting, natural ventilation and wind-driven rain studies were also conducted to ensure a comfortable learning environment for users.

SUSTAINABILITY INNOVATION FOR CLIMATE POSITIVE CHANGE

The commitment to tackling climate change first began in DP as a ground-up green movement and has since culminated in a strategic whole-of-DP approach in 2021. Green-Well-Tech (GWT) extends from DP's core values and harnesses its multidisciplinary strengths to adopt sustainable practices, wellbeing design and purposeful technology to drive the practice towards meaningful and innovative solutions for better-than-sustainable outcomes. Since 2022, DP has meticulously tracked the sustainability performance of its Singapore projects using its Attributes of Purposeful Design wheel, a design tool and practice guide to analyse the impact on carbon, natural, human and socio-economic systems of DP's projects. As a whole, DP has also organised GWT masterclasses that focus on the impact of carbon and strategies for decarbonisation. These classes are conducted regularly, led by internal domain experts or industry practitioners, serving as an educational platform for employees.

Continually pushing for excellence, DPSD is harnessing digital technology and pushing for sustainability innovation in its processes. In 2018, the ESD consultancy piloted NimbleSIM, a platform for architects to generate iterative building performance simulations and to make design decisions with more speed and confidence. Using knowledge of modelling software, three-dimensional data is automatically converted into inputs for simulation and generated data is summarised. It is designed for early-stage building feasibility studies and each simulation emulates an aspect of passive sustainable design. The outputs are presented in both quantitative and qualitative formats, assessing building performance using simulation data and spatially mapped images. The images provide a visual representation of building performance, while a data dashboard summarises performance details into key indicators. Ultimately, these streamlined outputs will be compiled into an Environmentally Sustainable Design (ESD) report, forming a crucial aspect of building design evaluation.

An upgraded and expanded version – NimbleSIM+ which will integrate a suite of simulation and calculation tools – is currently being developed in collaboration with DP's venture development arm, the Smart Sustainability Unit. In parallel development, are the Façade ReGen and DC ReGen, specialised computation software that leverage NimbleSIM+ simulations to generate façade and data centre design solutions.

Cross-industry collaborations are also key in its drive for sustainability innovation. One such partnership is with Eutech Cybernectic, with whom DPSD developed holistic smart solutions for the building and real estate industry. This materialised as a pilot implementation, Spaceworx, delivered together with DPA under the grant from the Infocomm Media Development Authority (IMDA) for CapitaLand. The first one-stop digital marketplace for smart building solutions, Spaceworx simplifies the acquisition, assembly and integration of technologies that address sustainability, health and wellbeing, and smart facilities management. DPSD has also collaborated with the Singapore University of Technology and Design (SUTD) via their Capstone Programme, to streamline

embodied carbon calculation process and help designers gain insights to optimise sustainable design and reduce embodied carbon at different design and construction stages. Presently, DPSD is in discussions with the National University of Singapore (NUS) to address the present lack of a comprehensive local embodied carbon database that is focused on mechanical, electrical and plumbing (MEP) systems. Given the urgent need to cut emissions, identifying ways to mitigate MEP system impacts is imperative.

Infographic by DP Architects

A BETTER-THAN-SUSTAINABLE FUTURE

As part of its commitment to sustainability, the DPA group established a DP Sustainability Plan with the goal to achieve net-zero carbon for its projects and net-zero carbon emissions for its business operations by 2045. In collaboration with DPA, DPSD joined the Singapore Built Environment Embodied Carbon Pledge by SGBC to accelerate the decarbonisation of the built environment. DPSD dedicates significant effort to optimising designs with resource efficiency as a primary objective. Additionally, the company promotes the adoption of green materials with lower embodied carbon for all its projects, striving to promote sustainability in every engagement.

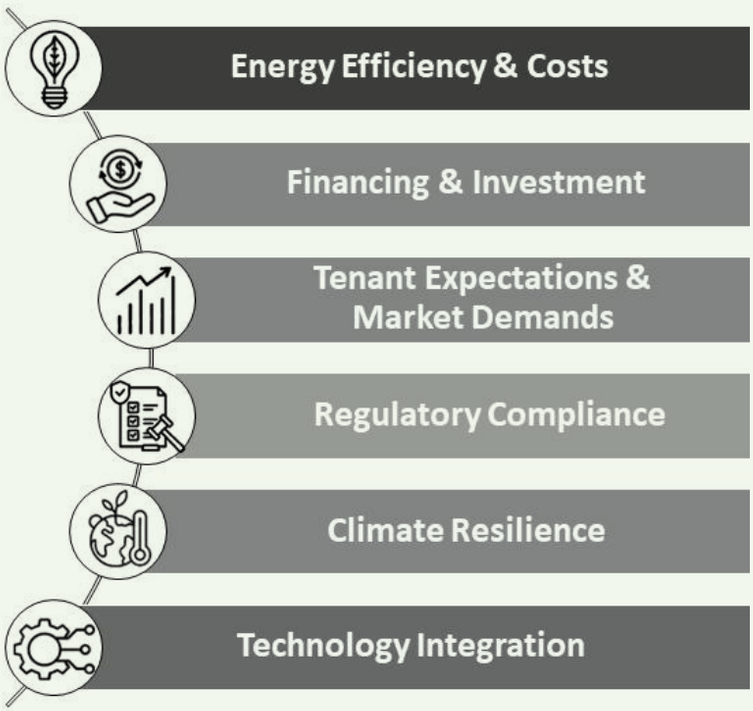
Article contributed by:
DP Sustainable Design

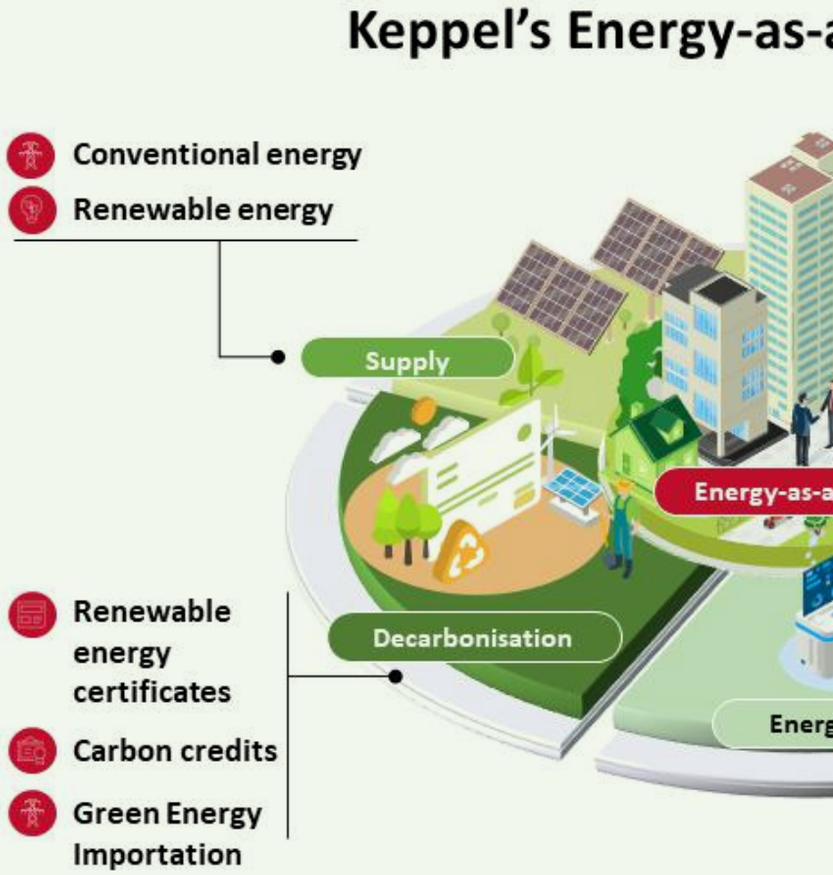
DELIVERING ENERGY AS A SERVICE

Find out how Keppel addresses decarbonisation challenges by offering end-to-end sustainable urbanisation solutions

Climate change poses an urgent need for decarbonisation and sustainable practices. For highly urbanised spaces, such as Singapore, steps can be taken to make the built environment greener. Building owners may have concerns on energy efficiency, compliance to regulations and financing options for taking measures to support Singapore's advancement of sustainable development.

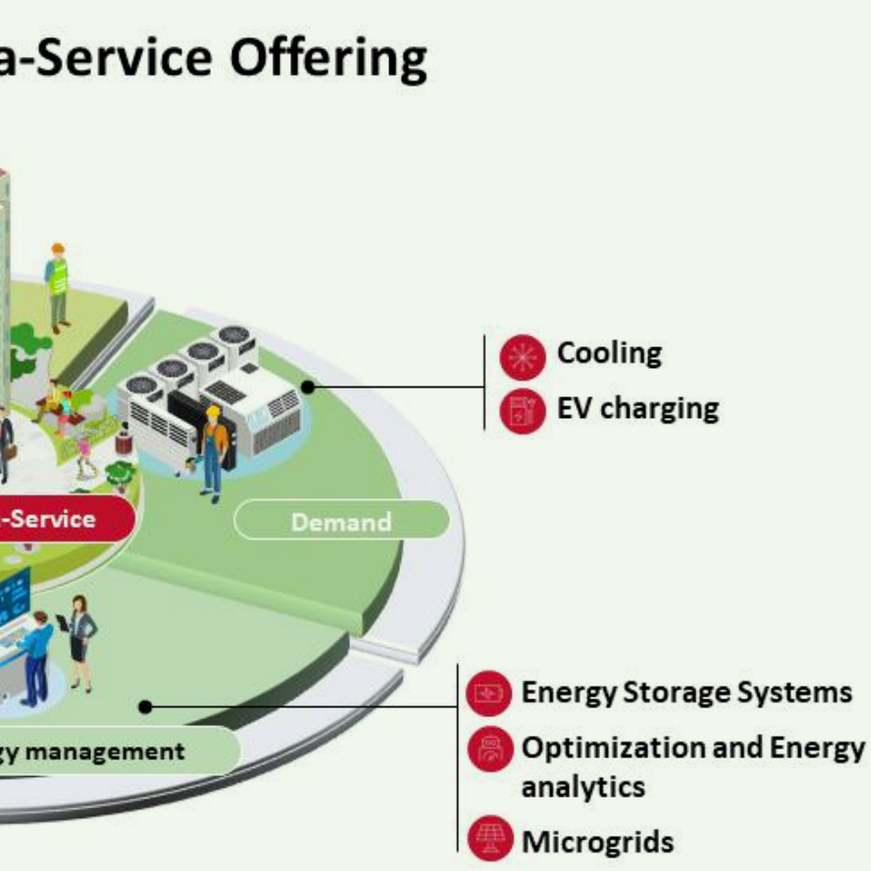
MAIN CONCERNS OF OWNERS IN SINGAPORE





As a Winner of the SGBC-BCA Leadership in Sustainability Awards 2024 for Business Leadership in Sustainability (Transformation), Keppel operates a subscription-based business model where clients pay recurring subscription fees for energy infrastructure rather than making upfront capital investments, collectively termed Energy As a Service or EaaS. EaaS comprises solutions such as Cooling-as-a-Service (CaaS),

Cooling-as-a-service



solar power purchase agreements, and the provision of electric vehicle (EV) charging points. EaaS supports commercial and industrial clients towards achieving carbon neutrality by providing an easy-to-implement solution.

Electric Vehicle Charging Points

Solar Power Purchase Agreements

The EaaS model aggregates the volume of demand for environmental solutions to bring about cost reductions that might not be achieved by asset owners on their own. Centrally managed from the KI@Changi Operations Nerve Centre (ONC), EaaS solutions tap on data analytics and machine learning algorithms to help building owners reduce their overall energy consumption through performance optimisation.

Keppel EaaS has the expertise to support building owners on their sustainability targets, such as energy conservation and enhanced operational performance, while mitigating operational risks. Asset owners adopting the Keppel EaaS model can reap multiple advantages:

COST SAVINGS

Building owners and managers can avoid upfront capital expenditures, and instead pay predictable - and often lower - operational expenses through subscription or usage-based fees.

RELIABILITY

The service provider assumes responsibility for system performance, maintenance, and upgrades, reducing unplanned downtime for customers.

ACCESS TO EXPERTISE

Customers benefit from Keppel's engineering track record and expertise in energy management systems.

SCALABILITY AND FLEXIBILITY

The EaaS model allows for scalable solutions tailored to the customer's needs, with the leeway to adjust energy services as requirements change over time.

FOCUS ON CORE BUSINESS

By outsourcing energy management to a service provider, building owners and managers can concentrate on their core business activities instead of allocating resources to manage their energy infrastructure.

INTEGRATION OF ADVANCED TECHNOLOGIES

Keppel EaaS leverages technology to offer innovative and efficient decarbonisation solutions, combining Internet-of-Things (IoT)-enabled utilities and operational expertise, as well as artificial intelligence and machine learning algorithms for command, control, and resource optimisation. This approach allows asset owners to access cutting-edge technology to perform fault detection and diagnosis, peak load management and peer benchmarking - all of which provide monitoring and facilitate pre-emptive corrections to achieve optimal outcomes.

One such technology is a novel Phase-Change Material (PCM), which Keppel EaaS has collaborated closely with the National University of Singapore (NUS) on to design and develop. The PCM can store and release cold energy as it changes between liquid and solid states, and is suitable for deployment in Thermal Energy Storage (TES) systems, where tanks gradually release stored cold energy in a district cooling plant to offset cooling peak loads in commercial buildings. The PCM has been specifically designed and engineered to bridge the gap between local cold energy supply and energy demand, allowing for the redistribution of cold energy to meet peak load demands in an energy-efficient manner without increasing strain on the overall energy grid.

SUSTAINABILITY AND COMPLIANCE

The model supports sustainability goals by offering renewable energy options and helping asset owners meet regulatory and environmental compliance requirements.

CASE STUDIES

Keppel EaaS has implemented its solutions for several projects in Singapore, such as:

RAFFLES CITY SINGAPORE

The provision of CaaS to Raffles City Singapore over a 15-year period, after being awarded a contract by CapitaLand Investments. With over 3.45 million square feet of gross floor area (GFA) and an installed capacity of 10,000 refrigeration tons (RT), Raffles City Singapore will be the largest integrated development by GFA in Singapore and one of the largest in Southeast Asia to adopt the CaaS system to date.

JALAN PAPAN SINGAPORE

Implementation and operation of Southeast Asia's largest public EV fast-charging hub at Jalan Papan in Singapore by Setsco Services. Volt will operate the fast-charging hub for up to 15 years, and the hub will feature up to 80 direct-current charging points which will be installed in multiple phases to serve the general public, including electric buses, taxis, private hire cars, and other electric vehicles.

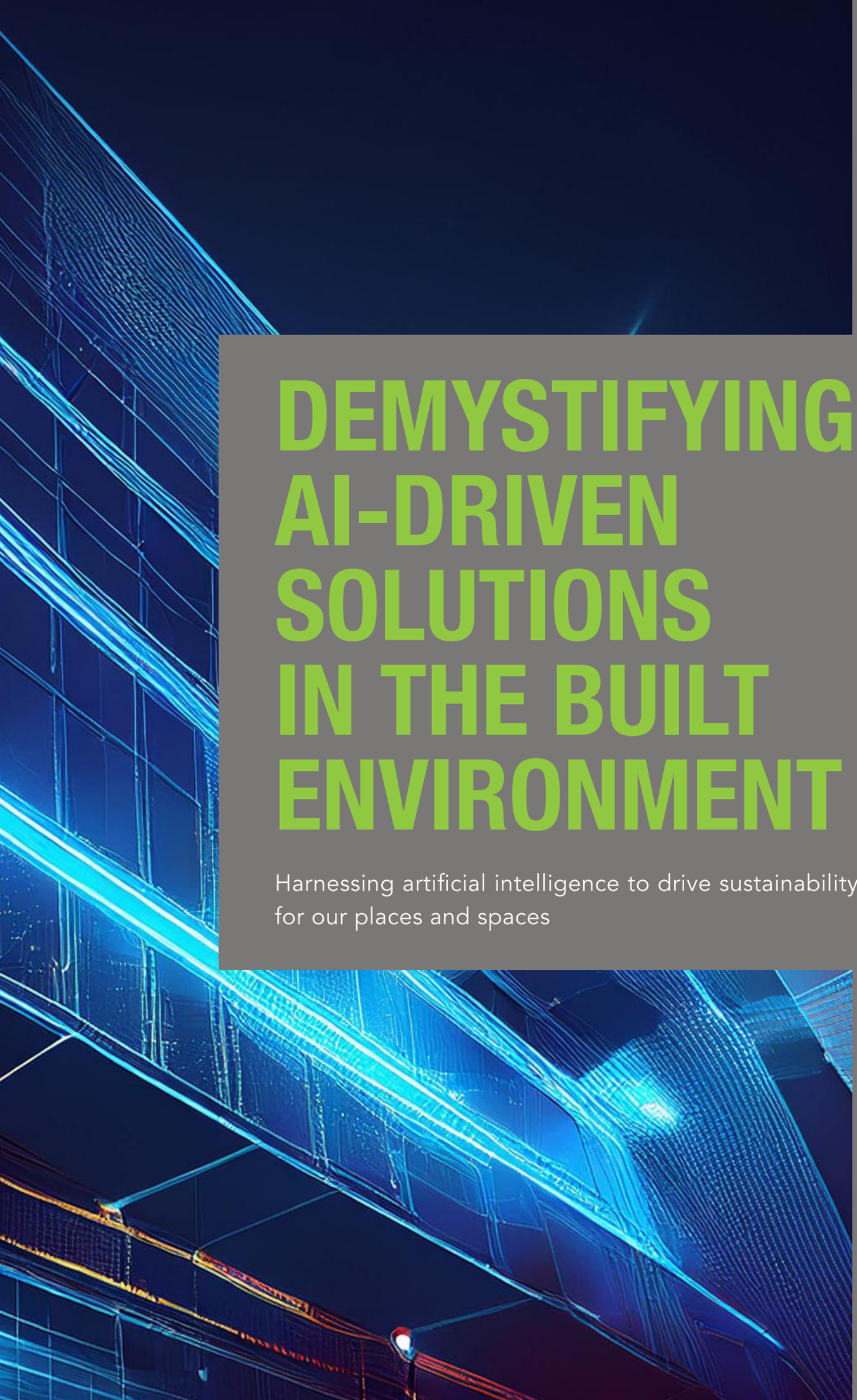
CHANGI AIRPORT SINGAPORE

The ongoing installation of Singapore's largest single-site solar photovoltaic (PV) system at Changi Airport. This PV system will generate a total of 43 megawatts-peak of clean energy - enough to power more than 10,000 four-room HDB flats annually. It will reduce Changi Airport Group's carbon emissions by up to 20,000 tons annually and utilises remote monitoring with predictive maintenance capabilities integrated in the Keppel ONC to enhance energy management and system reliability.

CONCLUSION

EaaS has emerged as an innovative solution in the global effort to combat climate change and promote sustainable development. This model has not only accelerated decarbonisation efforts in Singapore but has also positioned Keppel as a leading player in the international district and retail cooling sectors. With over 80 developments served and 235,000 RT of refrigeration capacity across various industries, including data centres, industrial facilities, offices, retail spaces, and educational institutions, Keppel EaaS has proven its adaptability and effectiveness. Keppel EaaS is seeking out new opportunities in ASEAN to drive more substantial cuts in carbon output, bolster energy self-reliance, and make a meaningful impact on climate change mitigation in the region.

Article contributed by:
Keppel, Infrastructure Division



DEMYSTIFYING AI-DRIVEN SOLUTIONS IN THE BUILT ENVIRONMENT

Harnessing artificial intelligence to drive sustainability for our places and spaces

Image Credit: Keppel

AI and sustainability are buzzwords today. Artificial Intelligence (AI) has emerged as a transformative force across various industries, and its potential to drive sustainability is increasingly coming into focus. As we confront the pressing challenges of climate change, resource depletion, and environmental degradation, AI offers innovative solutions that can enhance efforts to create a more sustainable future. Its ability to analyse data, optimise processes, predict outcomes and facilitate close-loop AI automation positions it as a key player in addressing some of the most pressing environmental challenges of our time.

Energy consumption and production are central to sustainability efforts. Optimising energy use has become a critical focus for industries, governments, and individuals alike. AI is at the forefront of this transformation, offering innovative solutions to enhance energy efficiency, reduce costs, and support sustainability goals.

Buildings are energy guzzlers. Operating and maintaining buildings today is resource-intensive, expensive, and it generates significant carbon emissions as well as requires specific skills, engineering equipment, utilities, and capital.

The core skills and technology required to operate and maintain buildings involve engineering and operations technology (OT). OT encompasses a broad range of hardware and software used to monitor and control the physical environment or manage devices that interact with it. Information Technology (IT) uses hardware, software, services, and supporting infrastructure to manage and deliver information using voice, data, and video. In recent years, data science has emerged from the management of large amounts of data and information, with techniques including closed-loop decision-making and execution, evolving into AI.

So, integrating OT and IT seems an obvious way to supercharge net-zero and sustainability goals. In practice, this integration is complex. The challenge does not lie with technology integration but with domain knowledge, skills, and resistance from the current OT and IT workforce.

The sense of superiority and dominance in each domain prevents the free flow of ideas and solutions. Our educational institutions are now playing catch up in developing curricula in engineering, business, and information science to align with the digital economy. If we want to accelerate the move towards net zero, governments and businesses must invest in merging OT and IT domains and knowledge to solve previously intractable problems.

Ironically, what is available today is not cutting-edge AI technology but proven techniques and methods used successfully in many other domains, only now being adopted in the built environment. AI-driven solutions significantly improve energy efficiency by providing real-time insights and automating optimization processes. This leads to reduced energy consumption, lower operational costs, and a smaller carbon footprint.

The benefits of tapping on AI are multifold:

1. **Automating complex tasks via closed-loop capabilities:** freeing humans from time-consuming tasks for more value-added work.
2. **Optimising utilities use:** improving energy and water use efficiency by managing usage behaviour.
3. **Enabling predictive maintenance, fault, and false detection:** analysing data to identify potential issues enhances the reliability of energy systems and reduces the risk of unplanned downtime.
4. **Leveraging big data and empowering decision-making:** continuously managing and analysing large amounts of complex data to provide insights, foresight, and optimisation recommendations. AI technology can also implement these recommendations, improving productivity traditionally unattainable.

With these promising benefits, it is no wonder that the market is inundated with products and solutions all claiming the AI badge. But the most common AI methodology offered in the market is often rule-based. This hypothesis-driven approach relies on human understanding to translate into a series of rules. Rule-based solutions do not offer probability scores, achieve low accuracy, and result in high false positives, leading to higher maintenance costs and lower trust. Other solutions branding themselves as AI offer only dashboarding with some statistical or even machine-learning algorithms.

The challenge with such methodologies is that they merely report past events. And if they have predictive, forecasting, and optimisation capabilities, they require engineers to interpret and act on the output. This necessitates updating organisational processes, policies, and guidelines and ensuring that a team of trained engineers can read, interpret, decide based on the output, and execute decisions. A closed-loop AI solution leveraging machine learning and self-learning algorithms is therefore a more effective approach to AI adoption.

The future of AI in energy optimisation is promising, with ongoing advancements in technology and data analytics offering new opportunities. As AI algorithms become more sophisticated and data availability increases, we can expect even greater improvements in energy efficiency and sustainability. The future of AI in energy optimization will be shaped by ongoing collaboration between technology developers, energy providers, policymakers, and consumers. Public and private sector partnerships will drive innovation and deployment of AI solutions, ensuring that they meet both technical and regulatory requirements. Investment in research and development will further advance AI capabilities, enabling new applications and improvements.

The AI genie is already out of the bottle, and it cannot be put back in. We are currently midway through the Digital 4.0 data and AI revolution. In less than a decade, Digital 5.0 will be upon us. The sooner we embrace the potential of AI while navigating its complexities the better. We cannot kick the can down the road much longer if we want to re-engineer a greener, more resilient energy future.

Article contributed by:
Bill Lee
Founder & CEO
Azendian Solutions


EPD

UNDERSTANDING ENVIRONMENTAL PRODUCT DECLARATIONS

Sustainability in supply chains is no longer optional - it is a necessity.

With the growing global focus on decarbonisation and addressing supply chain emissions, building developers, professionals, contractors and specifiers are increasingly seeking to understand the carbon emissions impact of building materials and products. Environmental Product Declarations or EPDs are a key means of communicating a product's environmental impact in a transparent and consistent manner, allowing for more informed decision-making towards building materials and product selection.

WHAT ARE EPDS?

EPDs provide a clear, third-party verified report on the environmental impact of a product throughout its lifecycle. This transparency is essential for businesses looking to make informed, sustainable purchasing decisions. Without EPDs, companies are essentially operating in the dark, unable to compare the true environmental costs of their options.

WHY EPDS MATTER

Companies often assume that any "green" product is environmentally friendly, but without an EPD, you cannot be sure. Mistakes happen when businesses rely solely on marketing claims without verifying the data. EPDs eliminate this uncertainty by providing standardised information, ensuring that your procurement decisions are based on facts, not assumptions.

HOW TO USE EPDS

Many businesses struggle with interpreting EPD data. The key is to focus on the aspects most relevant to your company's sustainability goals, such as carbon footprint or water usage. Prioritise products that align with your specific environmental targets. This targeted approach maximises the benefits of using EPDs in your procurement process.

OBTAINING AN EPD FOR YOUR PRODUCTS

For companies looking to obtain an EPD for their products, the process can be daunting but invaluable. The first step is conducting a detailed Life Cycle Assessment (LCA) to gather the necessary data. Collaborate with third-party verifiers to ensure the accuracy and credibility of the EPD. The biggest mistake is underestimating the complexity of the process, leading to incomplete or inaccurate declarations. However, once completed, an EPD becomes a powerful tool for differentiating your product in a competitive market, showcasing your commitment to transparency and sustainability.

ASKING FOR EPDS FROM YOUR SUPPLY CHAIN

Requesting EPDs from suppliers can initially meet resistance, but persistence pays off. Companies must clearly communicate that EPDs are a non-negotiable part of their procurement criteria. One strategy is to start with key suppliers, gradually expanding the requirement across the entire supply chain. This not only ensures that your company's sustainability goals are met but also encourages broader adoption of EPDs, raising the environmental standards across industries.

COMMON PITFALLS

A frequent mistake is to view EPDs as a one-time effort. Sustainability is a continuous process. Regularly updating your product choices based on the latest EPDs ensures your supply chain remains aligned with evolving environmental standards and regulations.

THE BUSINESS CASE FOR EPDS

Implementing EPDs is not just about being eco-friendly - it is also good business. Companies with robust sustainability practices, including the use of EPDs, often see improved brand reputation, increased customer loyalty, and even cost savings. EPDs help you stand out in a market increasingly driven by consumer demand for transparency and sustainability.

STEPS TO OBTAIN AN EPD

1. **Conduct a Life Cycle Assessment (LCA):** Begin by gathering data on the environmental impacts of your product across its entire lifecycle. This includes raw material extraction, manufacturing, distribution, use, and disposal. An LCA is the foundation for your EPD, so ensure it is thorough and accurate.
2. **Select a Programme Operator:** Choose a recognised programme operator who will guide you through the EPD process. They will verify your LCA data, ensure it meets international standards, and help you draft the EPD in the correct format.
3. **Undergo Third-Party Verification:** Have your LCA and EPD independently verified by a third-party expert. This step is crucial for credibility, ensuring that your EPD is trustworthy and meets all necessary standards and requirements.
4. **Publish and Register the EPD:** Once verified, publish your EPD and register it with the relevant programme operator or international database. This makes your EPD publicly accessible, allowing customers and stakeholders to review and compare your product's environmental impact.

STEPS TO START USING EPDS

1. **Identify Key Products:** Start by identifying the products in your supply chain with the most significant environmental impact.
2. **Request EPDs:** Work with your suppliers to obtain EPDs for these products.
3. **Analyse and Compare:** Use the data from the EPDs to compare products and choose the ones that best align with your sustainability goals.
4. **Review Regularly:** Make EPD reviews a regular part of your procurement process to ensure ongoing alignment with your environmental objectives.

EPDs are more than just a report card; they serve as a comprehensive roadmap guiding businesses towards a sustainable future. For businesses seeking to enhance their environmental credentials, obtaining an EPD for their product lines can be a strategic move. By quantifying a product's environmental impact throughout its lifecycle, EPDs provide valuable insights for making informed decisions about product design, material sourcing, and manufacturing processes.

Moreover, requiring EPDs from suppliers can incentivise them to adopt more sustainable practices, fostering a ripple effect of environmental responsibility throughout the supply chain. This proactive approach not only strengthens a company's commitment to sustainability but also positions it as a leader in the industry, attracting environmentally conscious consumers and partners.

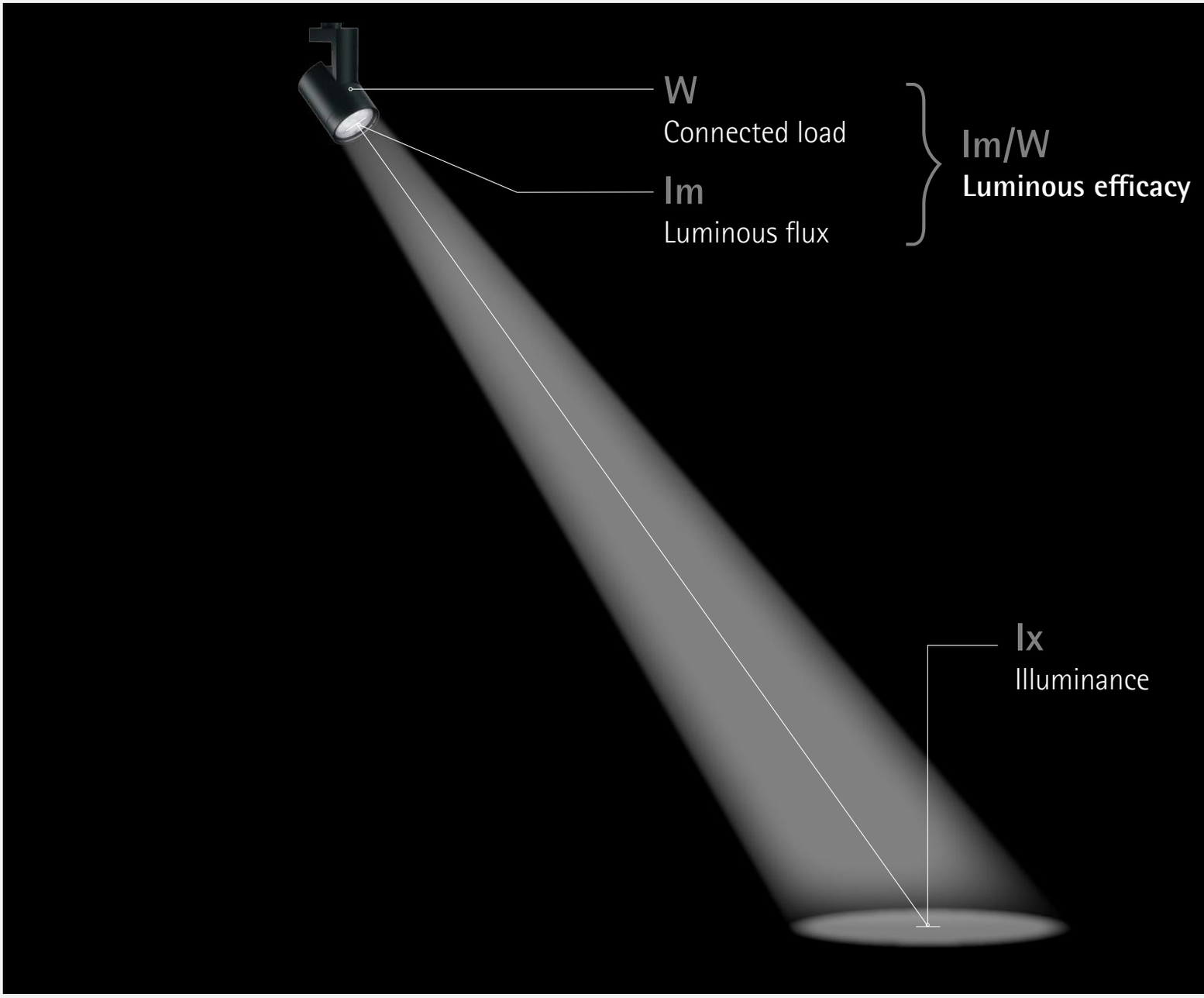
Article contributed by:
Stephen Skalecki
Technical Principal –
Sustainability and Climate Change
EnviroSolutions & Consulting

			Product stage	Construction stage		Use stage							End of life stage				Reuse, recovery recycling
	Environmental indicators		A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
	Climate Change (GWP-total)	kg CO_2 eq.	5,07E-01	3,70E-02	2,34E-01	0	0	0	0	0	0	0	4,47E-03	4,85E-05	0	1,33E-02	0
	Climate Change (fossil) (GWP-fossil)	kg CO_2 eq.	6,07E-01	3,61E-02	1,90E-01	0	0	0	0	0	0	0	4,47E-03	4,82E-05	0	1,52E-02	0
	Climate Change (biogenic) (GWP-biogenic)	kg CO_2 eq.	-3,80E-02	9,04E-04	3,85E-02	0	0	0	0	0	0	0	5,89E-06	8,12E-08	0	0,00E+00	0
	Climate Change (land use change) (GWP-luluc)	kg CO_2 eq.	2,58E-05	2,11E-06	4,55E-06	0	0	0	0	0	0	0	9,82E-08	3,91E-07	0	4,37E-05	0
	Ozone depletion (ODP)	kg CFC-11 eq.	4,81E-08	5,32E-18	2,40E-09	0	0	0	0	0	0	0	4,75E-19	8,87E-21	0	5,63E-17	0
	Acidification terrestrial and freshwater (AP)	Mole of H+ eq.	2,50E-03	6,21E-05	1,56E-04	0	0	0	0	0	0	0	1,32E-05	2,80E-07	0	1,09E-04	0
	Eutrophication (EP) freshwater	kg P eq.	4,55E-05	6,93E-09	2,95E-06	0	0	0	0	0	0	0	9,87E-10	1,47E-10	0	2,61E-08	0
	Eutrophication (EP) marine	kg N eq.	1,40E-04	2,13E-08	9,04E-06	0	0	0	0	0	0	0	3,03E-09	4,52E-10	0	8,00E-08	0
	Eutrophication (EP) terrestrial	Mole of N eq.	1,50E-03	2,62E-05	8,81E-05	0	0	0	0	0	0	0	2,45E-06	1,35E-07	0	2,80E-05	0
	Photochemical ozone formation (POCP) - human health	kg NMVOC eq.	4,37E-03	2,89E-04	3,46E-04	0	0	0	0	0	0	0	2,68E-05	1,50E-06	0	3,08E-04	0
	Resource use, mineral and metals (ADPE)	[kg Sb eq.][1]	1,65E-03	5,58E-05	1,08E-04	0	0	0	0	0	0	0	7,69E-06	2,56E-07	0	8,48E-05	0
	Resource use, energy carriers (ADPF)	[MJ][1]	2,36E-06	4,31E-10	1,18E-07	0	0	0	0	0	0	0	1,17E-10	3,91E-12	0	1,36E-09	0
	Water deprivation potential (WDP)	[m³ world equiv.][1]	1,32E+01	4,97E-01	7,15E-01	0	0	0	0	0	0	0	5,46E-02	6,45E-04	0	1,99E-01	0

Source: International EPD System

LIGHTING THE WAY TO SUSTAINABILITY

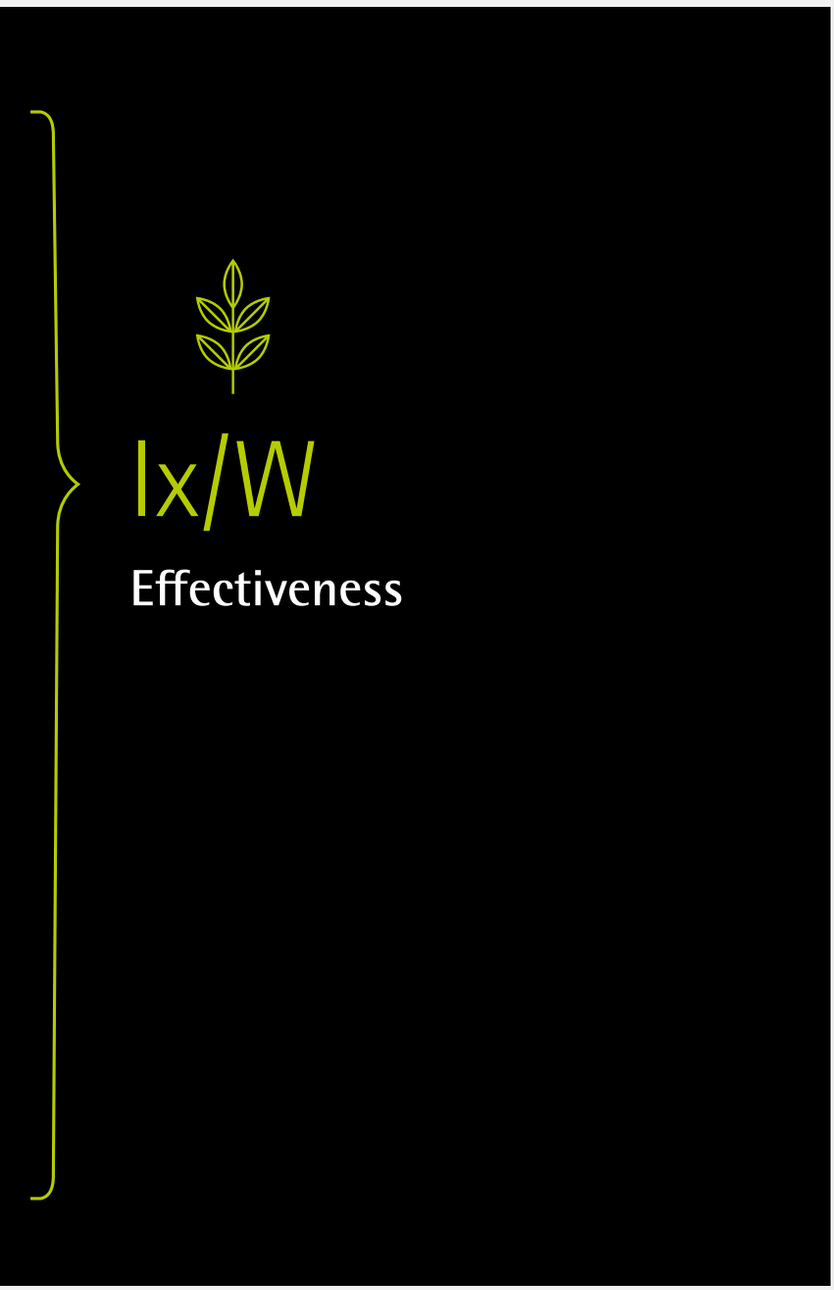
Read about ERCO's journey towards obtaining environmental product declarations as a lighting manufacturer.



Have you ever wondered about the environmental impact of a product being considered for use, beyond just how much energy it uses? An Environmental Product Declaration, or EPD for short, is like a report card that tells you exactly that.

Imagine an EPD as a label that goes beyond the usual features list. It breaks down the materials used in a product, letting you know what is inside. It even estimates the product's impact on global warming. This is becoming increasingly important because people are more interested in understanding the environmental footprint of what they buy.

So why is this important in construction and lighting? Buildings are like giant collections of materials, sometimes called "urban mines." An EPD for a building material tells you what is in it, making it easier to figure out if those materials can be reused or recycled later. This, combined with the building's overall energy use and potential



repairs, helps determine its lifetime environmental impact. It is like a checklist for building owners who want to be environmentally responsible. For those considering greening their buildings, an EPD is a valuable tool to make informed decisions based on facts.

In this article, Mr. Heiko Becker, Head of ERCO's Greenology Program shares ERCO's EPD journey as a lighting manufacturer with SG Green.

CAN YOU DESCRIBE ERCO'S OVERALL SUSTAINABILITY PHILOSOPHY AND ITS CORE PRINCIPLES?

At ERCO, our "Greenology" program is not just a slogan, it is how we approach lighting. We combine environmental responsibility with the latest technology to create sustainable lighting solutions. We prioritise crafting long-lasting, efficient luminaires that minimize waste and environmental impact. But we go beyond just illumination.

We champion "Human Centric Lighting" principles, ensuring our designs enhance the human experience within a space. Ultimately, our goal is to achieve carbon-neutral production. We do this by using recycled materials and maximising the effectiveness and sustainability of our lighting solutions.

Our commitment to sustainability is a journey with many milestones. For decades, we have been using energy-saving light sources, significantly reducing energy consumption by 85 percent compared to the past. We power our facilities with 100 percent renewable energy and integrate recycled materials like cast aluminium into all our fixtures. Finally, our long-lasting 3-phase track system exemplifies our dedication to creating durable and future-proof designs.

WHAT ARE SOME OF THE BIGGEST CHALLENGES ERCO FACES IN ITS PURSUIT OF SUSTAINABILITY, AND HOW IS THE COMPANY WORKING TO OVERCOME THEM?

Traditionally, innovation in lighting focused on the "what" – developing the most powerful technology for a specific need. But for us, sustainability goes beyond just lumens and watts. It is about the "how" as well – the entire lifecycle of a product and its impact on the environment.

We are constantly re-evaluating our materials and processes. We monitor the entire value chain, ensuring responsible sourcing and minimising hazardous substances. We also prioritise transparency, working closely with suppliers to understand their practices. This allows us to make informed decisions that minimise our environmental footprint.

Other than that, it is true that efficient lighting saves energy. But true sustainability goes beyond just saving watts. It is about how light is used and how it affects people. We are integrating human-centric lighting principles into our luminaire development process. This ensures our products not only illuminate spaces efficiently but also create environments that enhance well-being and user experience. We transfer this knowledge to projects, working with designers and architects to create lighting solutions that are both sustainable and user-friendly.

WHAT MOTIVATED ERCO TO EMBARK ON THE JOURNEY OF OBTAINING EPDS FOR ITS PRODUCTS?

First and foremost, it is about transparency. We see a growing demand from customers who want to know exactly what they are buying. EPDs provide a clear picture of the materials used in our lighting solutions and their environmental impact. This aligns perfectly with our commitment to sustainability and empowers customers to make informed choices that align with their own values.

But EPDs are not just a way to satisfy curiosity – they are a powerful tool for internal improvement. By analysing EPD data, we can see the environmental footprint of different parts of our manufacturing process, including our supplier network and production methods. This goes beyond simple efficiency and cost optimisation. EPDs allow us to identify areas where we can make even more sustainable choices. For example, having a single production site minimises transportation emissions. They are a springboard for continuous improvement on our path towards environmental responsibility.

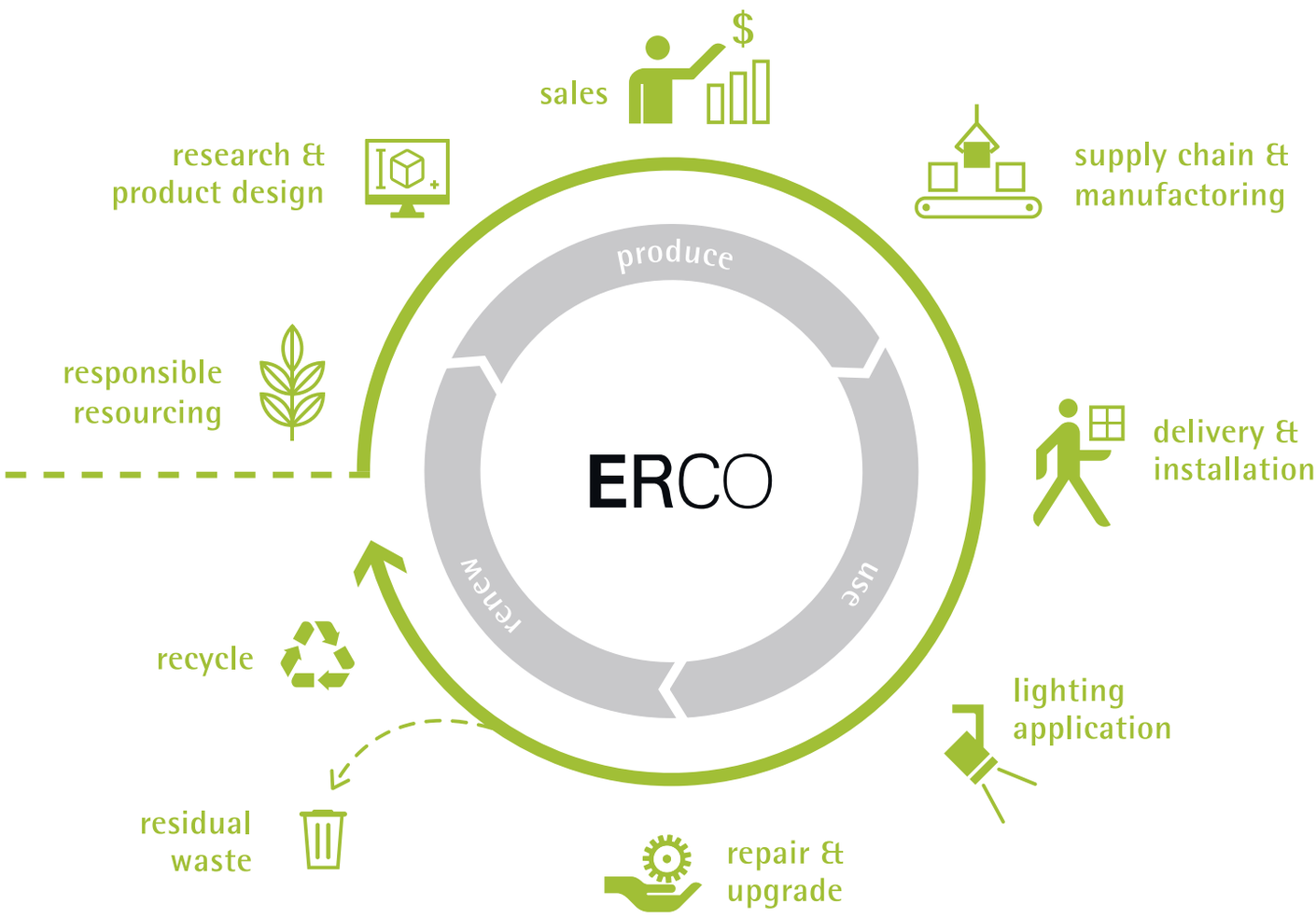
EPDs are also key to helping us constantly improve and optimise both our products and their design. This optimisation starts right from the beginning, with material selection and design decisions. By collecting data for future EPDs early in the development phase, we can consider materials, substances, and design with the environment in mind. This not only improves the product itself but also makes its manufacturing more sustainable.

WHAT ARE THE BENEFITS OF USING EPDS FOR BOTH MANUFACTURERS AND SPECIFIERS, AND HOW DOES ERCO ENSURE THE ACCURACY AND TRANSPARENCY OF THE DATA PRESENTED IN ITS EPDS?

EPDs empower specifiers with the information they need to make informed choices about the building materials they use. They can compare the environmental impact of different products and select those that align with their project's sustainability goals. EPDs also provide a clear picture of the materials used in a product, including their potential impact during both the use phase and end-of-life stage. This knowledge helps specifiers plan for responsible material management throughout the building's lifecycle.

Phase	**Manufacturing**				**Installation**	**Application**	**End-of-Life**				**Benefits**
-	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
	Raw Materials	Transport	Manufacturing	Transport	Installation	Energy Consumption	Disassembly	Transport	Waste Processing	Disposal	Advantages through recycling

The table shows all phases and their subdivisions (modules) used in the ERCO EPD.



All of ERCO's EPDs are Type 3 Environmental Product Declarations (EPDs), which means they are independently verified by a third party, adding a crucial layer of trust and transparency.

Data goes through a rigorous verification process throughout EPD creation. It might seem like a simple task, but even basic checks like confirming the total weight of all components matches the product's weight require close attention. With numerous parts and data sources (like suppliers), discrepancies can occur. That's why we have a comprehensive verification process in place, catching inconsistencies through meticulous checks.

This is just one example of the many steps we take to guarantee the transparency of the information you see in our EPDs. You can be confident that the data presented in our EPDs is accurate and reliable, allowing you to make informed decisions about the lighting solutions you choose.

CAN YOU WALK US THROUGH THE PROCESS ERCO FOLLOWED TO DEVELOP EPDS FOR ITS LIGHTING PRODUCTS?

Developing EPDs for our lighting products was not a simple task. It required a significant investment in both time and resources. The first step was securing management buy-in. We created a project scope document outlining the financial and labour commitment involved. After some thorough discussions about the total investment, we received the green light.

Next, we prioritised product groups. For the initial set (encompassing over 46,000 unique products), we embarked on a detailed data collection process. This involved identifying every single component, its weight, transport distances and even the type of vehicles used for delivery.

Since most components and materials are handled within our own factory, the process also considered the energy consumption involved in production. We even factored in "leftovers" – materials that might be recycled or returned to the production line. Every detail, no matter how seemingly small, was meticulously documented.

WHAT WERE SOME OF THE CHALLENGES FACED DURING THE EPD PROCESS AND HOW WERE THEY ADDRESSED?

Obtaining EPDs for our lighting products was not without its hurdles. One of the biggest challenges, besides understanding the program itself and the specific rules for each product, was the sheer complexity. The vastness of our product portfolio and the intricate data involved required a dedicated approach.

To address this, we assigned a highly experienced senior project manager to lead the initiative. Their deep understanding of both our products and the available data proved invaluable in navigating this complex landscape.

Another hurdle was ensuring the availability of external resources. This included finding a qualified verifier for the final assessment and collaborating with our suppliers to gather the necessary information. Since EPDs were a new concept for many, we made a concerted effort to keep everyone informed throughout the entire project. Building strong relationships and fostering personal commitment from all parties involved – both internally and externally – was key to overcoming these challenges and achieving success.

IN WHAT WAY DO YOU ENVISION THE DEVELOPMENT OF EPDS IMPACTING THE FUTURE OF SUSTAINABLE CONSTRUCTION METHODS, AND HOW CAN COOPERATION AMONG MANUFACTURERS, ARCHITECTS, AND SPECIFIERS FACILITATE ADVANCEMENTS IN ECO-FRIENDLY BUILDING PRACTICES?

The sheer amount of energy consumed by buildings today is undeniable. They are increasingly being viewed as "resource mines" for the future. This underscores the critical importance of collaboration among all stakeholders in the construction industry. For new subjects like sustainability, actively listening to stakeholders – architects, specifiers, and others – is even more crucial than with established practices. Keeping our ears and minds open allows us to anticipate future project needs and adapt accordingly.

Sustainability is a complex and evolving field, and EPDs hold great promise for improving the quality of equipment specifications. The vague term "or similar" often used in tenders creates challenges for everyone involved. EPDs will help clarify the true similarities between different products – how they're manufactured, how they perform, and how they're handled at the end of their lifespan. This increased transparency will make EPDs a go-to resource for both bids and purchasing decisions.

WHAT ADVICE WOULD YOU GIVE TO OTHER MANUFACTURERS CONSIDERING CREATING EPDS FOR THEIR PRODUCTS?

Quite simple, get started! I am convinced that we need to consider the consequences of our actions more than in the past. It is a fact that resources – raw materials, energy, labour – are all finite. That is why we need tools to optimise their use, understand the impact of our actions, and constantly improve our processes.

Think about how often construction sites encounter problems because of unknown materials in old buildings or buried underground. In the future, with tools like EPDs and better documentation practices, we will have a clear picture of the materials and substances used in construction. This will allow for responsible reuse, proper identification, and safe handling – a win-win for both the environment and construction efficiency.

By prioritising timeless design, long-lasting products, and adaptability, we can make construction truly sustainable. This journey requires continuous learning, open communication, and a commitment to working together. It is an exciting path forward, and I believe EPDs will be a powerful tool in our collective toolbox.

Responses provided by:
Mr. Heiko Becker
Head of Greenology
ERCO

REDEFINING CONSTRUCTION WITH SUSTAINABLE ENERGY

Find out how Battery Energy Storage Systems are revolutionising energy management for building and construction.

In the face of rapid urbanisation and the relentless pace of development which is expected to grow by 1.2 million km² by 2030 (World Bank, 2023), the construction industry is under immense pressure to meet the rising demand for new buildings and infrastructure. However, this rapid expansion comes at a significant environmental cost. Construction activities, particularly those powered by traditional energy sources like diesel generators, are major contributors to greenhouse gas (GHG) emissions, which accelerates global warming. The challenge of balancing the need for development with the imperative to reduce carbon emissions is one that the construction industry must urgently address.

THE CHALLENGE: CARBON EMISSIONS FROM CONSTRUCTION

Construction sites are energy-intensive environments. From powering heavy machinery to lighting large work areas, energy consumption is vital. Traditionally, diesel generators have been the go-to solution for providing this energy, especially in locations where access to the power grid is limited or unreliable. However, the environmental implications of this reliance on diesel are profound. Diesel generators consume large quantities of fuel, resulting in the emission of significant amounts of carbon dioxide (CO_2) and other pollutants like unburned hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NO_X) or particulate matter (PM).

In addition to their carbon footprint, these generators are also notorious for their noise, causing disruptions to surrounding communities in urban areas, where construction activities can disturb residents, disrupt local businesses, and even lead to conflicts with local authorities over noise regulations. Moreover, diesel generators are not flexible in terms of energy sourcing. They rely solely on fossil fuels, meaning that construction sites using these generators are locked into a high-carbon energy model. As a result, any effort to reduce carbon emissions on such sites requires a complete overhaul of the energy infrastructure, which can be costly and disruptive.

This current widespread usage of diesel generators in construction not only contributes to global warming but also impacts local air quality, public health, and community well-being. As cities continue to grow, the cumulative effect of these emissions becomes increasingly unsustainable. To truly build greener cities, the construction industry must rethink its approach, starting from the ground up - literally.

A NEW APPROACH: BUILDING SUSTAINABILITY FROM THE GROUND UP

While much attention has been given to decarbonising existing buildings through retrofitting and the addition of eco-friendly fixtures, there is an equally critical need to focus on the sustainability of buildings during their construction phase. A truly green building is one that is designed, constructed, and operated with sustainability in mind from its very inception. This means that the journey toward a sustainable built environment must begin not when the building is completed, but when the first foundation is laid.

This approach requires the adoption of cleaner, more sustainable energy solutions at the construction site itself. By reducing the carbon footprint during construction, we can set the stage for buildings that are not only eco-friendly in their operation but also in their creation. This is where innovative Battery Energy Storage Systems (BESS) solutions come into play, offering a viable power alternative to traditional diesel generators.

A CLEANER, MORE FLEXIBLE SOLUTION

Battery Energy Storage Systems (BESS) are revolutionising energy management, particularly in construction, where dependable power is essential. These systems store energy and deliver it precisely when needed, significantly reducing dependence on traditional power sources that are both expensive and harmful to the environment.

An example of such a BESS is the Infinity Cube: a sustainable alternative to conventional diesel generators. The Infinity Cube provides a clean, adaptable, and efficient power solution for construction sites. What truly sets it apart is its ability to seamlessly integrate with various energy sources, allowing contractors to choose the most cost-effective and environmentally responsible option for each project.

The Infinity Cube features three different modes of operation:

1. **Island Mode with Power Grid**

   In this mode, the Infinity Cube operates in conjunction with the local power grid, providing a stable and continuous energy supply while reducing reliance on diesel.

2. **Hybrid Mode with Diesel Generators**

   For projects where a complete shift away from diesel is not yet feasible or cost effective, the Infinity Cube can operate in a hybrid mode, working alongside traditional generators to store and amplify power, significantly cutting down on diesel consumption and emissions.

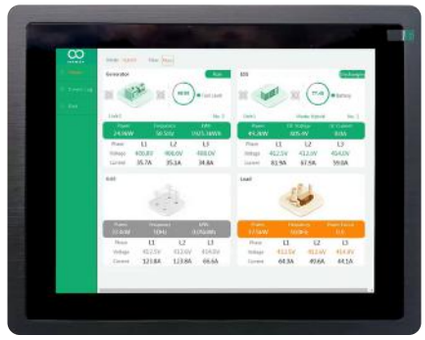
3. **Renewable Power Sources**

   The Infinity Cube can also be connected to renewable energy sources, such as solar or wind power, enabling construction sites to operate with zero emissions.

This multi-connectivity approach allows contractors to find the best balance between cost and sustainability, making it easier to adopt greener practices without compromising on efficiency or budget.

SCALABILITY & ADVANCED TECHNOLOGY

The Infinity Cube is designed to cater to a wide range of construction scenarios and project sizes. It comes in various sizes and can be multiplied and connected seamlessly, providing scalable power solutions for both small and large projects. This adaptability ensures that contractors can use the Infinity Cube in diverse settings, from residential developments to large-scale infrastructure projects.



One of the standout features of the Infinity Cube is its integration with an Energy Management System (EMS) application. This cloud technology allows for remote monitoring and control of the system, enabling contractors to manage energy consumption more efficiently. The EMS reduces the need for on-site supervision, saving time and increasing overall project efficiency.

Additionally, the Infinity Cube is equipped with a fully automatic fast-charging system that charges at 180kW per hour. This telematic system automatically activates when the battery level drops below 30 percent state of charge (SOC), ensuring a reliable power supply without manual intervention.

SAFETY & COMMUNITY BENEFITS

Safety is a top priority in construction, and there is a growing concern about batteries overheating under extreme weather conditions, the Infinity Cube is designed with this in mind. It features a built-in extinguishing system that activates automatically if high temperatures are detected. An alarm system is also in place, alerting both onsite personnel as well as contractors through the EMS application, ensuring that any potential hazards are addressed promptly. Unlike diesel generators, which pose risks of flammability and spillage, the Infinity Cube has undergone rigorous safety testing and is proven to be safer and more reliable.

Beyond reducing carbon emissions and noise pollution, the Infinity Cube also contributes to the wellbeing of the surrounding community. On 25th January 2023, Singapore residents took to the media to feedback about construction noises; “The noise is terrible”: Residents say quality of life affected by North-South Corridor (The Straits Times). Infinity

Cube's quiet operation makes it ideal for construction sites in noise-sensitive residential areas, helping to maintain community happiness and satisfaction. This reduction in noise levels also aids contractors in obtaining necessary permits for night-time construction, which can accelerate project timelines and improve overall efficiency.

CASE STUDY 1: CHINA CONSTRUCTION SOUTH PACIFIC - HYBRID POWER SOLUTION FOR CONDOMINIUM PROJECT

BACKGROUND

China Construction South Pacific (CCSP) was engaged for a large-scale condominium project along Bukit Timah Road, Singapore. The site required substantial power to operate two 25-ton capacity tower cranes, two passenger hoists, a site office, and various auxiliary equipment. However, the available power supply from the grid was limited to just 200A, far below the operational demands of the construction site. As a result, CCSP had to rely heavily on diesel generators to supplement their power needs, leading to increased costs and environmental impact.

CHALLENGES

1. Limited Grid Power

The site's operational needs far exceeded the 200A power supply provided by the grid, creating a significant energy shortfall.

2. High Fuel Costs

The heavy reliance on diesel generators to make up for the grid's limitations resulted in substantial fuel expenses.

3. Environmental Impact

The use of diesel generators significantly contributed to carbon emissions and air pollution, impacting the project's environmental footprint.

4. Operational Efficiency

Managing and maintaining multiple diesel generators added complexity to operations and increased overall costs.

THE SOLUTION

Infinity Cube provided a tailored power solution designed to meet the specific challenges faced by CCSP. The solution included:

DEPLOYMENT OF A M-SIZE INFINITY CUBE

This Battery Energy Storage System (BESS) was configured to operate in island mode, efficiently leveraging the 200A grid power to minimise diesel consumption.

INTEGRATED POWER MANAGEMENT

The Infinity Cube seamlessly integrated with the existing grid power, ensuring a consistent, reliable power supply for all construction operations.

The Results

Annual Fuel Cost Savings: SGD 200,000
Annual Carbon Reduction: 345,180 kg

Operational Efficiency: The hybrid system replaced two units of 300 kVA generators and two units of 100 kVA generators, simplifying operations and reducing maintenance requirements.

Conclusion

The implementation of the Infinity Cube's Island Mode solution at the Bukit Timah Road condominium project significantly improved both the operational efficiency and sustainability of CCSP's construction activities. By integrating the M-Size Infinity Cube with the limited grid power, CCSP not only achieved substantial cost savings but also made a significant reduction in carbon emissions. This case study highlights the transformative potential of hybrid power solutions in enhancing sustainability, efficiency, and cost-effectiveness in construction projects, especially in scenarios with limited grid access.

CASE STUDY 2: LBD ENGINEERING PTE LTD - HYBRID POWER SOLUTION FOR HOUSING PROJECT

BACKGROUND

LBD Engineering Pte Ltd undertook a housing development project in Bukit Merah, Singapore, where access to the Singapore power grid was unavailable. To power essential operations, including two tower cranes (one with a 50-ton capacity and another with a 36-ton capacity) and two passenger hoists, the company initially relied solely on diesel generators. While effective, this approach resulted in high fuel costs and significant carbon emissions, raising concerns about both economic efficiency and environmental impact.

CHALLENGES

1. High Operational Costs

The heavy reliance on diesel generators led to substantial fuel expenses, increasing overall project costs.

2. Environmental Impact

The diesel generators contributed to increased levels of carbon emissions, negatively impacting air quality and the environment.

3. Operational Complexity

Managing multiple diesel generators proved to be cumbersome and less efficient, adding layers of complexity to the project.

THE SOLUTION

To address these challenges, Infinity Cube provided a tailored hybrid power solution that aligned with LBD Engineering's specific needs. The solution included employing an M-Size Infinity Cube and a Synchronising Generator.

DEPLOYMENT OF A M-SIZE INFINITY CUBE

This Battery Energy Storage System (BESS) was configured to seamlessly integrate with both renewable energy sources and conventional generators, optimising energy use and reducing reliance on diesel.

400 kVA Synchronising Generator

This setup allowed for the synchronisation of power output, ensuring a stable and efficient energy supply to meet the project's demands.

THE RESULTS

Annual Fuel Cost Savings: Over SGD 72,000

Annual Carbon Reduction: 193,000 kg

Operational Efficiency: The hybrid system replaced two units of 400 kVA generators and two units of 100 kVA generators, simplifying operations and reducing maintenance needs.

CONCLUSION

The implementation of Infinity Cube's hybrid power system at LBD Engineering's housing development project in Bukit Merah showcases the substantial financial and environmental benefits that can be achieved through innovative energy solutions. By replacing multiple diesel generators with an M-Size Infinity Cube and a synchronising generator, LBD Engineering not only significantly reduced fuel costs and carbon emissions but also enhanced operational efficiency. This case study highlights the potential for hybrid power solutions to drive sustainability and cost-effectiveness in construction projects, especially those without access to the power grid.

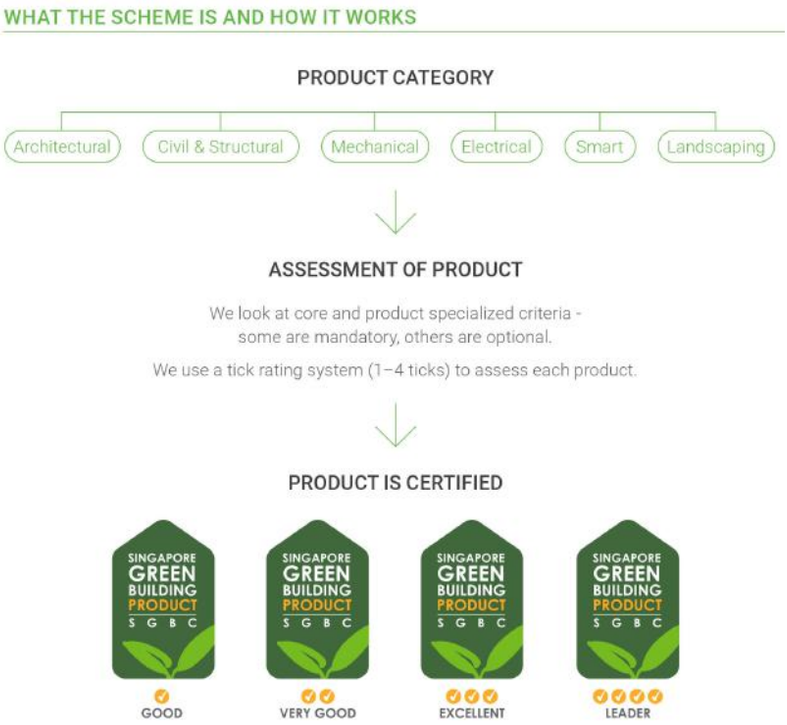
THE FUTURE OF SUSTAINABLE CONSTRUCTION

BESS represents a significant step forward in the quest for greener construction practices. By offering a flexible, scalable, and safe alternative to diesel generators, it enables contractors to reduce their carbon footprint and contribute to a cleaner urban environment from the ground up. As the construction industry continues to evolve, integrating sustainable energy solutions will be key to building the cities of the future - cities that are not only more resilient and efficient but also more harmonious with the environment and the communities they serve.

Article contributed by:
Infinity Cube Pte Ltd

SUSTAINABLE SOLUTIONS, SUSTAINABLE BUILDINGS

While sustainable development is a global priority, the fundamental principles guiding the construction industry remain a critical area of focus.



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.

While the national-level Green Mark Scheme sets the bar for green buildings in Singapore, achieving sustainability excellence involves more. This is where SGBC's comprehensive certification programmes come in. Complementing the Green Mark Scheme, SGBC certifications delve deeper, focusing on the individual components that impact a building's overall environmental performance.

The Singapore Green Building Product (SGBP) scheme is a certification for green building products and materials. While the Singapore Green Building Council is the owner of the SGBP certification scheme, its wholly owned subsidiary, SGBC Pte Ltd, is the certification body responsible for the evaluation of SGBP applications. The SGBP is developed based on scientific and engineering principles that is built upon the collective knowledge and expertise of the building and construction industry. The scheme advances the built environment to one that is greener and more carbon-efficient while facilitating sustainable procurement. It helps to ensure that sustainability targets are met while providing transparency and credibility to the products we choose to use when building green into spaces and places.

METHODOLOGY & ASSESSMENT CRITERIA

The SGBP certification scheme is one of the key standards and benchmarks for green building products in the building and construction industry. Products and materials certified by the SGBP 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 certified products to accrue 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.

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

SGBC is always working to improve our SGBP's quality and usability. The SGBP Certification Scheme is similar to internationally leading eco-labels, such as Cradle2Cradle, DECLARE, Global Green Tag, Good Environmental Choice Australia, Korea Environmental Industry and Technology Institute. Future versions of the SGBP may provide additional recognition for products that excel in addressing social issues, circular economy, and low embodied carbon, and reorganise the Scheme's governance to allow for products certified under our Scheme to be recognised under other eco-labels.

The SGBP certification scheme has been accorded accredited status by the Singapore Accreditation Council (SAC). This recognition signifies the scheme's adherence to the stringent ISO/IEC 17065 standard, a global benchmark for certification bodies. The accreditation underscores the SGBC's commitment to rigorous standards and transparency in promoting sustainable building products.

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, 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:

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.

ADDRESSING EMBODIED CARBON

The built environment is responsible for 40 percent of global carbon emissions, with embodied carbon emissions being especially critical. Embodied carbon, or the carbon emissions associated with the full supply chain of all materials and systems put into any built environment project, is different from operational carbon in that the latter can be improved over the lifetime of a building. If embodied carbon emissions are not addressed before the building project moves past the design stage, there is no way for building owners to reclaim lost carbon savings once the building is constructed and subsequently used.

The breakdown of carbon emissions for buildings is typically 30 percent embodied carbon emissions versus 70 percent for carbon emissions due to building operations. In Singapore, where the lifespan of buildings tend to be shorter due to urban renewal, the embodied carbon emissions of buildings can constitute up to 40 percent of the total carbon emissions over the lifespan of the building. The upfront emissions from materials and products used to construct buildings and infrastructure, and those installed later during maintenance and renovation, usually represent a significantly greater source of embodied carbon than all other stages in the lifecycle.

SGBC, in collaboration and partnership with key industry stakeholders, maintains a suite of targeted initiatives to help address embodied carbon emissions in the built environment.

EMBODIED CARBON IN BUILDINGS CALCULATION GUIDANCE

The Embodied Carbon in Buildings Calculation Guide supports Singapore's decarbonisation efforts by providing guidance on defining the scope and methodology for measuring and reporting the embodied carbon emissions of building and construction activities. It is particularly useful for understanding the upfront carbon of building and infrastructure projects, where upfront carbon is the emissions resulting from the materials production and construction phases of an asset's lifecycle, before the building or infrastructure asset begins to be used. In contrast to other categories of emissions, these emissions have already been released into the atmosphere before the building is occupied or the infrastructure asset begins operations.

This free-to-use Guide is intended to serve as an informative resource to harmonise carbon emissions data collection efforts during the design and construction phases of projects, and to provide a standardised framework for the reporting of embodied carbon emissions. This will facilitate the aggregation of embodied carbon emissions information of Singapore's buildings and construction activities, and allow for national averages and benchmarks to be determined. This serves as data driven guideposts from which further decarbonization targets can be set.

In collaboration with the Building and Construction Authority (BCA) and SGBC, JTC Corporation commissioned National University of Singapore – Energy Studies Institute (NUS-ESI) to develop

unified embodied carbon calculators for the Singapore built environment sector. These are customised for local industry use and includes key features such as localised aggregated emission factor values for critical building materials and mechanical equipment. The calculators enable accounting for upfront carbon with adapted carbon emission factors to reflect the carbon footprint of building and infrastructure projects within the local context. Usage of the calculators would provide the industry with the tools to make informed decisions on material and product selections to reduce the carbon footprint of projects for use under the Sustainable Construction section of the Code for Environmental Sustainability of Buildings (Edition 4.0) and the Green Mark 2021 Whole Life Carbon Section.

Two such Calculators are available for industry use:

- **Architectural and Civil & Structural Materials Carbon Calculator**
  - To help calculate the embodied carbon emissions arising from architectural and C&S products
- **Mechanical & Electrical Equipment Carbon Calculator**
  - To help calculate the embodied carbon emissions arising from mechanical and reticulation products

This comprehensive approach will enable building project teams to obtain a more complete picture of a building's whole-life carbon performance, ultimately contributing to certification as well as disclosure requirements.

Read on to find out more about industry-ready green building products and green building services put forward by SGBC Member organisations, showcased at the SGBC Pavilion @ BEX Asia 2024.

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.

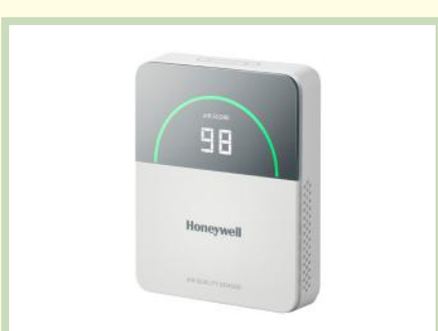
SGBP-certified Product(s) - Auto-Coil Cleaning System

Airverclean Pte Ltd

Airverclean Pte Ltd was formed in 1990, specialising in a wide range of Air Purification Filtration System for Commercial Air Handling Units and Kitchen Exhaust Applications.

Its focus is *"Better Indoor and Outdoor Air Quality"*, with its RydAiR UVGI, Bi-polar Ionization (BPI), PCO (Photo Catalytic Oxidization) improve IAQ, Industrial and commercial Electrostatic Precipitator solutions helping to remove unpleasant contaminants before they are released into the environment, creating safer and healthier environments for all occupants.

SGBP-certified Product(s) – Indoor Air Quality (UVGI)



Honeywell

Honeywell Building Automation (BA) is a global business with more than 23,000 employees. BA creates products, software and technologies found in more than 10 million buildings worldwide.

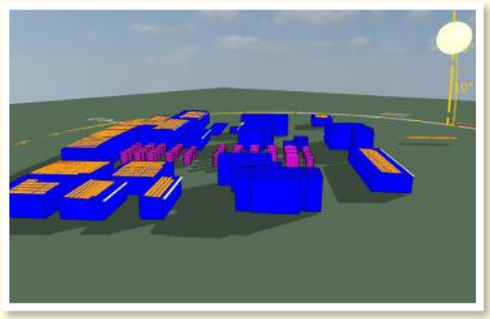
Commercial building owners and occupants use Honeywell technologies to ensure their facilities are safe, energy efficient, sustainable and productive. Honeywell is a Fortune 100 technology company that delivers industry specific solutions that include aerospace products and services; control technologies for buildings and industry; and performance materials globally.

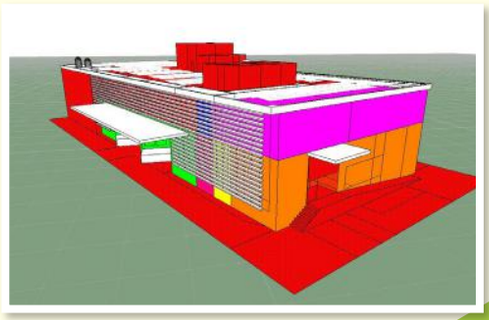
SGBS-certified Services - EPC Chiller Plant Retrofit (L3)

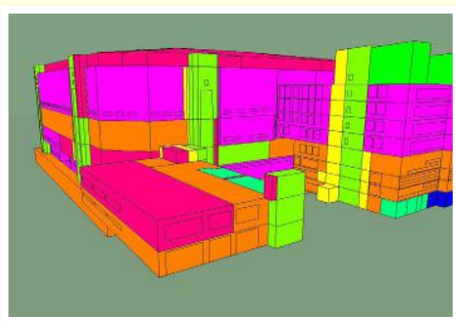
HY M&E Consultancy Services Pte. Ltd

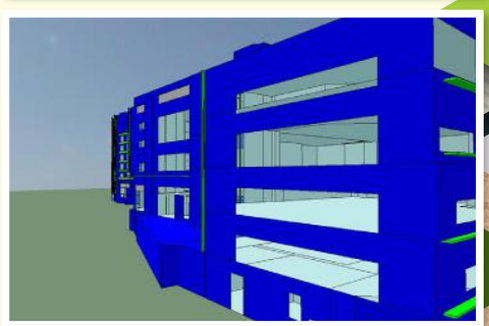
HY M&E Consultancy Services is a Professional Engineering Company that provides Mechanical and Electrical Consultancy Services to Building and Infrastructure Developers. Its services include Mechanical & Electrical service planning, authority submissions, project management, technology applications, 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.







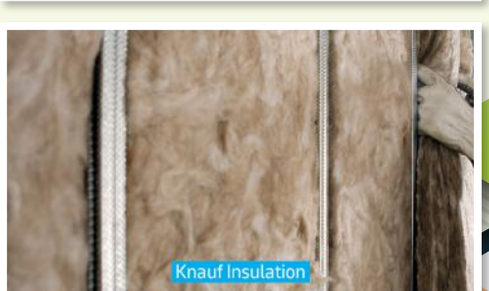


Knauf Singapore Pte. Ltd

Founded in 1932, Knauf is the world's leading manufacturer of building systems and green building materials, and its name is synonymous with gypsum in many countries.

Headquartered in Iphofen, Germany, Knauf operates 300 production bases across 90 countries and regions, employing over 41,500 people. Knauf offers superior-quality products and systems, along with customer-centric technical support and solutions. Knauf's comprehensive portfolio covers five product categories: plasterboards, ceilings, metal framing, compounds, and substrates.

SGBP-certified Product(s): Panel Board, Ceiling Board, Acoustic Ceiling Board

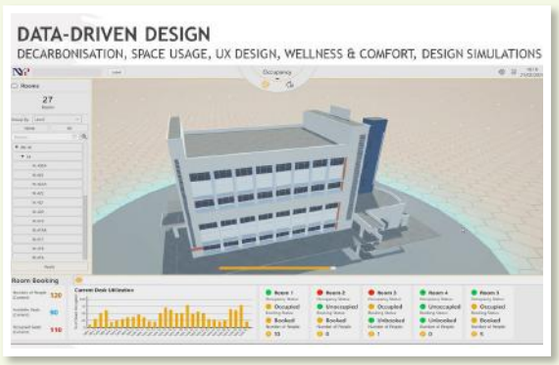


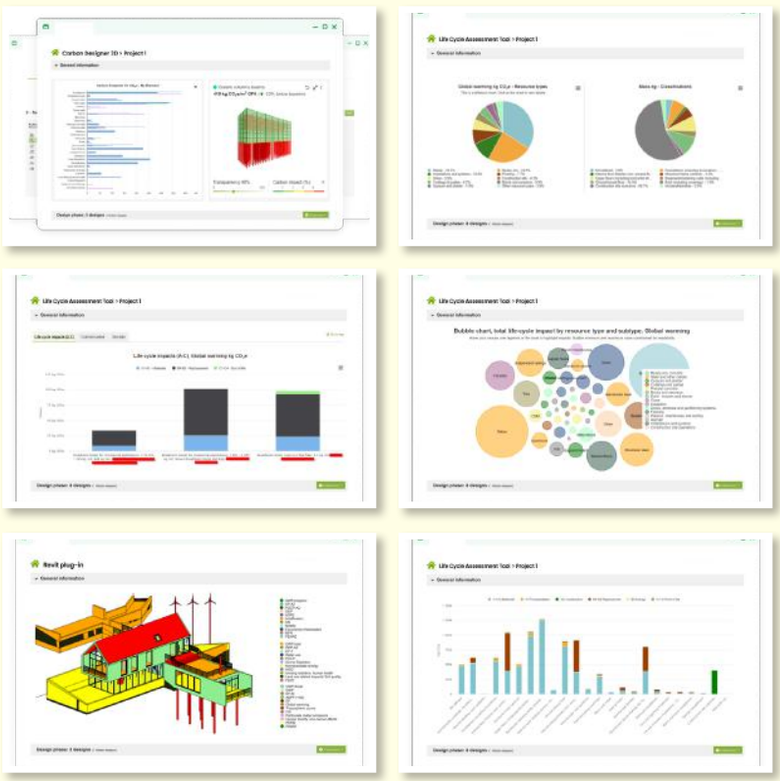
Nanyang Polytechnic

NYP's School of Design & Media (SDM) nurtures innovative and enterprising learners through a powerful combination of art, design, technology and expertise.

NYP's close industry partnerships enables our 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, Kingsmen Creatives, DBS Bank, National Healthcare Group, ONG&ONG Group, Singapore Green Building Council, and many more.

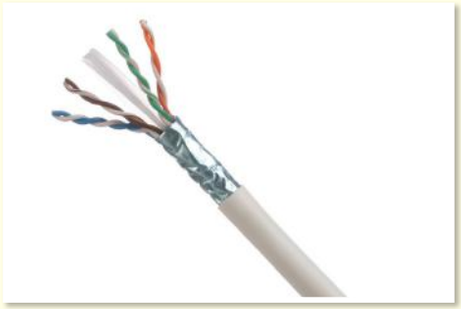




One Click LCA Ltd

One Click LCA is the industry-leading global tech company decarbonising construction and manufacturing. One Click LCA's mission is to power the makers of a zero-carbon future with its robust, global life-cycle assessment (LCA), environmental product declaration (EPD), and sustainability solutions.

The company connects the whole construction value chain, from property portfolio owners to manufacturers, applying a scientific approach to measuring, reporting, and reducing carbon, along with calculating other sustainability metrics for projects and products in the built environment.



Panduit Singapore Pte Ltd

Panduit is a world-class manufacturer of high-performance network and industrial electrical infrastructure. With operations in more than 112 countries and a worldwide partner network, Panduit ensures the success of our customers with the broadest range of physical infrastructure solutions and products for data centers, enterprise, industrial networks, OEMs, MROs, and industrial construction.

Panduit's proven reputation for quality and technology leadership, coupled with a robust partner ecosystem, help support, sustain, and empower business growth in a connected world.

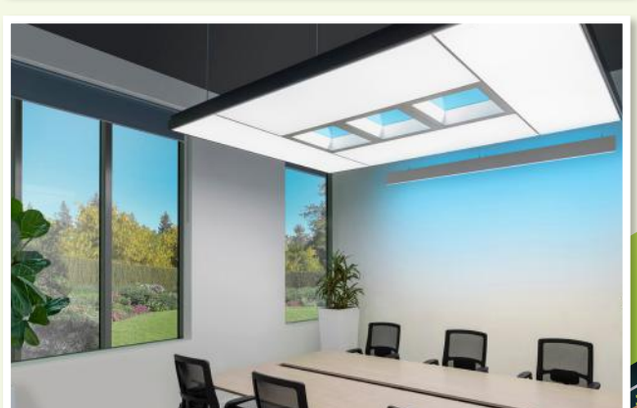
SGBP-certified Product(s): Network Cable

Signify Singapore Pte Ltd

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

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.

SGBP-certified Product(s): Occupancy Sensor
SGBS-certified Services: EPC Lighting Retrofit (L4)



SINGAPORE GREEN BUILDING PRODUCT CERTIFICATION SCHEME

The Singapore Green Building Product (SGBP) Certification Scheme evaluates building products based on scientific principles and industry expertise, ensuring certified products meet stringent environmental standards. SGBP-certified products are highly recognised under the Green Mark Scheme, allowing for the accrual of points that count towards a project's Green Mark rating.

SINGAPORE GREEN BUILDING COUNCIL

SGBC Corporate Membership

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, Sustainability 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 bulk discount on renewal fees for Green Mark Accredited Professionals
- Gain exclusive access and preferential rates to a wide range of learning and development activities as well as invitations to exclusive 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 & Communications

- Quarter (¼) page Sustainability Directory Listing on SG Green Digital Magazine
- One (1) SGBCommunity Spotlight feature on SGBC Website and SGBC Bulletin

Learning & Development

- Ten (10) passes for any On-Demand courses on Digital Academy
- One (1) pass for an Instructor-led SGBC Course
- Shared speaking opportunity at one (1) SGBC Webinar