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September / October 2019

SEAB

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Singapore

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SPECIAL FEATURE Green Roofs
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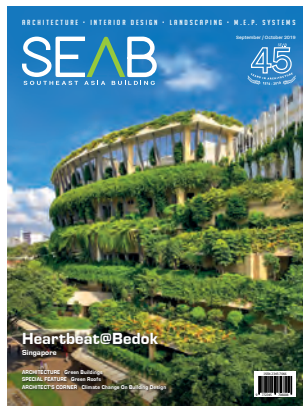
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On the Cover: Heartbeat@Bedok in Singapore. Photo: © ONG&ONG

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Hello readers and welcome to another issue of SEAB. As many of you already know, the September / October issue is annually dedicated to green building projects, news and industry developments. Inside, you will find a wide array of projects, which are green, sustainable, and eco-friendly, according to industry environmental standards.

On the cover of the magazine is a local project called Heartbeat@Bedok. Designed by ONG&ONG, the building has abundant greenery such as trees, shrubs and creepers, covering the mass of the building and mitigating the concrete impact.

We have also explored the topic of climate change and its wide-ranging impact on building design in the near and far future. We have asked architects from around the world to address some questions like how it will affect architecture and what action they will take to tackle the issue.

Every one of us has a part to play to protect our planet. I believe all of us can do many little things every day to lessen our impact on the environment and save our earth.

Amita Natverlal

NEXT ISSUE THEMES

- Architecture + Interior — Retail
- Special Feature — Architectural Glass
- M. E. P. Systems — Mechanical, Electrical and Plumbing Systems



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GEBT 2019 brings new trends under the spotlight

Guangzhou, China – The 2019 edition of Guangzhou Electrical Building Technology (GEBT) ended on a positive note on June 12th. Held concurrently with Guangzhou International Lighting Exhibition (GILE), the two trade fairs attracted 172,856 industry professionals from 133 countries and regions, a four percent increase from last year. 243 exhibitors were featured at GEBT this year. Continuing its long-standing support for the building sector, GEBT's insightful fringe events again provided a professional platform for the industry to envision the future of building technology, with topics ranging from communication protocols to healthy buildings and AIoT.

This year's GEBT forums invited industry leaders to illustrate the latest developments in the building sector, with hand-picked topics ranging from healthy buildings to smart homes and intelligent hotels. Highlights included the 'Development of Healthy Buildings and Intelligent Hotels Summit 2019', which shed light on how buildings could be brought one step closer to people's lives by encouraging a user-centric approach. And the 'AIoT+Scene Setting for Smart Space Summit' featured Tencent Smart Property, Alibaba Cloud, China Mobile and other renowned industry brands who discussed how AI redefines IoT, and the implication in a household context.



Photo: © Guangzhou Guangya Messe Frankfurt Co Ltd

The next edition of Guangzhou Electrical Building Technology is scheduled to take place once again from 9–12 June 2020 at the China Import and Export Fair Complex in Guangzhou. **To find out more about GEBT, please visit www.building.messefrankfurt.com.cn or email building@china.messefrankfurt.com.**

ASPECT Studios expands into Perth following Yagan Square success

Melbourne, Australia – Renowned design practice ASPECT Studios is delighted to announce its latest expansion into the Perth market, following the success of their award-winning project, Yagan Square. The new ASPECT Studio, located in the City of Perth will add to the seven existing studios across



Michael Rowlands (left) and Tom Griffiths. Photo: © ASPECT Studios

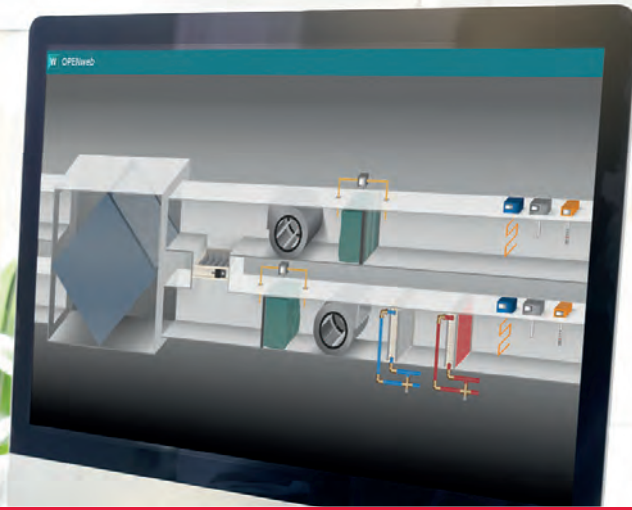
Australia, China and the United Arab Emirates – creating a share economy of specialist skills and diverse learnings. ASPECT Studios, highly regarded for their collaborative approach, design intelligence, innovative use of 3D design technologies and localised community-focused design processes are the designers behind some of Australia's most loved public spaces including Barangaroo South, Darling Square, Caulfield to Dandenong Level Crossing Removal, Bowden Park, The Goods Line and One Central Park.

"Our recently established Perth studio is the result of a harmonious balance between organic growth and the identification of strong local leadership capabilities. Our latest built project, Yagan Square located in the City of Perth, has seen high praise from local communities, council and our client, the Metropolitan Redevelopment Authority (MRA) on behalf of state government, for its successful outcomes benefitting the larger community," said Kirsten Bauer, Director, ASPECT Studios.

"As part of ASPECT Studios' ongoing planning for succession, we also saw the opportunity to expand our leadership team and are delighted to welcome Tom Griffiths and Michael Rowlands as our new Studio Directors of ASPECT Studios Perth. Tom and Michael will join an existing team of over 170 landscape architects, designers and specialist staff," said CEO Ivan Ross.

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IBEW 2019 to feature four built environment trade shows

Singapore – The International Built Environment Week (IBEW) 2019 will take place for the first time in Singapore from 4 to 6 September 2019 at the Marina Bay Sands Expo and Convention Centre. IBEW 2019 will run four trade shows concurrently to showcase the latest innovations and industry solutions in the built environment.

The four shows are BEX Asia covering the integrated design and planning space, Innobuild (IB) Asia focusing on construction 4.0, Mostra Convegno Expocomfort (MCE) Asia zooming in on energy efficient solutions and renewable energy and Smart Cities and Buildings (SCB) Asia featuring the latest advances in urban solutions and smart cities.

Billed as Asia's first fully integrated built environment value chain event, IBEW 2019 is the ideal platform for industry leaders and professionals from the global built environment to exchange ideas on policies, innovations, new technologies as well as the latest trends that are shaping the future of the construction and building industry.

Together, the tradeshow will gather over 550 exhibiting brands and more than 50 industry leaders who will share the latest innovation and best practices in their respective fields. More than



Photo: © Reed Exhibitions Singapore

12,000 business delegates are expected to convene at IBEW 2019, aptly themed "Transforming the Way We Build".

IBEW 2019 aims to showcase a comprehensive array of innovative products and solutions to meet every need across the built environment value chain. Technology remains at the core of innovation for the building sector, with the increasing adoption of artificial intelligence,

drones, augmented reality, 3D printing and Building Information Modelling (BIM) driving exponential improvements in productivity and efficiency. The industry has also pushed ahead with efforts to improve its sustainability profile, through innovations such as new building materials and methods as well as practices to reduce construction wastage. **For more information, visit www.ibew.sg.**

Ong Choon Fah elected as Chair of ULI Singapore

Hong Kong – Ong Choon Fah, CEO and Head, Research & Consulting at Edmund Tie & Company, has been appointed Chair of Singapore for the Urban Land Institute (ULI), an interdisciplinary research and education institute with more than 43,000 members dedicated to leadership in real estate and land use and creating thriving communities worldwide.

Ong Choon Fah has more than 25 years of experience in real estate and academia spanning across various sectors, with public and private sector clients, for profit and non-profit organisations, occupiers, investors, institutions and REITs. Choon Fah is passionate about real estate as it has the potential to create a sustainable built-environment and a thriving



and harmonious community. As ULI Singapore Chair, she will lead the Executive Committee in Singapore, which will continue to provide long-term thinking and suggest sustainable solutions for the city's ongoing development.

"It is an honour for me to be invited to be Chair of ULI Singapore, building on the outstanding work that Teng Chye has done," said Ong Choon Fah, CEO and Head, Research & Consulting at Edmund Tie & Company. "I obviously want to cater to the needs of ULI's existing members but I also want to further promote the great work that ULI is doing in Singapore and to work with both the public and educational sectors in helping to extend ULI's mission in the market," added Ong Choon Fah.

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BeyondX – Designing the Future

Singapore – ONG&ONG presented Singapore's First Digital Technology Showcase for the Architectural, Engineering and Construction (AEC) Industry.

Featuring leading experts in the field of digital design, BeyondX attracted over 500 delegates on 11 July 2019.

The event explored how the built environment is improved through the harnessing of Artificial Intelligence, 3D-printed structures, and Immersive Reality technologies for transformational growth.

Attendees were encouraged to embrace an agile mindset and adopt disruptive technologies so as to bring about innovative changes for the AEC industry.

Trinity Methodist Church and Bedok Public Library were among several projects in Singapore cited as developments that were designed using new technologies, ensuring greater levels of sustainability and efficiencies across their construction process.

Speakers including Adriel Sim from URA DCG, Patrick Janssen from NUS and Felix Raspall from SUTD, AIRLAB showcased an array of future-forward solutions, including 3D technologies, computational design and digital fabrication respectively.



Photo: © ONG&ONG

As an indication of its success, numerous attendees and various design technology experts are offering to come on board for the next edition of BeyondX in 2020.

Ong Tze Boon, Chairman of ONG&ONG Group, stated during his opening speech, "If you're not the one doing the disruption, regardless of your industry, you will be disrupted."

Architect Expo'19 records high attendance

Bangkok, Thailand – The Association of Siamese Architects Under Royal Patronage (ASA) and N.C.C. Exhibition Organizer Co., Ltd., announced that the visitors' responses to the 33rd "Architect Expo'19 held from 30 April to 5 May, 2019," themed "Living Green" is beyond expectations.

Mr Ajaphol Dusitnanond, President of the ASA, revealed that Architect Expo'19 has successfully attracted over 442,000 visitors from Thailand and abroad, as the attendance increased from the previous year. In addition, more than 3,000 delegates participated in ASA Forum and ASA Seminar taking place during

the Expo.

The Architect Expo'19 is destined to show the potentials and the latest architectural progresses, while serving as the key platform that connects the architects and the general public, which can tremendously benefit both the ASA members and the society. The main objective of the expo is to also expand ASA membership not only the architects but also the exhibitors and general publics. The Architect Expo has become the largest architecture expo in ASEAN region, with the aspiration to move forward as the global exposition in the near future."

The tremendous success of Architect Expo'19 can be reflected through positives outcomes for exhibitors in terms of both trade orders, which exceeded the target compared to the previous year, as well as the new buyer market penetration, establishing business opportunities they can capitalise on in the future. Therefore, a larger number of exhibitors have shown interests and already confirmed their participation next year, filling over 50 percent of the exhibition booth reservation. The expo next year will also feature the pavilion of different countries including China, Taiwan, South Korea, Germany, Italy, Singapore, Malaysia, USA, Japan and Australia.

Architect Expo'20 will return next year between April 28 and May 3, 2020, introducing a new theme "Heritage." For more information, visit www.asa.or.th/architectexpo.



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Mandai invites you to get closer to nature with new resort

Singapore – Come 2023, a new resort experience will open to guests at Mandai, bringing them closer to nature through a biophilic design that integrates the buildings with their natural surroundings. Owned by Mandai Park Holdings, the design of the new Mandai resort will be helmed by local architectural firm, WOW Architects.

The 4.6-hectare site for the 338-room resort currently houses the Singapore Zoo's back-of-house facilities. The resort will be carefully integrated into the site, which will be enriched through the planting of native tree species. Visitors will feel immersed in the surrounding nature, which they will be encouraged to enjoy in a non-intrusive manner.

WOW Architects' concept is sympathetic to the existing vegetation and treelines as well as natural topography. Wherever possible, the resort is elevated several metres above the ground to allow native wildlife to move across the site. It is also designed to be unobtrusive, sitting below the upper canopy layer of the surrounding trees. In addition to extensive planting at the roof and facade of the resort buildings, more than half the trees on the site will be retained, of which 40 percent are of conservation value. The re-greening effort will enhance the site's biodiversity through thoughtful planting strategies that will both promote native species on the site of the resort and double the number of trees from today.

In line with this theme of celebrating nature, the resort's standard and family rooms will offer views into the rainforest. 24 elevated treehouses are being designed in the shape of seed-pods and will be set amongst the trees surrounding the resort.

Aiming to be the first Super Low Energy (SLE) resort in Singapore, active steps will be taken to adopt sustainable and environmentally-friendly best practices. The design will



Architectural illustration of the treehouses at the resort. Image courtesy of Mandai Park Holdings.

incorporate a host of energy saving measures including the use of natural ventilation, mixed mode air-conditioning and solar panels. The treehouses will also feature passive displacement ventilation, a solution that cools air using chilled water rather than traditional air conditioning compressor units.

As the lead design architect, WOW Architects will be working alongside a team of specialist consultancies to ensure the sustainable design and development of the resort. The consultancies involved are Atelier Ten (Environmental Sustainability Design), Arup (Mechanical & Electrical), Bo Steiber (Lighting), Ramboll Environ (Ecology), Ramboll Studio Drieseitl (Landscape Architect), Warner Wong Design (Interior Design) and Web Structures (Structural Engineers).

A working group consisting of academics and professionals will also provide guidance and expert inputs across a variety of functions that are relevant to the resort's design and development including landscape, education, sustainability, ecology, horticulture and acoustics.

Nakheel Malls brings zombie-themed fantasy land to Deira Islands

Dubai, UAE – Nakheel Malls, the retail arm of master developer Nakheel, has teamed up with Sharjah Golf & Shooting Club to create a giant, zombie-themed entertainment zone, featuring more than 12 activities and attractions, at The Night Market at Deira Islands.

Zombie Apocalypse Park (ZAP) – the first of its kind in the UAE – boasts a thriller of a line-up of live acts, games, battles and events, powered by glow-in-the-dark technology. Activities include paintball games, escape games, VR 9D cinema, haunted house, axe throw,



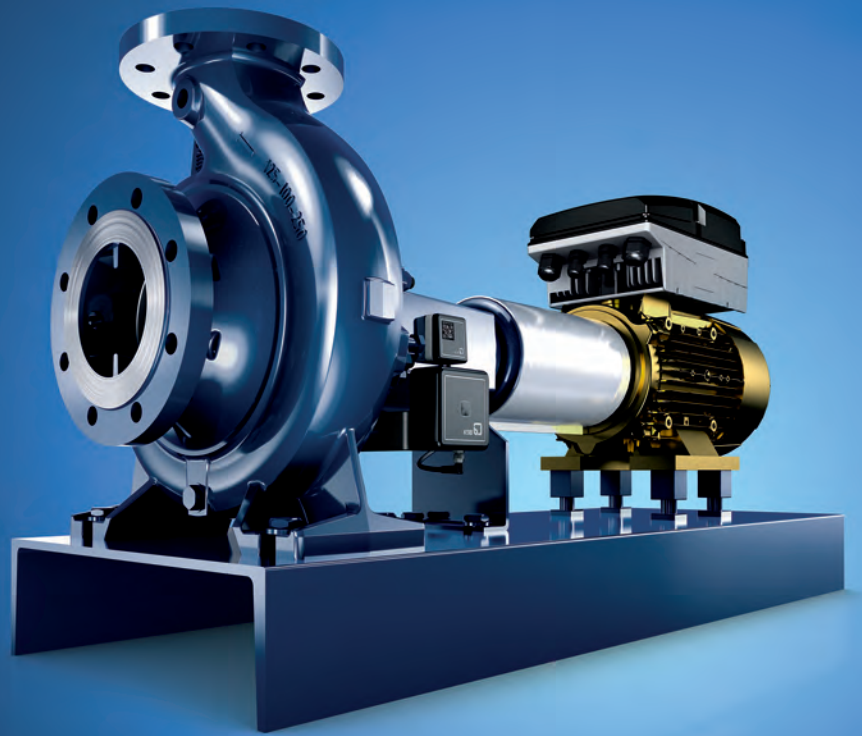
The Night Market. Photo: © Nakheel

archery, haunted corn maze, air soft battle games, laser tag, trampolines, target shooting, zombie apocalypse attack and zombie runs.

The ZAP collaboration was cemented on Thursday, 27 June 2019, at a signing ceremony led by Nakheel CEO, Sanjay Manchanda and Joseph Estephan, General Manager, Sharjah Golf & Shooting Club.

Set to open in mid-2020, the 65,000 square feet fantasy land also has its own car park, zombie-themed cafe, party room for private events and ZAP activities shop.

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New water spray park for children opens in Yishun



Photo: © Playpoint (Singapore) Pte Ltd



Photo: © Playpoint (Singapore) Pte Ltd

Singapore – Oasis Waterpark @ Nee Soon East is the first community spray park set within a public housing estate accessible to the public. Located at 307 Yishun Ring Road, it is designed for children aged between 2 to 12 years old.

Spanning over 5,600 square metres, Oasis Waterpark @ Nee Soon East consists of three main zones of water play including a 3.5-metre tall mist curtain, a main spray zone, an interactive ground spray area and a water channel.

Playpoint (Singapore) Pte Ltd worked with the Nee Soon East Town Council to jointly develop the spray park. The concept is to create a spray park that softens the surrounding by using circular zones. A path is created all the way around the zones, connecting not only the circles but also the surroundings four accesses. The concrete edges include benches, which offer seatings for children and adults alike.

Taking into consideration the children ages 2-12 years, three spray zones were planned to ensure children from different age groups can play safely and thus minimising the risk of accidents or collision.

The main spray zone was designed to be tropical rainforest theme. Consisting of columns of spray mist, falling buckets of water and spray guns, it brings fun and excitement for children aged between 6 to 12 years old.

For children aged between 2 and 6 years old, they have plenty of choices ranging from the pirate theme waterslide to the rain curtain coming from the aqua mast pirate. The mist curtain serves as an eye-catching feature. It creates a mist effect and provides cooling to children who do not want to get wet. The interactive ground sprays allow children to run and move freely while interacting with the ground sprays.

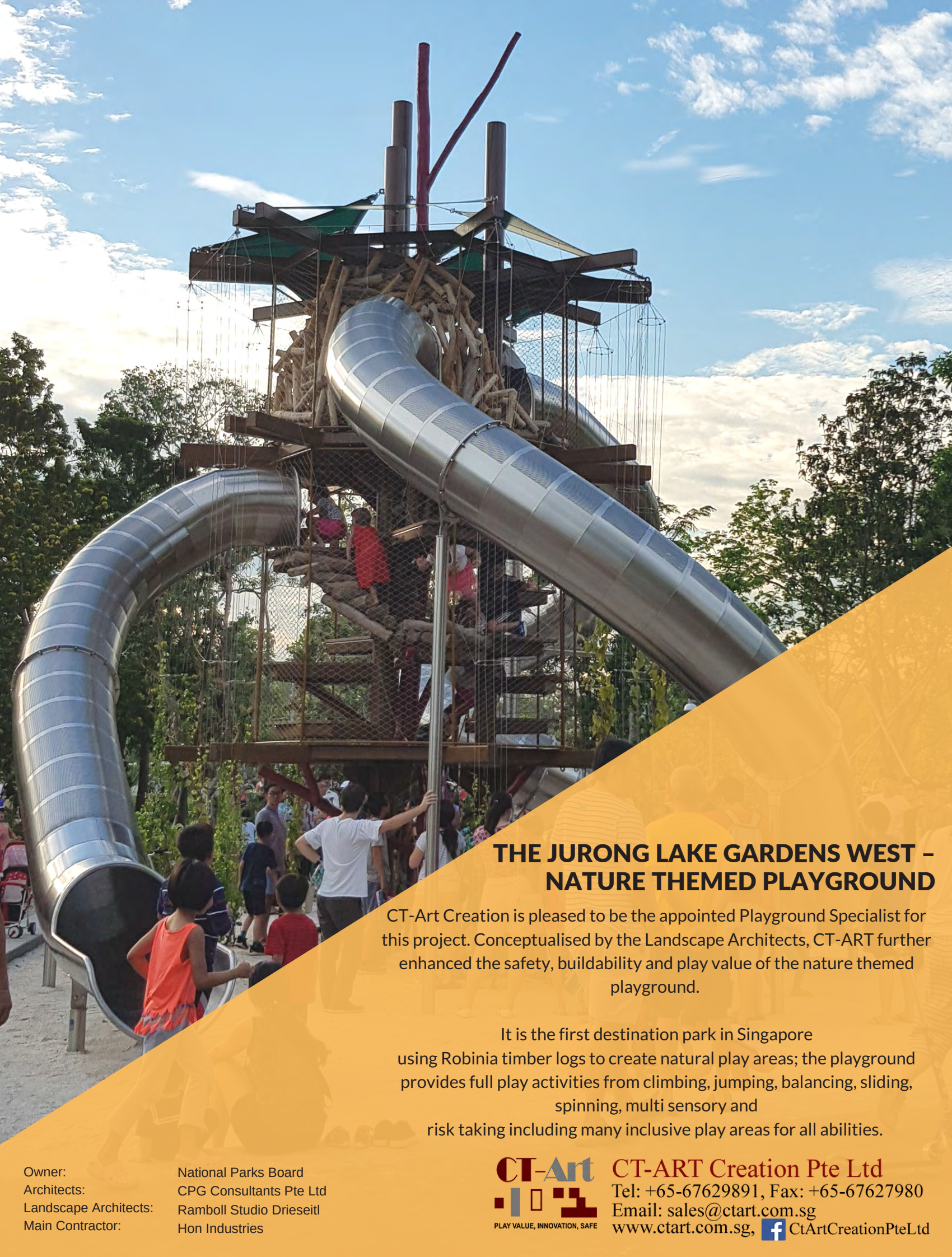
The shallow lake and the flushing water stream provide many different interactive play elements such as the water wheel for children to experiment with water flow while also offer seating elements to relax and restore.



Photo: © Playpoint (Singapore) Pte Ltd



Photo: © Playpoint (Singapore) Pte Ltd



THE JURONG LAKE GARDENS WEST – NATURE THEMED PLAYGROUND

CT-Art Creation is pleased to be the appointed Playground Specialist for this project. Conceptualised by the Landscape Architects, CT-ART further enhanced the safety, buildability and play value of the nature themed playground.

It is the first destination park in Singapore using Robinia timber logs to create natural play areas; the playground provides full play activities from climbing, jumping, balancing, sliding, spinning, multi sensory and risk taking including many inclusive play areas for all abilities.

Owner: National Parks Board
Architects: CPG Consultants Pte Ltd
Landscape Architects: Ramboll Studio Drieseitl
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SLA and URA launch RSVP: Reinventing Spaces into Vibrant Places programme



45 Sultan Gate before restoration. Photo: © Singapore Land Authority



45 Sultan Gate after restoration. Photo: © Singapore Land Authority

Singapore – The Singapore Land Authority (SLA) and the Urban Redevelopment Authority (URA) are jointly calling for innovative proposals to transform State properties and land into places that will inject vibrancy and enhance the character of precincts under a new programme called Reinventing Spaces into Vibrant Places (RSVP).

RSVP aims to activate available State-owned spaces in key selected precincts, and turn them into attractive places that will add to their charm and benefit the local community. Besides putting these spaces to interim uses, RSVP can help to encourage community interactions and create shared memories.

The programme also serves as a platform for business owners, architects and designers to team up to test creative business concepts. The overall concept and proposed uses of the site should complement other offerings in the precinct to enhance the visitor experience and add to the vibrancy of the area through suitable programming.

Six State properties and parcels of State land have been identified under the first phase of the RSVP programme in

existing areas with unique character and identity. SLA and URA will continue to identify potential sites island-wide for concept tender under RSVP, and these can range from shophouse units and standalone buildings to utility infrastructure and public spaces.

The first State properties to be launched for tender are two conserved shophouses at 45 Sultan Gate, which were recently restored by SLA. The Sultan Gate area is envisaged to be a focal point of activity and community node in the heart of the Kampong Glam Historic District – a vibrant melting pot of heritage and culture. The establishment of a new point of interest that complements the varied mix of uses and programming, both at the existing Malay Heritage Centre and the larger Kampong Glam precinct, will encourage more people to visit the area and activate the key junction at Baghdad Street and Kandahar Street.

The remaining five sites will be rolled out progressively for tender.

The tender opened on 14 May 2019, Tuesday. **For more information, visit www.sla.gov.sg/spio.**



Interior of 45 Sultan Gate before restoration. Photo: © Singapore Land Authority



Interior of 45 Sultan Gate after restoration. Photo: © Singapore Land Authority



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CFLD International marks further progress at latest Indonesia project

Jakarta, Indonesia – CFLD International, an end-to-end master planner, creator and operator of full-scale New Industry Cities, marked its continued progress in Asia with a ground breaking ceremony on 20 June 2019 for the tenants of its Karawang New Industry City (KNIC) project in Indonesia.

Strategically located 47 kilometres east of Jakarta, in the heart of the Jakarta-Bandung economic corridor, the 205-hectare KNIC features world-class infrastructure, digital connectivity, facilities and amenities specifically designed for food, automobile and motorcycles, consumer electronics, and building materials industries. It also houses innovation parks for small and medium enterprises (SMEs).

The ceremony was graced by more than 200 guests, partners, tenants and officials including Airlangga Hartarto, Minister of Industry for Indonesia; Ridwan Kamil, Governor of West Java; Wang Liping, Minister-Counselor of the Economic and Commercial Counselor's Office of the Embassy of China in Indonesia; Dito Ganinduto, Chairman of Commission 6 of the People's Representative Council, Indonesia; Wisnu Wijaya Soedibjo, Deputy Chairman of the Indonesia Investment Coordinating Board (BKPM); and Cellica Nurrachadiana, Regent of Karawang Regency.

Already, more than US\$100 million of investment has been committed from a strong suite of nine regional and international tenants and partners. This includes PT Wook Global Technology, PT Ikimura Indotools Centre, PT Ruiyuan Karawang Industrial Innovation and Development, PT Wonderful Food International, PT Brightgene Biomedical Indonesia, PT Binamitra Kwartasedaya, Zhengjia Henglin Co., Ltd., PT Sandin Heavy Equipment, and Dongguan JiaYaoXing Packing Products



Officials, partners and tenants at the ground-breaking ceremony for 6 of the tenants who invested in the Karawang New Industry City (KNIC) project in Indonesia. Photo: © CFLD International

Co., Ltd. Approximately 4,000 local jobs are expected to be created from this tranche alone.

KNIC aligns with the local government's commitment to economic and social progress. When fully completed, the project in its entirety is expected to create 40,000 new jobs locally, while contributing US\$12 million in local taxes per year to Indonesia.

KNIC is one of the projects currently being undertaken by CFLD International, along with Tangerang New Industry City, also in Indonesia, and Nhon Trach New Industry City in Vietnam. CFLD International is the international arm of CFLD, which has a strong track record of NIC development and operation. As the end of 2018, CFLD's projects in more than 80 regions have attracted over 2,000 enterprises, generated 105,000 new jobs, contributed US\$23.7 billion in GDP, and attracted cumulative investments of US\$76.5 billion.

Emaar launches fifth phase of the high-in-demand Expo Golf Villas located near the Expo 2020 Dubai site

Dubai, UAE – Following the sell-out response to the previous launch of four phases of Expo Golf Villas in Emaar South, global real estate developer Emaar has announced the launch of the fifth phase of the highly sought-after residences, only 10 minutes from the Expo 2020 Dubai site and seven minutes from the Al Maktoum International Airport.

The fifth phase of Expo Golf Villas, set amidst green parks and next to an 18-hole championship golf course, features only a limited collection of 302 three- and four-bedrooms villas

ranging in size from 123 to 155 square metres, and with a muted neutral palette to match the interior design choice of the customer.

Expo Golf Villas not only offer the unique location advantage of being near the Expo 2020 Dubai site, with the world-class event set to welcome over 25 million visitors when it opens in October next year. It also sits at the heart of the new growth corridor of Dubai with easy accessibility to the business hubs in Dubai South such as the Aviation District, Logistics District,

Business Park, Exhibition District and Humanitarian District. Further, the community is only 50 minutes from Abu Dhabi and 30 minutes from Jebel Ali.

The master-planned neighbourhood assures an exceptional lifestyle with community parks and a retail plaza in walking distance. Set by the main boulevard of Emaar South, residents have a choice of trendy F&B and retail outlets by their doorsteps. Other community amenities include a fully equipped gymnasium and children's play areas.

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Contract awarded to deliver Curtin's new industry and innovation precinct

Perth, Australia – A private sector consortium, led by InfraRed Capital Partners, has entered into a 35-year partnership with Curtin University to design, finance, construct and operate the new developments located in the heart of Curtin's Perth Campus, which have a total capital value of A\$300 million. InfraRed Capital Partners is the principal equity investor in the project.

The new developments include about 1,000 new student accommodation beds operated by St Catherine's College and UniLodge Australia, a 60-room boutique hotel operated by Waldorf Australia Group, 38 apartments (one, two and three-bedroom), 3,000 square metres of commercial space, and 15 specialty retail shops including a grocery store and food and beverage outlets. Programmed Facility Management will provide asset management services.

Curtin University Vice-Chancellor Professor Deborah Terry said construction would start in August 2019, with the first stage of the Exchange development set to officially open in January 2022.

"Our new student accommodation will be located in the heart of our main Perth Campus, and has been designed to complement our current 1,150 student



Curtin University's new industry-connected innovation precinct, Exchange. Photo credit: Curtin University.

accommodation beds," said Professor Terry. "The new development will target 5-Star Green Star Design and As Built, which includes water recycling, energy minimisation initiatives and is situated close to Curtin's bus interchange," she added.

InfraRed Capital Partners' Chief Executive Werner von Guionneau said: "We are delighted to partner with a leading organisation such as Curtin University to work on this unique project to deliver and manage world class

facilities which will enhance the learning experience of students for decades to come."

Probuild has been appointed to construct the three new buildings, which will be delivered simultaneously and completed in time for the official opening. The integration of sustainability initiatives are equally important to the InfraRed Capital Partners' lenders group which includes Clean Energy Finance Corporation and National Australia Bank.

T.O.P. This Is Our Place, designed by Aedas, wins gold award

Hong Kong – Aedas-designed T.O.P This Is Our Place won a Gold Award for Design and Development – Renovations/Expansions at ICSC China Shopping Centre & Retailer Awards 2019.

Designed by Executive Director Cary Lau, T.O.P This Is Our Place in Hong Kong transforms a 1980s former government complex into a modern office and retail-entertainment hub.

The building features a pixelated, colourful podium facade that reflects the signature palette of the underground station connected to the basement level. Targeting the young and young-at-heart, the new atrium provides gathering and performance spaces and connects to a fifth-floor open air performance area. Aedas interiors was also involved in the design of the office portion.



Photo: © Aedas



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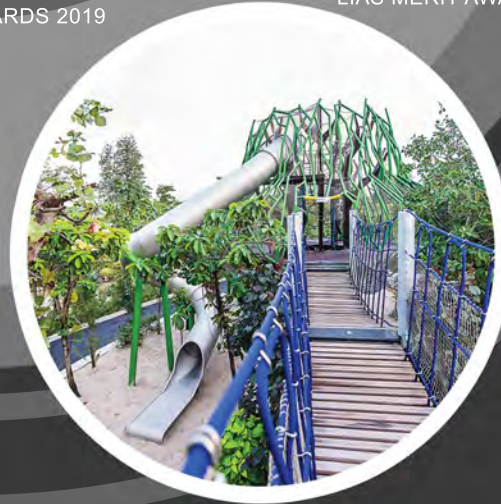
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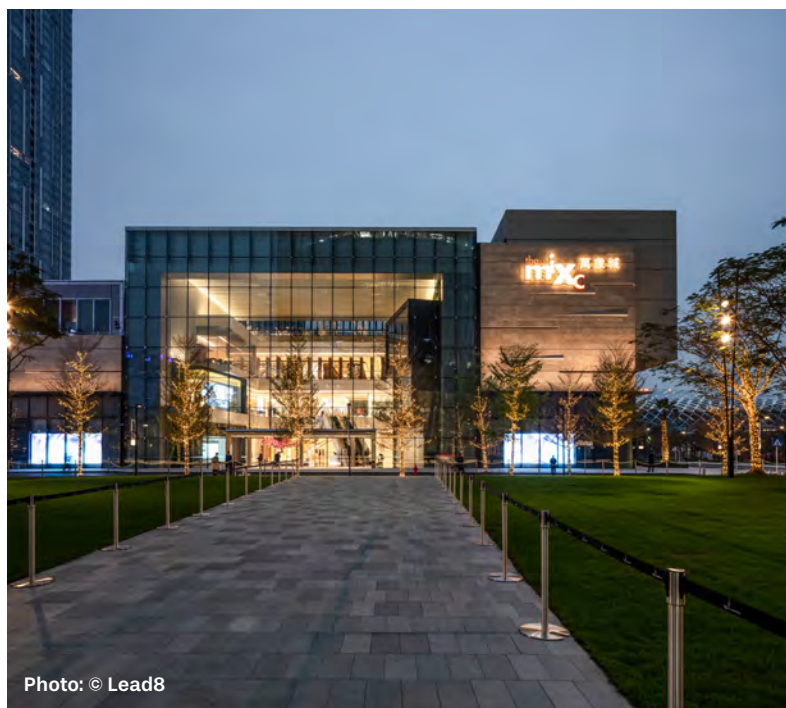
MixC Shenzhen Bay wins gold at ICSC China Shopping Centre Awards

Hong Kong – Lead8, the international firm of Architects, Masterplanners, Interior and Graphic Designers, has won Gold for MixC Shenzhen Bay at the International Council of Shopping Centres (ICSC) – China Shopping Centre & Retailers Awards on 18 June 2019.

Lead8 is the architect, interior designer and retail planner for the award-winning MixC Shenzhen Bay development, which took home the top award in the competitive Design & Development – New Developments category.

Located in the heart of Shenzhen's HouHai district, MixC Shenzhen Bay is an 80,000 square metre high-end, lifestyle-oriented retail, dining and entertainment (RDE) destination, which anchors a wider mixed-use development which has become the new city headquarters for developer China Resources Land (CRL). Representing the next generation of integrated retail destinations by CRL, MixC Shenzhen Bay is a sector-leading development in one of China's fastest growing cities and the world's top financial centres. The destination brings together experiential retail spaces with first-of-its-kind entertainment and F&B, coupled with green parks, seamless transportation links and innovative design interventions. The design concept blends the interior and exterior, celebrating the natural landscape of the city's bayside mangrove forests to deliver a modern and luxurious shopping and lifestyle destination for Shenzhen.

As a Gold Award winner, MixC Shenzhen Bay will go on to compete in the ICSC VIVA (Vision, Innovation, Value, Achievement) Best-of-the-Best Awards alongside other regional winners from around the world. The ICSC Global Awards are the most recognised achievement for professional excellence in the retail real estate industry and will be announced at the ICSC RECon conference in Los Angeles, USA in 2020.



"Waste Less, Recycle More" programme helping to pave the road with glass



Pavement trial. Photo: © RMS

Sydney, NSW, Australia – The EPA has supported the Woolgoolga to Ballina Pacific Highway upgrade project to improve sustainability with a \$107,636 grant to trial the use of recycled glass sand in the road base.

NSW EPA's Executive Director for Waste and Resource Recovery, Carmen Dwyer, said the grant was awarded through the 'Waste Less, Recycle More' programme which aims to stimulate new investment and transform waste and recycling across the state.

"Working with large organisations in the civil construction industry creates great opportunities to reduce landfill and support new markets and opportunities for recyclable materials, reducing the impact of changes in the global recycling market," said Ms Dwyer.

"These grants aim to foster innovative thinking while removing the potential risks associated with implementing new processes," she added.

The glass was collected from Lismore City Council's waste collection system, which includes glass from household recycling bins and Return and Earn stations.

Roads and Maritime Service Acting Director Northern Vicky Sisson said recycled glass has previously been used for ramps and drainage but this is the first time it has been used on the main carriageway on the Pacific Highway.

"The recycled glass sand was used in place of sand quarried for this purpose, reducing material consumption and waste at the same time. The mix meets Roads and Maritime Services' specifications for concrete pavement and will be tested for quality in the same way as traditional concrete pavement," said Ms Sisson.



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HDB & URA Exhibition Galleries on Future of Play

Singapore – As part of HDB’s Master Plan, community spaces are to play a major part in each town. Play, learning and fitness areas are planned to be a centralised hub for each estate, for residents to play and learn together.

This was gathered by CT-Art Creation Pte Ltd, a leading playground equipment supplier in Singapore during their visit to the HDB & URA Exhibition Galleries on Future of Play.

As part of the Remaking Our Heartland initiative, HDB’s Master Plan is to focus on the heritage aspects of each area. Community spaces will be planned around the heritage of each estate, such as the military themed playground in Chua Chu Kang.

As part of the Heritage Trails and Round Island Route, HDB is introducing the concept of “Pause and Play” at activity nodes along the trails. Each route will include multiple smaller sized play areas, similar to Jurong Lake Gardens.

Commenting on concept of “Pause and Play”, Patrick Lee, Managing Director of CT-Art Creation Pte Ltd said: “The “Pause and Play” concept is a great idea in making play accessible to all and creates pocket play spaces around walking trails; it benefits everyone by getting them outdoors for physical activities, exploration and play.”



Photo: © CT-Art Creation Pte Ltd



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ASLA Center for Landscape Architecture in Washington, D.C. awarded LEED Platinum® certification

Washington, D.C., USA – Across the country, landscape architects design outdoor environments that are climate-resilient and sustainable. The American Society of Landscape Architects is proud to LEED® by example.

The ASLA Center for Landscape Architecture in Washington, D.C. was officially awarded LEED Platinum® certification. Mahesh Ramanujam, CEO of the U.S. Green Building Council presented the certification to ASLA President Shawn T. Kelly, FASLA and ASLA CEO and Executive Vice President Nancy Somerville, Hon. ASLA, during a reception for the ASLA Board of Trustees and Chapter Presidents Council.

"ASLA has been a valued partner of USGBC's in promoting the power of green infrastructure and its ability to impact the lives of people and communities," said Mahesh Ramanujam, President and CEO, U.S. Green Building Council. "Achieving LEED Platinum for their renovated headquarters in Washington, D.C. is another sign of their commitment to creating sustainable spaces that prioritise the health and well-being of people. Their leadership in the development of the SITES certification system and dedication to healthy, sustainable landscapes is vital to promoting a better quality of life for us all," he added.

The ASLA Center for Landscape Architecture, the headquarters of the American Society of Landscape Architects, is a showcase for sustainable design excellence.



ASLA Center for Landscape Architecture. Photo by Jim Richards.

The 12,600-square-foot headquarters, located in the historic Chinatown district of Washington, DC, was built in 1995 and completely renovated in 2016 with a focus on maximising energy efficiency, occupant health and comfort, and sustainable design. ASLA worked with architecture firm Gensler and landscape architecture firm Oehme van Sweden to build a new Center that embodies the mission, vision, and values of the Society.

WilkinsonEyre and Morphis win international design competition at Shenzhen Bay, China

London, UK – It has been announced that WilkinsonEyre and Morphis have won a major international competition for a 6.3-hectare urban design and masterplan project in Shenzhen, China.

The Shenzhen Bay Avenue East Extension will create a 1-kilometre multi-layered pedestrian connection, between



Photo: © WilkinsonEyre

the commercial district of the city and the bay. The result will be a new city destination of lively public realm promoting healthy and sustainable living.

The designs celebrate the concept of 'City-Culture-Bay' to create a coherent ensemble of interconnected elevated walkways, linked by escalators and stairs to a lively streetscape and basement level civic realm.

Matthew Potter, Director of WilkinsonEyre Hong Kong, said: "WilkinsonEyre and Morphis have collaborated to create a proposal that holistically blends architecture, urban design and landscape design. Our concept will deliver a strong linear public space with the flexibility to allow the city to breathe, develop, grow and adapt."

Mark Blackwell, Director of Morphis, said: "The creation of new and contemporary public realm integrated with city life is crucial to simultaneously transform and unite Shenzhen with its waterfront. It will be spectacular and dynamic, beyond imagination, rooted in the culture of Shenzhen's diverse community delivering a thriving, well-served and sustainable cityscape."

Denmark's Inger Andersen takes over as head of UN Environment Programme

Nairobi, Kenya – Danish economist and environmentalist Inger Andersen has taken up her new role as Executive Director of the UN Environment Programme, promising to prioritise greater action on climate change, biodiversity loss and pollution during her four-year tenure.

Ms. Andersen was nominated for the post by United Nations Secretary-General António Guterres and approved by the General Assembly in February 2019.

"I am proud and excited to begin work at the UN Environment Programme in beautiful Kenya at a critical time for humanity," said Ms. Andersen. "Good environmental stewardship has never been more important. Climate change, biodiversity loss and pollution in all its forms pose a clear and present danger to human and planetary health, and to prosperity," she added.

Ms. Andersen brings to the role a passion for conservation and sustainable development, demonstrated

throughout over 30 years in international development economics, environmental sustainability and policy-making, designing and implementing projects and generating on-the-ground impact.

Between January 2015 and May 2019, Ms. Andersen was the Director General of the International Union for Conservation of Nature (IUCN). Prior to joining IUCN, Ms. Andersen held various leadership roles at the World Bank: she served as Vice President of the Middle East and North Africa, Vice President for Sustainable Development and Head of the Consortium of International Agricultural Research Centers (CGIAR) Fund Council.

Prior to her time at the World Bank, Ms. Andersen worked at the United Nations for 12 years. She started in the UN Sudano-Sahelian Office, focusing on drought and desertification issues, before being appointed as the UN Development Programme's Water and Environment Coordinator for the Arab Region.



Inger Andersen.
Photo credit: United Nations Environment Programme (UNEP)

Ms. Andersen's educational background includes a BA from London Metropolitan University North and an MA from the School of Oriental and African Studies at the University of London, with a specialization in development economics. She takes over from Joyce Msuya, of the United Republic of Tanzania, who has served as acting head of the organization since late last year. Ms. Msuya will continue as Deputy Executive Director.

Houston Endowment Headquarters international design competition launches

London, UK – Houston Endowment (HE), a leading philanthropic organisation based in Houston, Texas, U.S., and design competition organisers, Malcolm Reading Consultants, on 13 June 2019, launched the global search for an outstanding design team of architects and landscape architects for the philanthropy's new headquarters.

The initiative, on a site adjoining Spotts Park near downtown Houston, will embed Houston Endowment in the community, and strengthen its work bringing people together from public, private, non-profit and philanthropic sectors to achieve lasting positive change for low-income and under-served sections of the local population.

The centre, circa 40,000 square feet, will be the organisation's new public face and will provide dedicated space for its team and community partners, including

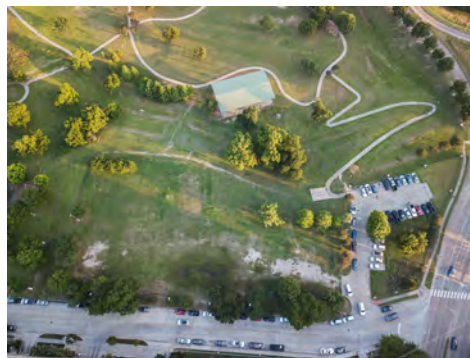
healthy workspaces, accessible and inspiring meeting spaces, and flexible and innovative engagement facilities. It is intended that the project, which has a construction value of US\$20

million (excluding FF&E), will connect strongly with the wider landscape and Park.

The funding for the project has been secured, along with the site, and the project has a fast-track timetable – the finished building is due to open in May 2022.

The competition's second stage will start in early August; the winner announcement is expected in November 2019.

Full details of how to enter the competition are available on the dedicated competition's website at malcolmreading.com/houstonendowment.



Headquarters' site, adjoining Spotts Park.
Photo: © MRC /Urban Tripod

**3-6
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SCAN & LEARN MORE

8th annual EmiratesGBC Congress highlights critical role of circular economy in driving sustainable growth



Photo: © Emirates Green Building Council

Amman, Jordan – The Middle East and North Africa (MENA) region congress was held on the 24th, 25th, and 26th of February 2019 at the Kempinski Hotel, Amman – Jordan. Organised under the patronage of HE Dr. Omar Al Razzaz, Prime Minister of Jordan, in cooperation with the Jordan Green Building Council, and with the sponsorship from Majid Al Futtaim Holding; the World GBC's MENA Green Building Congress 2019 represented an opportunity to share the latest trends across the industry internationally and regionally. It was a chance to share success stories and discuss ways MENA Green Building members can collectively respond to challenges facing the region. Furthermore, it highlighted means to ensure that buildings provide a high quality of life for people, minimise negative impacts on the environment, and maximise economic benefits.

The congress brought together government, business, city and civil society leaders to exchange ideas on best practices for green buildings to address the regions' environmental, economic and social challenges. Four primary topics were covered during the congress, including Health and Wellbeing, Sustainable Reconstruction and Rehabilitation, Advancing Net Zero buildings, and Embodied Carbon.

World GBC's Chair Lisa Bate gave a keynote speech and emphasised the need for action. World GBC's Global Project heads, Victoria Burrows and Catriona Brady gave an insight into some of the global efforts within their domain. Congress

also included speakers from EBRD, UN Habitat and many other international organisations. In addition, leading companies and individuals from 21 countries were amongst the speakers and participants, this included members of the World GBC's Corporate Advisory Board such as Saint Gobain, Signify and Majid Al-Futtaim Holding.

All nine MENA Green Building Councils (GBCs) participated, including Emirates, Morocco, Egypt, Palestine, Lebanon, Jordan, Kuwait, Bahrain and Qatar. During their regional meeting, each GBC presented its approach towards responding challenges and opportunities on the ground. And after much deliberations MENA GBCs acknowledged the need to Advance Net Zero Building to achieve Paris agreement goals, called for the development of sustainable reconstruction and city regeneration guidelines, recognised the need for healthier buildings for all and emphasised on the need to address embodied carbon in buildings to combat climate change.

The World GBC's MENA Head, Mr Mohammad Asfour indicated: "The Middle East and North Africa region is currently home to over 350 million people, and its population growth has been characterised by rapid urbanisation. This is projected to continue, with urban population expected to double from 2010 to 2050. This means a large demand for buildings, complicated by the challenges of conflict-induced displacement of people. Concrete steps need to be taken now if the future of our youth is to be secured."

Hong Kong Green Building Council's Director and Executive Director appointed to key roles in World Green Building Council

Hong Kong – The Hong Kong Green Building Council (HKGBC) is delighted to announce two executives are appointed to key roles in World Green Building Council (WorldGBC). Ms Ada Fung, BBS, JP, Director of HKGBC, has been appointed Board Secretary of the WorldGBC's Board of Directors. The WorldGBC also appointed Ir Cary Chan, JP, Executive Director of HKGBC, the Vice Chair of WorldGBC's Asia Pacific Regional Network (APN). The appointment signifies Hong Kong's position in leading the green building movement locally and globally.

"I am very happy to be elected as the Board Secretary after serving at the Board for one year. As a keen advocate for passive design, low carbon and low energy architecture in the built asset environment, I believe that all systems must integrate and human beings must work towards sustainable development, and green buildings would be no exception to this rule in our global village on Planet Earth. Quality & excellence, safety & health, green & sustainable development, well-being and harmonious community, societal growth and international collaboration must go hand in hand with each other, as a "habit" instead of an "act"," said Ms Ada Fung.

The WorldGBC Board of Directors is comprised of senior leaders from 15 Green Building Councils around the world. The Board's role is to advise and oversee WorldGBC's organisational strategy and governance to ensure it is operating effectively as a not for profit organisation, and delivering on its mission. Ms Fung's appointment of Board Secretary is a one-year term from 1 July 2019 to 30 June 2020.

"I am honoured to be appointed as the Vice Chairman of the APN of the WorldGBC. Most of the countries within Asia Pacific have a lot in common such as stages of development in sustainability, climate and culture. We



Cary Chan. Photo: © Hong Kong Green Building Council

are facing the same challenges on sustainability and how to formulate our goals, targets and strategies to fulfill our international responsibilities. I strongly believe that by working closely together, the WorldGBC with all national GBCs can lead the industry to build a sustainable built environment for the generations to come. I will do my best within my term as the Vice Chairman to work closely with the chairman and other members towards this goal," said Ir Cary Chan.

WorldGBC's APN comprises 14 Green Building Councils based in the Asia Pacific region: Australia, China, Hong Kong, India, Indonesia, Kazakhstan, Malaysia, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan and Vietnam. The appointment of Vice Chairman of the APN is a 2-year term from 1 July 2019 to 30 June 2021.

Cristina Gamboa, CEO of the WorldGBC said, "Ada has demonstrated outstanding leadership in the field of sustainability, and has championed green building as one of the most



Ada Fung. Photo: © Hong Kong Green Building Council

effective solutions to climate change. Our Board of Directors is an influential group of global leaders which works hard to ensure WorldGBC delivers on our collective mission of green buildings for everyone, everywhere. As WorldGBC prepares to implement a new three-year strategy in 2020, Ada's role as Board Secretary will be essential to fulfil the full potential of WorldGBC globally. I look forward to working with her and our fellow Directors to make our mission a reality."

"Whilst climate change is a global challenge, the solutions to it are often local and regional. Championing green building at these levels through our regional networks is therefore essential in order to deliver on our collective mission of green buildings for everyone, everywhere. Cary has been a true champion of sustainability across Asia Pacific, and his leadership as Vice Chair will help to strengthen the network of Green Buildings Councils in the region," added Cristina.



An industrial building in Grugliasco

Mapei was involved in upgrading the energy efficiency and refurbishing the waterproofing systems on the roof of an industrial building in Grugliasco, Italy.

An interesting intervention was carried out to renovate the roof of an industrial building in Grugliasco (Province of Turin, Northern Italy) and upgrade its energy efficiency. MAPEPLAN™ flexible polyolefin waterproofing membrane proved to be highly effective and has enabled the roof to be renovated by installing a more modern and efficient system.

The condition of the roof

The building in question is several decades old and, when it was purchased, the intention of the new owner was to upgrade it to make it more up to date and functional.

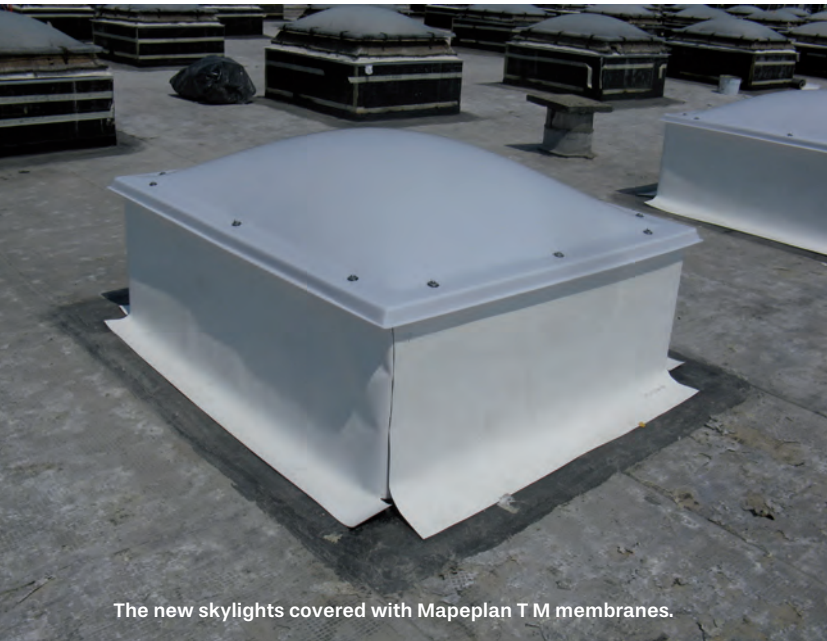
Renovation of the roof of the building was a strategically important part of the project.

The building itself has an area of around 4,500 square metres and is made from precast, reinforced concrete elements. Its original waterproofing system was made up of two polymer-bitumen membranes with the upper membrane coated with aluminium foil.

The roof had already been refurbished by installing 20 mm thick polyurethane insulating panels and a PVC-P waterproof membrane over the original polymer bitumen membrane. The panels were installed dry and had a 15 cm thick layer of loose, expanded clay aggregates over them to act as ballast.



Condition of the roof prior to the upgrade.



The new skylights covered with Mapeplan T M membranes.



Laying and fastening MAPEPLAN T M membrane in place.



Heat-welding the overlaps in the membrane with hot air.



An expansion joint in the roof.



A view of the "cool roof" completed with Mapeplan T M.



A view of the Mapeplan T walkway for foot access.

The aims and requirements of the refurbishment and upgrading work were very clearly specified, enabling the client, along with the Polyglass Technical Services Department, to identify the key phases of the project:

- removal of the layer of expanded clay ballast;
- refurbishment of the waterproof membrane by installing a more durable system with a longer service life;
- to have a more modern and upgraded roof from an energy point of view to bring it in line with current best practices regarding energy savings and comfort in winter and summer;
- to raise the skylights on the roof to prevent any risk from heavy snowfall;
- to equip the building with a cutting edge, modern roof with advanced ecological characteristics in order to increase the value of the entire building and then maintain its value over the years.

Renovation of the roof

The roof was refurbished by installing a "cool roof" system with a dry-laid MAPEPLAN T M flexible polyolefin membrane anchored to the load-bearing structure with induction welded fasteners.

The first step was to remove the expanded clay ballast and the various layers of the more recent insulating and waterproofing system to expose the building's original bitumen waterproofing membrane. This was then repaired where necessary and left on the roof, but in this case to act as a vapour barrier.

The next step was to remove the skylights and the mounts for the skylights and replace them with new ones. These were compliant with current thermal insulation standards and the mounts were also taller so that the skylights would sit proud of any snowfall. Then, the original bitumen membrane was fastened around the new mounts and skylights to prevent anything accidentally leaking in while the work was being carried out and the MAPEPLAN T M waterproofing membrane and a series of small domes were installed on the roof.

The next step was to install the thermal insulation panels, in this case 120 mm thick EPS 200 kPa, which were anchored to the substrate with the same type of induction-welding fasteners as the ones used to fasten the 2 mm thick MAPEPLAN T M flexible polyolefin membrane in place. The membrane was dry-laid and left exposed and this too was fastened to the substrate using the induction-welding system. The last step was to heat-weld all the overlaps and joints to form a perfect, seamless layer impermeable to both water and snow.

The mechanical fastening system for the new waterproof membrane was calculated and designed by the Polyglass Technical Services Department. The calculations were made in compliance with the specifications of EUROCODE 1-4 and current norms and standards and were based on the actual conformity of the roof and factored in both the effect of wind

lift and adequate safety coefficients.

Advantages and characteristics of the MAPEPLAN T M System

The MAPEPLAN T M waterproofing system used in this case has excellent characteristics and performance properties.

It ensures an upgraded and modern roof with improved energy performance characteristics and sufficient thermal resistance to combat heat loss during the winter, correct according to thermal hygrometric considerations and with no risk of condensation forming on the surface or in the gaps and spaces.

In summer, including when exposed to direct sunlight, the high-solar reflectance "Smart White" finish of MAPEPLAN T M guarantees that the membrane has a low surface temperature and, as a result there are more comfortable conditions inside the building, less energy is required to cool the building and running costs are much lower. Thanks to this intervention, the building now has a modern and efficient "cool roof".

The waterproofing system is a "seamless" layer welded together with hot air to remain functional and durable over the years. MAPEPLAN T M waterproofing membranes have a long life expectancy and are highly ecological, as indicated by the product EPD (Environmental Product Declaration) certified by an accredited certification body.

Apart from the advantages mentioned previously, it is also easy to maintain and only requires regular cleaning and inspection of the drainage points and the flashing around the edge and sealing with silicone mastic.

Article source: Realtà Mapei International no. 70/2018

For more information, email mapei@mapei.com.sg.

Polyglass Product: MAPEPLAN T M

PROJECT DATA

Project Name: Industrial building in Grugliasco
Location: Grugliasco, Italy
Year of the intervention: 2017
Intervention by Polyglass: Supplying products to rebuild and upgrade the roof
Client: SIF SpA
Contractor: Borgatta Emilio
Polyglass Coordinators: Mauro Redemagni (Head of Technical Services), Cristian Spinazzé (Area Manager)
Photos: © Mapei



Heartbeat@Bedok

Heartbeat@Bedok, designed by ONG&ONG, carries a forest theme throughout the development.

Hearthbeat@Bedok is a multi-use, multi-occupant 7-storey building in Singapore. Envisioned as a key civic, it resulted from the dramatic transformation of a public park in the heart of the vibrant East Coast neighbourhood. Envisioned through Housing Development Board (HDB)'s "Remaking Our Heartland" initiative to reinvigorate the Bedok Town Centre, the development showcases abundant green features to address humidity of the year-round tropical season.

The new building, with amenities from four swimming pools to public healthcare, resulted from the dramatic transformation of a public park in the heart of the vibrant East Coast neighbourhood. In reverence to its historical park of dense landscapes and mature trees, the proposed design carries the same forest theme throughout the development, retaining the characteristics of a community park. The verdure is practical, utilised as privacy and acoustic screens from the neighbouring residential units.

An exemplary tropical building

Bordered with greenery on every floor plate, the modern biophilic space play host to trees, shrubs and creepers, enveloping the mass of the building – mitigating the concrete impact. Additionally, it reduces heat gain for the indoor areas. Softscape selections are native to Singapore, abundant within and around the structure including the playground and fitness corner for a park-like surrounding.

Environmentally progressive features

Featuring lush greenery and landscaping throughout the site, it contains an impressive array of passive environmental controls. From rainwater and grey water systems, to tapered facade glazing and brise soleil elements that mitigate solar heat and radiation, the result is an environmentally progressive building, centred on reduced energy consumption, and lowered building operation and maintenance cost.

Embodying holistic and integrated sustainable design and features, HeartBeat@Bedok's unique scheme conveys the designers' intent to create an environmentally progressive building with reduced energy consumption, resulting in lowered overall building operation and maintenance costs.

To reduce the building's reliance on mechanical systems for comfort, a number of measures were taken to create an internal environment suitable to the tropical climate. First, the early adoption of passive design concepts and intention to channel wind led to the building mass being configured to promote wind flow through Level 1 atrium space via Venturi effect, leading to a conducive and comfortable naturally ventilated social space.

The channelling of ventilation simulation through CFD (Computational Fluid Dynamics) helped to refine the design and achieve acceptable wind flow rates in non air-conditioned spaces.

Secondly, internal spaces were designed with high ceilings for enhanced overall porosity, allowing for effective cross-ventilation and air circulation. This helped create microclimates



Reception of the People's Association.



Bedok Public Library



SingHealth Polyclinic inside Heartbeat@Bedok.



The Gymnasium, part of the ActiveSG Sport Centre at Heartbeat@Bedok.



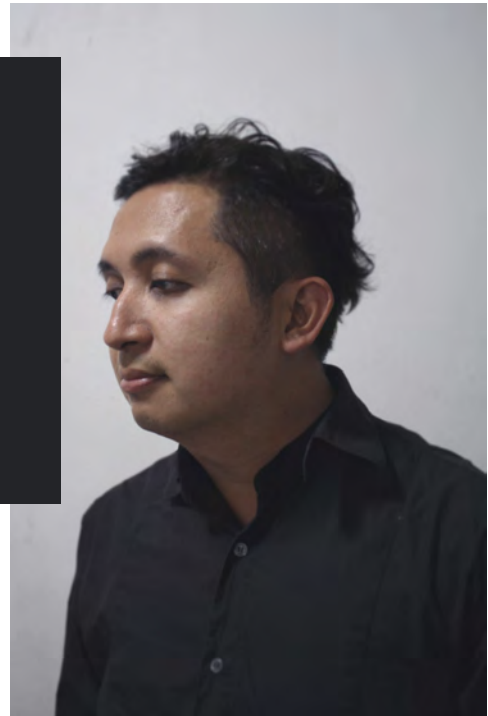
Tapered fenestrations, wrap-around tensile fabric and vertical fins help reduce solar heat gain through the facade.



Playground and senior-friendly fitness corner surrounded by greenery for a park-like ambience.

“Heartbeat@Bedok mimics the public park that it once was by having lush greenery throughout while not affecting the natural breezes the neighbourhood enjoys. This is the core strength of our tropical sustainability efforts – to being closer to nature; with the residents’ comfort in mind.”

– Robert Brodeth, Associate Director, ONG&ONG



PROJECT DATA

Project Name: Heartbeat@Bedok

Location: Bedok, Singapore

Client: People’s Association

Architect Firm: ONG&ONG

Gross Floor Area: 45,000 square metres

Completion: June 2017

Accolades:

- [World Architecture Festival Award, Leisure-Led Development – Future Projects Category: Finalist, 2015](#)
- [BCA Green Mark Awards: Platinum, 2016](#)
- [American Architecture Prize, Landscape Category: Winner, 2017](#)
- [Asia Pacific Property Awards: Singapore Best Mixed-Use Architecture 5 Star Award Winner, 2018](#)
- [International Property Awards, Asia Pacific Mixed-use Architecture: Nominee, 2018](#)
- [World Architecture Festival Award, Civic and community – Completed Buildings: Finalist, 2018](#)
- [BCA Universal Design Award: Gold^{Plus}, 2019](#)
- [Landscape Industry Association Singapore Awards, Implementation – Non Residential: Best of Category, 2019](#)

Photos: © ONG&ONG

at both the pedestrian thoroughfare and sports complex area for enhanced end-user comfort.

Thirdly, a self-shading façade was conceptualised to reduce heat gains through the façade. Tapered fenestrations, wrap-around tensile fabric and vertical fins help reduce solar heat gain and the incidental cooling load by 30 percent, by allowing wind to permeate into naturally ventilated corridors on the upper levels. The peripheral planter boxes serve as natural screens to the internal space, reducing heat gain, while having an aesthetic and therapeutic impact.



View of the atrium.



1 Hotel Haitang Bay

Designed by The Oval Partnership Ltd, 1 Hotel Haitang Bay is a luxury lifestyle hotel brand whose ethos is founded on innovative eco-conscious design and sustainable architecture.

Nature inhabits the very heart of all that embodies 1 Hotels. Its story began with a simple yet ambitious mission – to create the most unique, sustainable and inspiring experience that redefines what a hotel in the 21st century should be. However, the vivid beauty of nature is not simply there to enhance the ambience for guests but also to promote the principles of sustainable travel and encourage interaction with the surrounding locale. In essence, the design of 1 Hotels fundamentally revolves around our Mother Nature, from the inside out.

Operated by Starwood Capital Group, 1 Hotels is a luxury lifestyle hotel brand whose ethos is founded on innovative eco-conscious design and sustainable

architecture. 1 Hotels Haitang Bay on Hainan Island is the Group's first property in Asia. Its captivating design takes cues from local geographical characteristics as well as the cultural and scenic backdrop of Hainan, while committing to the principles of sustainable travel that the hotel brand is renowned the world over for.

Perched 22 metres above sea level, the hotel's breath-taking views of the bay are enhanced by generous natural lighting and strategic cross ventilation to take advantage of the sea breezes. The hotel's intelligent single loaded structure ensures that all the rooms are equally light-filled and airy, while also affording a stunning ocean outlook. Nature positively seeps into the hotel's





“Our design inspiration of 1 Hotel Haitang Bay project has been deeply rooted in the vision of 1 Hotels brand. We aspire to design a more relaxed, comfortable, natural and open environment for sophisticated travelers, and to craft a more tangible and imaginative sustainability that could celebrate the DNA of the 1 Hotels brand. We are keen to make this project real, an authentic and narrative place-making with a soul that could intrinsically connect with local geographical, cultural and scenic backdrop of tropical tradition of Hainan Island.”

— Dr. Lin Hao, Director at The Oval Partnership





architecture, which is planned around a series of lush landscaped gardens (Hundreds of Gardens) situated to the east. The rooftop space is cleverly treated as the fifth facade, being put to innovative use through the integration of a rooftop sky farm and three individual villas featuring lush sky gardens.

Local vernacular architecture and passive environmental design guided the overall approach and aesthetics of the development. This is emphasised by a series of external shading devices and green landscaping, presenting a spatial experience that is both rich in texture and mesmerizing in detail, heightened by the interplay of light and shadow. Elevations are not bereft of planting either – ‘green’ walls extensively planted with local vegetation complement the staggered roof terraces and semi-open courtyards to amplify the integrated quality

of the architecture with its natural surroundings. Warm timbers and weather resistant metals form a harmonious composition alongside locally sourced lava stones, celebrating the beauty of humble, natural materials.

Sustainability is not simply a slogan at 1 Hotels, but embedded in the lifestyle, practices and culture of the brand, as well as the performance of its buildings. Green technologies are designed to reduce the environmental impact of the development and the hotel incorporates a number of sustainable technology strategies to achieve this, such as rainwater recycling, grey water reuse, solar thermal hot water, an energy efficient E&M system, and an organic farm, among others. The result is a relaxed, comfortable, natural, ecological, open, serene and modern environment that champions the DNA of the 1 Hotels brand.

PROJECT DATA

Project Name: 1 Hotel Haitang Bay
Location: Sanya, China
Client: Sunshine Life Insurance Company Limited
Architect Firm: The Oval Partnership Ltd
Size: 68,348 square metres
Completion: 2020
Photos: © The Oval Partnership Ltd



Ayla Clubhouse & Golf Academy

Designed by Oppenheim Architecture + Design, the form of the Ayla Golf Academy & Clubhouse establishes a unique connection with nature by capturing the elemental, vibrant beauty of the rolling desert landscape.

Ayla Golf Academy & Clubhouse takes inspiration from the natural dunescapes and mountains of the surrounding desert as well as the architectural heritage of the ancient Bedouin. The innovative and organic design of the building forms the iconic core of the Ayla Oasis mixed-use resort development.

This 1,200 square metre building is part of the first phase of a 44 square kilometres leisure development currently under construction in Aqaba, Jordan. The development encompasses residential, hotel and commercial space, all centered around an 18-hole signature golf course. The Clubhouse features retail, dining, bar/lounge, banquet, fitness, and spa components; while the Golf Academy includes retail, dining, and indoor/outdoor swing analysis studio components.

The distinct architectural form of the Ayla Golf Academy & Clubhouse establishes a unique connection with nature by capturing the elemental, vibrant beauty of the rolling desert landscape. A massive concrete shell drapes over the program areas, enveloping the interior and exterior walls of each volume. The curved shotcrete shell blends with the sand like dunes instead of having conventional walls and ceilings. Openings grant views towards the spectacular Aqaba Mountains in the background. Corten steel perforated screen filters the light, similar to the traditional Arabic 'Mashrabiya'.

Jordanian patterns inspired the triangular pattern of openings while the tones of the surrounding mountains are echoed in the colours of the shotcrete and the metals.



“The Ayla Clubhouse & Golf Academy showcase how we think about making buildings part of the site, designing architecture that meshes with the landscape.”

— Chad Oppenheim, Principal, Oppenheim Architecture + Design





The construction of the project is the result of a knowledge exchange program between the European office of Oppenheim Architecture and local workforce. Shotcrete pouring techniques were taught to workers in the first phases so that they could take ownership of the construction and obtain specialised skills. A local artist also helped shape the building by applying a traditional pigmentation technique to the interior surfaces, granting a raw, unadorned look that stays true to its context and inspiration.

PROJECT DATA

Project Name: Ayla Clubhouse & Golf Academy
Location: Aqaba, Jordan
Client: Ayla Oasis Development Company
Architect Firm: Oppenheim Architecture + Design
Area: 1200 square metres
Completion: 2018
Photos: © Rory Gardiner



Cyrus Tang Foundation Center

The Center is designed as a green building, which focuses on the integration with the surrounding environment.

As the headquarters of Cyrus Tang Foundation (CTF) in mainland China, the project is a complex which integrates multiple functional spaces, including the foundation's offices, a museum for displaying various gifts that the foundation has received, and spaces for holding exchange activities with its college members, including exhibitions, conferences, and training, etc.

Situated at the central area of East Tai Lake Ecological Park in Wujiang District, Suzhou, China, it enjoys favourable site conditions and beautiful landscape. The design focuses on the integration with the surrounding environment, inherits CTF's mission of serving disadvantaged communities with love and passing on the spirit of giving, and produces a "dissolved" and green building.

"Dissolved" Architecture

Organic Layout

With the continuous development and growth of the foundation, its demands for functional spaces will continue to increase. The design fully considers the necessity of leaving space for future development and therefore applies an organic layout on the irregular site, to allow flexible expansion and adjustment of the building's outline. Future extensions can be constructed naturally alongside the existing layout, without destroying the overall unification and harmony. Additionally, the curvilinear contours break through the building's monotonous interfaces, and the layout strategy of interpenetration enables the architecture to coexist with the natural landscape in the most environmentally friendly manner.



Main entrance.



Interior view

"Dissolved" Volumes

Main functions are designed on 1F (storey height: 7.0 metres) in order to minimise the architecture's intrusion to the park where it is located. Meanwhile, the rooftop garden functions as elevated vegetation, which not only increases the park's green area, but also provides a beautiful open viewing platform and activity venue for visitors. The protruding building volumes (museum, exhibition area, and multi-function hall, etc.) hide behind the rooftop garden, like a few sculptures, highlighting the "solidness" of the architecture while also strengthening the hierarchy of spaces.

"Dissolved" Facades

1F is mainly enclosed by glazed curtain walls. Featuring a rhythmic arrangement of green glass with different transparency, its erected facade echoes the nearby bamboo and dissolves into the surroundings. Besides, facades of the protruding volumes also present bamboo-like vertical patterns, which blend together as an integrated whole. Those refined facades partly result from the elaborate arrangement of the building's equipment: all the tube wells and outlets are all

integrated orderly in the roof design.

Green Building

Efficient Layout

Since only the office area is used perennially while the exhibition area and the multi-function conference hall are utilised occasionally, the design employs a centralised layout, where the office area, exhibition area, multi-function hall and museum are incorporated in one complex. Each functional space can be utilised independently, and at the same time enables efficient integrated operation with others. When utilised independently, each area is set up with its own entrance and exit. Based on site conditions, the office area and the museum are respectively located on the west and the southwest side, resulting in a tranquil ambience on the west part of the site. To connect with the northern outdoor activity venue, the multi-function conference hall is arranged on the north of the site. And the exhibition area is on the east side, next to the secondary entrance. All of those functional spaces are joined by the central hall, which ensures the proper distance among each section as well as the unity of the building.



“The design focuses on the integration with the surrounding environment, inherits CTF’s mission of serving disadvantaged communities with love and passing on the spirit of giving, and produces a “dissolved” and green building”.

– Design team at The Architectural Design and Research Institute of Zhejiang University Co., Ltd. (UAD)



Roof garden

Green Technologies

This project won the Chinese Certificate of Green Building Design Label (Two Star) in 2014, for its application of many fully developed green technologies in China, such as geothermal heat pumps, building-integrated photovoltaics, tubular daylight devices, green roof, automated shading system, green lighting and intelligence operation management that saves land, energy, water and building materials. During the initial design process, simulation software was used for the optimised analysis of the building's natural ventilation and lighting. On the other hand, this is not only an efficient and eco-friendly architecture, but also an exemplary platform for display and exchanges of green technologies, which gathers high-tech resources that universities have brought in.

The architecture is the outcome of effective multi-disciplinary integration and collaboration. Green designs, functional optimisation and fusion with the site were fully considered throughout the design process, thereby an architecture that blends and coexists with the ambient natural environment was created.



Curtain wall details



Material contrast

PROJECT DATA

Project Name: Cyrus Tang Foundation Center
Location: East Tai Lake Ecological Park, Wujiang District, Suzhou, China
Client: Cyrus Tang Foundation
Architectural Firm: The Architectural Design and Research Institute of Zhejiang University Co., Ltd. (UAD)
Area: 15,000 square metres
Completed: February 2015
Photographer: Zhao Qiang

Protect and style wooden floors with Bona's sustainable solutions

As the market leader in waterborne finishes, Bona's aim is to develop environmentally sound products of the highest quality in order to bring out the best in wooden floors. Through continued research, the company develops wooden floor treatments that focus on design and performance. With the belief that a good design solution is not just about appearance but also about functionality, Bona takes into account factors such as durability, gloss, shade, friction and slip resistance. With a complete system of products for installation, maintenance and renovation of wooden floors, the company offers its customers lifetime support. All photos: © Bona AB, Sweden



Bona Inspiration

The Bona Inspiration concept includes a palette encompassing a range of modern styles and flooring effects, where Bona's sanding and brushing methods, varnishes, oils and paints bring new life to a wooden floor. Restyling wooden floors is environmentally friendly; the trends include beautiful selections from dark, rustic floors to pale, lacquered ones.

Waterborne finishes

Bona's waterborne finishes are durable, fast drying, clear in colour, almost odourless, and most importantly, environmentally adapted. As the finish

dries, water evaporates into the air, leaving the protective polyurethane coating on the wood. This means low volatile organic compound (VOC) emissions and no toxic fumes, minimising the health risk to contractors and homeowners. In 2007, Bona received the Singapore Green Label for the waterborne finishes Bona Prime Classic, Bona Novia, Bona Mega, Bona Traffic and Bona Naturale as well as for the Bona wooden floor cleaners.

Silane-based adhesive

Bona's innovative silane-based reactive adhesives can be used for all types of wooden floors. They are also especially

suitable for sensitive wooden floors as they do not contain water or organic solvents. In 2009, Bona received the Singapore Green Label for Bona R848 and R850 silane-based adhesives.

Dust-free sanding

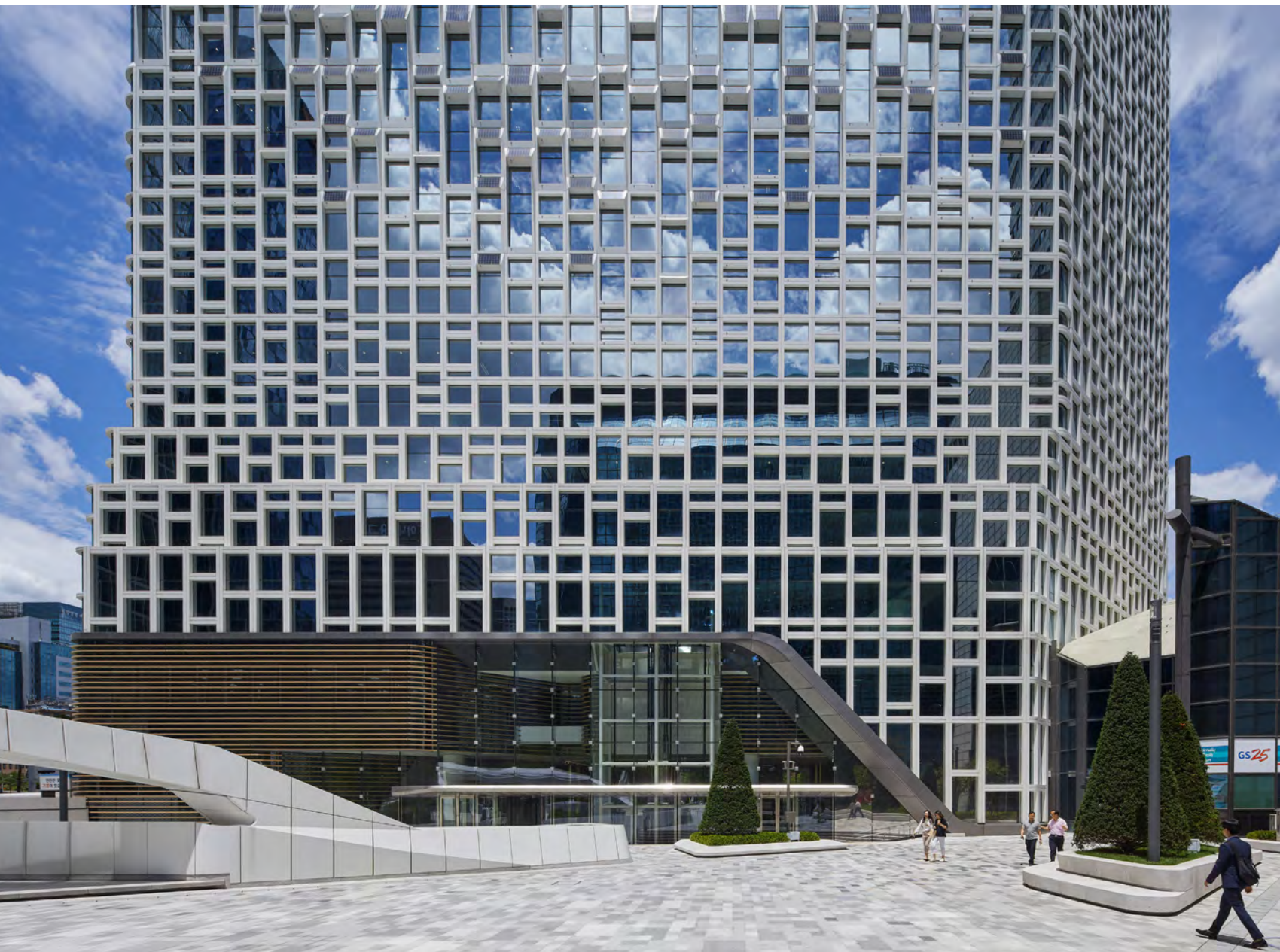
Sanding wooden floors has always been associated with lots of dust, affecting indoor air quality. Bona's patented technology to vacuum wood dust during floor sanding has been developed to meet health and environmental standards, with measurements showing that the company's dust-free sanders contribute to better and cleaner air quality.



Bona Traffic HD – fastest drying lacquer that provides extra protection suitable to use in public and commercial areas.



Copenhagen Airport



Hanwha Headquarters

In 2013 UNStudio's design was selected as the winning entry in the competition for the remodelling of the Hanwha headquarters building in Seoul. The design of the building is driven by the environment.

The renovation of the office tower incorporates the remodelling of the facade, the interior of the common spaces, lobbies, meeting levels, auditorium and executive areas, along with the redesign of the landscaping.

Located on the Cheonggyecheon in Seoul, the 57,696 square metres headquarter building was seen to no longer reflect Hanwha as one of the leading environmental technology providers in the world. For the competition to remodel the tower UNStudio teamed with Arup (sustainability and facade consultant) and Loos van Vliet (landscape designer). Following the selection of the competition design, agLicht joined as lighting consultant for the interior and landscape lighting.

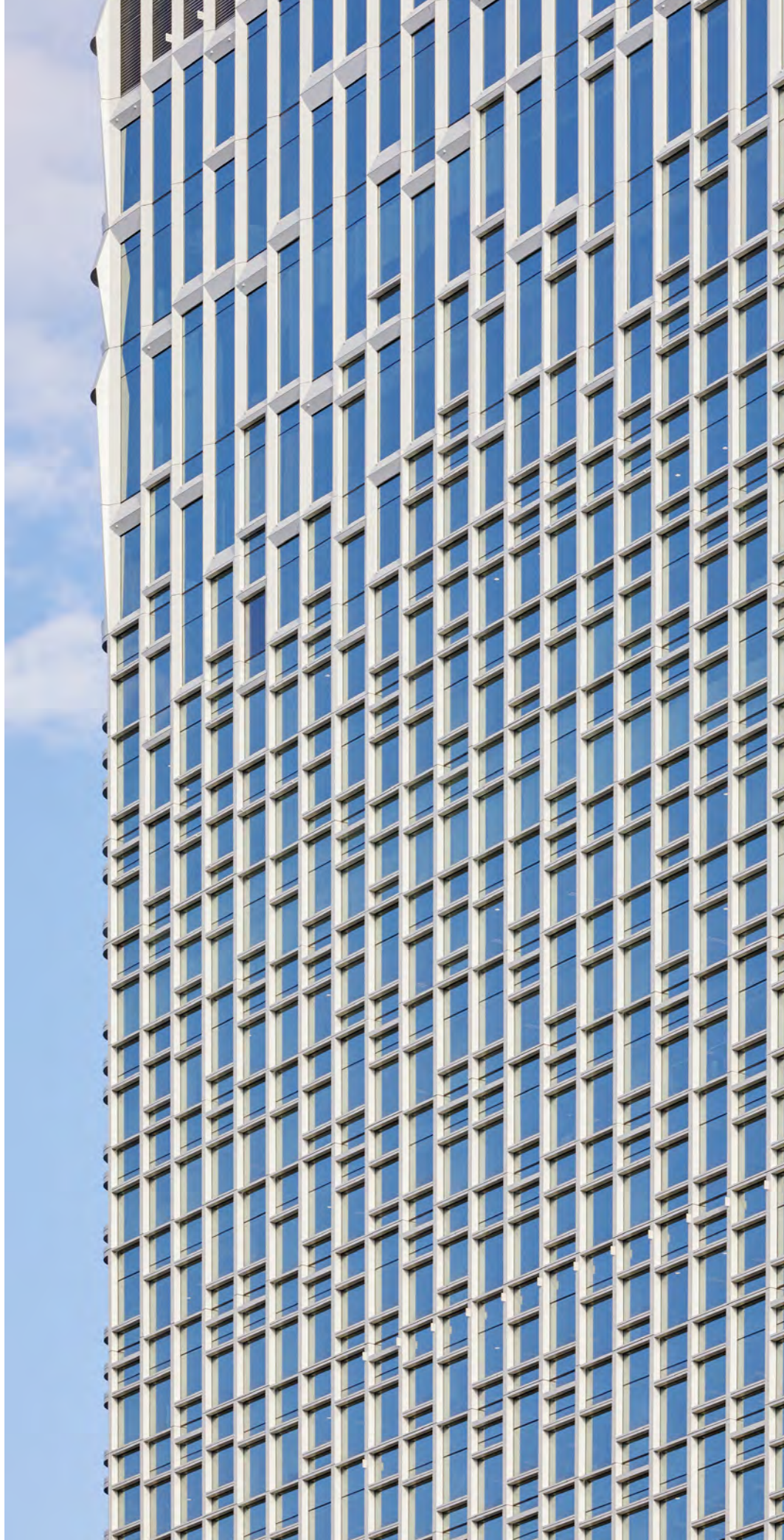
Responsive facade concept

In response to the request that the design be guided by the surroundings, influenced by nature and driven by the environment, UNStudio developed an integrated responsive facade concept, which improves the indoor climate of the existing building and reacts to both the programme distribution and the location.

Well-being

Social well-being is considered fundamental for enhanced creativity and concentration and is driven by several factors, the most significant of which is the improvement of the indoor environment – primarily in order to enhance physical comfort. The existing facade contains horizontal bands of opaque panelling and single layers of dark glass. In the remodelling this will be replaced by clear insulated glass and aluminium framing to accentuate views and daylight. The geometry (pattern, size and reveal) of the framing is further defined by the sun and orientation factors to ensure user comfort inside and reduced energy consumption.

In the design for the Hanwha headquarter building the North facade opens to enable day lighting within the building but becomes more opaque on the South facade, where the sun would otherwise have too much impact on the heat load of the building. Openings





신한은행

우리은행

비보호

신한저축은행

“The new facade for the Hanwha headquarter building demonstrates that existing buildings can be substantially modernised and have their performance significantly enhanced by fully inclusive and responsive facade remodeling.”

— Ben van Berkel, Founder and Principal Architect, UNStudio



Ben van Berkel. Photo: © Els Zweerink

within the facade are further related to the views: opening up where views are possible but becoming more compact on the side adjacent to the nearby buildings.

Solar impact and PV integration

Direct solar impact on the building is reduced by shading which is provided by angling the glazing away from direct sunlight, while the upper portion of the South facade is angled to receive direct sunlight. The window to wall ratio is taken into account in order to achieve 55 percent transparency across the entire facade, while PV cells are placed on the opaque panels on the South / Southeast facade at the open zones where there is an optimal amount of direct sunlight. Furthermore, PV panels are angled in the areas of the facade where energy from the sun can best be harvested.

Facade expression

The basis for the facade expression is to achieve an effect of variety, irregularity and intricacy throughout the facade. This is approached by combining a system of multi-scaled elements in a simple fashion and is additionally

informed by the programme. By varying the placement of the facade panels a variety of programme-related openings are created. Variations in programme therefore create the opportunity for differentiation, with the result that the restaurant, the executive room, the sky



gardens, the seminar spaces etc. are all expressed in the facade.

Interior concept lobby

In UNStudio's concept for the lobby of the Hanwha headquarter building the landscape continues into the interior and acts as a guiding aid, while natural materials and planting provide a relaxing environment for visitors. A subtle colour scheme is combined with wooden furnishing and in both the North and the South entrance lobbies a coffee corner creates the possibility for social interaction and exchange.

PROJECT DATA

Project Name: Hanwha Headquarters
Location: Seoul, South Korea
Client: Hanwha Group
Architect Firm: UNStudio
Size: 57,696 square metres above ground
Completion: 2019
Photos: © Rohspace



Viettel Offsite Studio

Viettel Offsite Studio, designed by VTN Architects, has several roof gardens which can be used as outside studio for the staff.



Located on a light slope, besides a quiet lake and landscape abundant trees, Viettel Offsite Studio is inclusive six units; a welcoming reception, a dining and four studios. It is located on the outskirts of Hanoi, around 30 kilometres and takes 40 minutes to reach by car.

Viettel is a global telecommunication group in Vietnam with over 27,000 staffs (as of 2015). They represent in many big cities in Vietnam such as Hanoi, HCMC, Da Nang, etc. Even a major IT Company knows the importance of offline communication. Viettel Offsite Studio's facility for meeting is prepared for their leaders to have boot camping meeting to make discussion and decision located at the corner of Viettel Academy's campus where provide education for their engineers. These studios also supply an offsite short-term working place for the leaders, after getting away

from busy cities and miscellaneous.

There are six V-shaped wall blocks, which freely arranged, follow the layout of land and connected by an open corridor. These blocks form triangular surface spaces: two sides closed and the other side opens towards lake and trees. The wall creates an open book shape that exhibits "open from inside to nature". While the open side directly faces to surrounding environment, it allows people to both relax, be immersed in nature and concentrate.

The studios are opened to North direction where it offers the most beautiful greenery view to people. The V-shaped walls are designed to be high to cut strong harsh sunlight from the east and west while giving impressive exterior facade for the entrants. The roof garden also works as outside studio. The small holes on the wall provide gentle lights and wind to the roof studio.

PROJECT DATA

Project Name: Viettel Offsite Studio
Location: Thach That, Hanoi, Vietnam
Client: Viettel Corporation
Architect Firm: VTN Architects (Vo Trong Nghia Architects)
Gross Floor Area: 1,427 square meters
Completion (year): 2018
Photos: © VTN Architects (Vo Trong Nghia Architects), Hiroyuki Oki



LECTURE B



“I tried to spatialize the interactive possibilities between simplicity and complexity, between nature and artificial. V-shaped concrete structures were semi-autonomously arranged with the functions of the facility. It also integrated nature with architecture seamlessly, the experience of the spaces transforms every second accompanying with the certainty and uncertainty. I tried to activate direct communication of those vague spaces. I believe it should be “Hundreds Years Buildings”. In order to realise that, we believe that it is necessary to seize the truth and pursue the essence.”

— Mr Vo Trong Nghia, Partner, VTN Architects (Vo Trong Nghia Architects)





Artist's impression of Tahir Connexion Foundation – The Solar Verandah. The open space between the Tahir Foundation Connexion and the existing SMU School of Accountancy is transformed into a vibrant campus boulevard, which will form a new hub for student life on campus. The café, together with key circulation nodes, are strategically located on the ground floor to activate this linear space, keeping it active and vibrant 24/7. Balconies and terraces are introduced at strategic locations to enable inter-floor connectivity and visual transparency, adding to the overall vibrancy of the campus. This street is sheltered by a canopy of photovoltaic (PV) cells, reflecting SMU's strong commitment towards sustainability.

Tahir Foundation Connexion

Besides being Singapore's first large-scale Mass Engineered Timber (MET) development, the Tahir Foundation Connexion is also the first on-site Net Zero Energy Building, being self-sustainable with its own power generated from a photovoltaic system located within the same building.

Singapore Management University (SMU) is constructing a new five-storey green building in the heart of the city designed to support the University's innovative SMU-X pedagogy, as well as cultivate innovation and entrepreneurship. The ground-breaking ceremony for the development was held successfully on 27 August 2018 and the building is expected to be ready by the end of 2019.

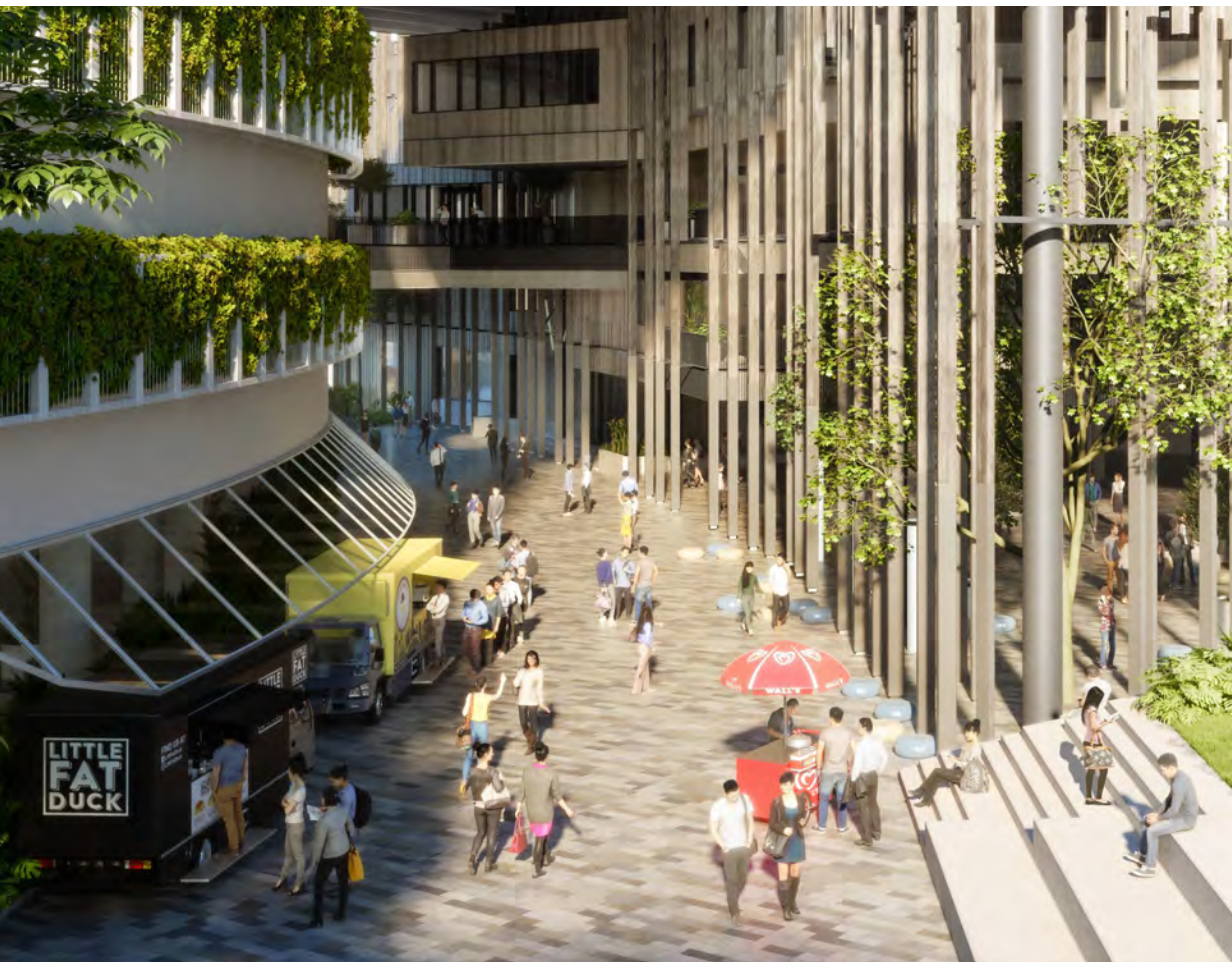
The \$70 million development has been made possible by a donation from the Tahir Foundation and a grant from the Building and Construction Authority (BCA) under the Public Sector Construction Productivity Fund. SMU has named the building Tahir Foundation Connexion in appreciation of the Foundation's contribution.

Located between SMU's School of Accountancy and School of Law, the new building will add over 8,600 square



Artist's impression of The North Plaza. The North Plaza is a distinctive urban space within the Tahir Foundation Connexion which celebrates SMU's unique character as a city campus. It has been carefully designed to integrate seamlessly with Fort Canning Park and enables the cityscape to form the backdrop for campus life and activities within SMU. Historical elements, such as the gateway pillars of the former National Library are sensitively integrated within the space, enriching the overall spatial experience of the place. The construction system is exposed within the Plaza space, reflecting the X-perimental nature and character of the SMU-X initiative.

Artist's impression of Boulevard Link. Tahir Foundation Connexion is connected to the School of Accountancy via the Boulevard Link. Key facilities such as active learning classrooms and seminar rooms are located at this common level to facilitate shared use of common resources and encourage inter-disciplinary interaction and collaboration. It also serves as a viewing gallery, enabling participation and appreciation of activities along the campus boulevard under the sheltered Solar Verandah.





Artist's impression of Innovation Bridge @ Fort Canning. Tahir Foundation Connexion has a two-storey link building that spans across the Fort Canning Link. Providing a physical connection between the new building and the SMU School of Law, this link building will house SMU Institute of Innovation and Entrepreneurship's (IIE) incubator – Business Innovation Generator (BIG). The Innovation Bridge @ Fort Canning thus serves as a strong symbol of SMU's unique qualities as a city campus that continually forges meaningful relationships between academia and industry.

metres of teaching-and-learning space to SMU's city campus. It will enable seamless connectivity through the entire SMU's city campus, as well as provide a sheltered link (aboveground and underground) from Bras Basah Road leading to Fort Canning and Armenian Street. Besides enhancing convenience for the SMU community, it will also benefit members of the public, who will have better access to the lush greenery at Fort Canning Park. With some of the new building's spaces and facilities being open 24/7, it will also add vibrancy to the Bras Basah precinct.

To support the University's SMU-X pedagogy, which focuses on experiential learning through real-world projects, the Tahir Foundation Connexion is designed to provide new-generation learning spaces that boast flexibility and future adaptability. These include active learning classrooms, brainstorming hubs, collaborative zones, a dining commons, integrated learning studios, makerspace and student lounges. The ample active learning spaces will enable students' meetings with industry practitioners and faculty, as well as promote socialising. About



“The Tahir Foundation Connexion design demands a new architectural expression, which must sensitively set against the existing SMU campus, the lush Fort Canning Park and the historical buildings in its vicinity while intelligently rise up to the challenge of a new form of construction.” – Mr Siew Man Kok, MKPL Architects



Artist's impression of Collaboration Spaces. The Tahir Foundation Connexion is seen as a central learning hub within the SMU campus, with extensive informal learning zones complementing formal learning spaces. Collaboration spaces strategically located on levels 3 and 4 are designed to have different sitting configurations and settings to suit a variety of uses. The strategic location of open staircases facilitate inter-floor connectivity and provide opportunities for chance encounters and exchange, so as to foster community-bonding and strengthen the spirit of collegiality and collaboration.



“With every new development project in our city campus, we have tried our best to raise the bar in sustainability. With its many ‘firsts’, and the advanced green features and technology integrated into its design, the distinctive Tahir Foundation Connexion building represents SMU’s commitment towards improving our environmental footprint as we build a smart, green and sustainable campus.”

– Mr Sundaravadivelan Selvam, Vice President, Office of Campus Infrastructure and Services at SMU

500 square metres will also be set aside as incubation spaces for start-ups to provide an environment that fosters innovation and entrepreneurship among SMU students and alumni.

Aside from being the city centre's first large-scale Mass Engineered Timber (MET) development, the building is also its first On-site Net Zero Energy Building, being self-sustainable with its own power generated from a photovoltaic system located within the same building. The building also boasts many green features and technologies, including an advanced passive displacement cooling, smart LED lighting and predictive smart building control systems.

The Tahir Foundation Connexion is designed to meet the International WELL Building Standard as well as the BCA Green Mark Platinum certification, the latter of which SMU successfully achieved in May 2019. Three other projects – the SMU City Campus, SMU Administration Building and SMU Prinsep Street Residences – also won the Green Mark Platinum awards. With these latest accolades, the University has achieved 100 per cent Green Mark Platinum status for its entire campus.

PROJECT DATA

Project Name: Tahir Foundation Connexion
Location: Singapore
Client: Singapore Management University
Architect Firm: MKPL Architects Pte Ltd
Area: 8,600 square metres
Completion: End 2019
Photos: © Singapore Management University



Photo: © Dianna Snape

Monash University – Civil Engineering Hydraulics “Living Lab”

ASPECT Studios collaborated with DesignInc and Irwinconsult on a refurbishment of Monash University’s Hydraulics Laboratory, for the Faculty of Civil Engineering.

The overarching objective of the project was to transform the Keller Hydraulics Laboratory into a living laboratory, showcasing specialised bio-filtration and water treatment systems to industry, peers, researchers, and the general public.

The 'Living Lab' is a flexible platform for testing technologies required to create a water sensitive city. It showcases Monash University's outstanding research and

demonstrates the motivation for water harvesting and recycling.

The project includes living elements including green roofs, green walls and a green facade – making the facility a truly living laboratory. The primary design move was the introduction of a living scaffold to the curtilage of the existing building. This new green facade acts as a visual manifestation of the research ambitions of the faculty.

There are also a number of green walls and vertical gardens, which have been integrated within the envelope of the existing building. These are both the research green walls that allow for the collection and sampling of the irrigation discharge, and which can be interchanged and modified to suit a range of research agenda, as well as to the public realm demonstration green walls which are permanent state of the positive visual amenity that green walls can provide.

The facility includes a green roof that has been designed to test the water quality improvement function of shallow profile roof gardens to not only verify storm water improvement performance of such systems, but also showcases the possibilities of implementing living architecture to the broader design and construction industry, and community.

Also included in the project is a series of ground level rain gardens that demonstrate the WSUD objectives that should be encouraged on all urban projects in order to manage storm water impacts within our cities. Coupled with this is an array of permeable pavements to showcase how these useful WSUD elements look and perform within public spaces.

Primary to the purpose of the project was facilitating a framework for the display and application of research into biofiltration and water treatment systems. The building and landscape have been designed together to allow an adaptive, expandable research platform for the Faculty of Engineering.

PROJECT DATA

Project Name: Monash University – Civil Engineering Hydraulics ‘Living Lab’

Location: Monash University, Clayton Campus, Clayton, VIC, Australia

Client: Monash University

Landscape Architect: ASPECT Studios

Project Site Area: 845 square metres

Completion: 2017



Photo: © ASPECT Studios



Designing for climate change

Architects across the world share their thoughts on the impact of climate change on building design.



ALEXANDER CHNG

Senior Architect, BDP

Attmann's book "Green Architecture: Advanced Technologies and Materials" published in 2010, he observed that buildings contribute close to almost half of all greenhouse gas emissions, energy consumption, and raw material use in the world. The impact that climate change has on architecture is inextricably linked to buildings being a major source of contribution in that process. As a means to address these consequences, it is essential for architects to re-evaluate and balance the relationship between designing buildings to achieve client's demands as well as our duty to care and be responsible as contributors to the environment.

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

ALEXANDER: We have already started to experience the adverse effects of climate change as the weather is increasingly warming up across the globe. According to the Meteorological Service Singapore (MSS), Singapore is close to one degree Celsius warmer today in comparison to the 1950s and the city-state is warming up twice as fast as the rest of the world – at 0.25 degrees Celsius per decade. In Osman

SEAB: How does climate change affect the design of buildings?

ALEXANDER: Climate change alters people's choices in using public and building spaces. In Singapore, with rising temperature coupled with high humidity, there is an inclination for people to seek comfort in sheltered spaces within buildings or even underground spaces. During daytime, there is a tendency for people to avoid open public places such as parks arising from the warm and humid weather. This is unlike the

past, where people would gather at open public spaces to enjoy the sun, wind breeze and have picnics. Open park spaces and social gathering spaces will inevitably be redefined and possibly be integrated within buildings arising from the adverse effects of climate change. Looking ahead from a city planning scale, I think that more public spaces will be integrated within building landscape due to the provision of shelters and technologies that can afford to provide comfort to building occupants. More so, it is possible that more controlled-climate environment such as underground spaces will be developed for leisure use to replace on-grade parks as the heat becomes unbearable for people to use and enjoy it. In this regard, public spaces will be increasingly housed within interiorised environment and how we design these interiorised environment to encourage people to enjoy the use of these spaces while including elements of park such as greenery, daylight and even natural wind breeze will be a challenge in the design of buildings.

SEAB: How can architects take action on climate change?

ALEXANDER: In an article written by Ned



BDP's Eco-housing project in Nanjing has sustainable elements embedded into its architectural form. Completed in 2012, the apartments are designed with full height louvered triple glazing on the balconies to the south east elevation. These balconies offer a changeable and dynamic representation of the passive design philosophy, allowing free flowing natural ventilation via the open louvers or when closed acting as passive solar winter-gardens depending on the seasons. With this, the design achieved an estimated annual heating energy demand of 0.95kgCO₂/m², which outperforms the energy performance of the best European low-energy residential building (such as Passivhaus) and challenges the forthcoming UK zero carbon homes standards. Photo: © BDP & Terrence Zhang

Cramer that was published in 2017 by the Journal of the American Institute of Architects, Cramer noted *"that buildings consume some 40 percent of the energy in the U.S. annually, and they emit nearly half of the carbon dioxide (CO₂), through greenfield development, cement production, and the burning of fossil fuels such as oil, gas, and coal."* Quoting Cramer – "More critically, because CO₂ traps solar energy in the atmosphere, thereby heating the planet, it is the chief agent of climate change, making buildings – and by association, the architecture profession – profoundly responsible."

As architects, we initiate the design, curate the building materials and oversee the construction processes. In both Attmann and Cramer's articles, they have rightly pointed out that architects have a significant role in combating

climate change and this should not be overlooked. As architects, one approach to address this issue is to design buildings to be more energy efficient through passive design strategies. One example is BDP's Eco-housing project in Nanjing, which was completed in 2012. The apartments are designed with full height louvered triple glazing on the balconies to the south east elevation. These balconies offer a changeable and dynamic representation of the passive design philosophy, allowing free flowing natural ventilation via the open louvers or when closed acting as passive solar winter-gardens depending on the seasons. With this, we were able to deliver a design to achieve an estimated annual heating energy demand of 0.95kgCO₂/m², which outperforms the energy performance of the best European

low-energy residential building (such as Passivhaus) and challenges the forthcoming UK zero carbon homes standards.

Closer to home, the Building Construction Authority (BCA) has put in place policies that encourages the construction industry to adopt the use of environmentally-friendly materials such as Mass Engineered Timber. According to the BCA, this will help to reduce the carbon footprint and net carbon emissions compared to steel or concrete buildings.

With innovative technologies that are constantly introduced into the construction industry, I believe that architects can be initiators and agents in the adoption of these technologies and hopefully, contribute in our ways towards combating climate change.



T. COSTON DICKINSON

Designer II, Portman Architects

as temperature, humidity, atmospheric pressure, wind, and precipitation. The characteristics of these variables change according to their location: latitude, terrain, altitude, and proximity to water bodies. Thus, the climate is always changing.

The extent to which man-made climate change exacerbates the impacts on architecture has to do with increased variability and intensity of weather phenomena calamities also known as natural disasters. Man's artificial unbalancing of the climate caused by actions like expanding urban sprawl development, increasing resource consumption, and emission of pollution like unnatural levels of greenhouse gases, increases the unpredictability of climate patterns as well as the frequency of extreme weather. Therefore, it also increases the vulnerability of the existing infrastructure and buildings we currently live in making people and society more susceptible to catastrophe. The potential impact on architecture is unprecedented structural and building system failure as most existing buildings were not designed to withstand super storms

and extreme weather conditions. As weather patterns become increasingly unpredictable in the future, it will be up to architecture to serve as a threshold for adaptability and resilience.

SEAB: How does climate change affect the design of buildings?

COSTON: The most essential function of architecture is shelter or a structure that provides protection from the local environment and its climate conditions. Therefore, architecture has always been impacted by climate and so been in dialogue with this context.

However, as these climate conditions continue to increase in severity, architecture will have to return to its roots of both structure and function and reconsider sustainability not as a luxury, but as an imperative. The design of buildings will increasingly have to be conceived and constructed in a manner that symbiotically integrates them with nature from the project's inception rather than as an afterthought. The optimal way to start a climate responsive design is for the architect to gain a deep understanding of the physical location's

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

COSTON: Climate is scientifically defined as the statistical description in terms of the mean and variability of relevant quantities over a period ranging from months to thousands or millions of years. The general definition for climate is "average weather patterns over time" and is commonly measured through meteorological variables such

environmental data: sun, wind, light, and rainfall. Likewise, the process of architecture's construction coupled with knowledge of its materials will have to be adaptive, responsive, and resilient.

Architects will increasingly have to take careful consideration of the process by which and the quantity of resources a design scheme consumes. Elements of green design like energy conservation, water and resource efficiency, reducing waste, pollution, and environmental degradation, and protecting the health and well-being of its occupants, will become baseline standard practices. Great design in the future will be based on the ability of architects to utilize design thinking to best adapt their buildings to the extreme conditions of the future as well as facilitating the improvement of health and productivity of its users. Therefore, the integration of climate data and metrics as a driving factor in the design of new buildings and the renovation of existing buildings will be key to making them more adaptive and resilient to extreme conditions.

SEAB: How can architects take action on climate change?

COSTON: There are two primary ways architects can take action on climate change. The first is by utilising what we are trained to do: problem solve with design thinking. This can be applied to the design process itself. By reversing the traditional design process and beginning a project with climate data rather than conceptual sketches, architects can start to effectively implement resilient integrative design. According to the Rocky Mountain Institute, buildings account for 35 percent of the energy consumed globally, 60 percent of the electricity consumed globally, and 39 percent of the carbon emissions in the U.S. That means that the existing buildings in which we live, work, and play are some of the primary culprits and threats to our climate. Therefore, the least that architects can do is make sure that all their designs going forward strive toward achieving a net-zero impact.

However, bold architects stand to lead and make the greatest change by taking action to design buildings that not only reduce or offset impact but begin to reverse impacts. Architects on the leading edge of sustainable



Designed by Portman Architects, Coda at Tech Square is a signature mixed-use office, computing centre, and retail complex, with the Georgia Institute of Technology as its anchor tenant. The complex is programmed around high-performance computing (HPC) modeling, simulation, and an innovative ecosystem – integrating the existing complex with new opportunities in interdisciplinary research, commercialisation, and sustainability. Photo: © 2019 The Portman Archives, LLC, photo by David Naughton

technology and practice are challenging the traditional building paradigm by employing regenerative design. Regenerative, adaptive, or living buildings as they are being referred to are aiming to not only integrate symbiotically with the natural environment, but are designed to actively restore and enhance local ecology such as remediating a site's natural hydrology or regenerating damaged or displaced plants, soil, and wildlife habitats. Also known as "net-positive," these regenerative buildings are designed to produce more than they consume. They produce more energy

than they consume and share or sell back the excess. They capture and treat more water than they consume and either share the excess or recharge local aquifers. They create opportunities for urban agriculture with green roofs or vertical farms. Regenerative buildings passively sustain themselves and actively revitalize the conditions around them. Some of the principles of regenerative and integrative design include: utilizing free energy to let nature do most of the work; finding multifunctional solutions to multiple problems; employing complementary systems to increase

resiliency; optimizing the system design over individual parts; creating closed-loop cycles; managing storage of natural capital (energy, water, waste, nutrients, etc); employing appropriate technology and scales; and working to shift attitudes by evolving the understanding of those involved in the industry. By utilising these methods, architects can greatly increase a building's resilience allowing them to quickly adapt and recover from extreme weather.

This leads to the second way architects can take action: by educating fellow practitioners, financiers, and the clients they work with. Many architects have been talking about these problems

and their solutions for decades yet have not been heard until recently as society has no choice now but to listen. The knee-jerk reaction is to have governing bodies dictate how the building industry practices and mandate sustainable practices going forward. In my estimation, that will be too little too late. Therefore, the key to educating the remaining naysayers is by articulating the financial advantages of green design. By integrating energy performance as cost savings, employing resilient design as risk mitigation, and developing more productive landscapes to accumulate greater returns, architects can best articulate

how the perceived cost of sustainability is embedded insurance by design and therefore a method to reduce future expenditure. If architects constantly reiterate to clients, developers, and financial institutions the cost-benefit of improving technical efficiency and passive design techniques, then they can fuel the wide-spread adoption of green design as well as an urban environment that works with people to actively reverse climate change. As more practitioners in the building industry learn about the financial risk that climate change poses, it will be up to architects to lead the critical transition to a low-carbon future.



JOY GAI

Principal Engineer, Sustainability Design, Surbana Jurong

pollutions. Architecture elements such as fins, shading devices, windows, as well as the roof can be utilised.

With limited energy resources around the world, energy efficiency is core for sustainability. Buildings can be designed to be an energy hub to generate renewable energy and depend less on energy from the grid. An example is Surbana Jurong's new global headquarters under construction, Surbana Jurong Campus, which has recently been awarded the Green Mark for Super Low Energy by the Building and Construction Authority of Singapore. The Campus utilises solar photovoltaic technology which will yield around 340MWH of renewable energy annually. Rain gardens and bio-swales will also be adopted to enhance the efficiency of water usage. Sustainable technologies such as smart lighting control, an underfloor air-distribution system, and predictive smart building controls (such as live energy and water management dashboards) will also be incorporated.

SEAB: How does climate change affect the design of buildings?

JOY: In the face of global climate change and diminishing natural resources, designing today's cities and buildings

require environmental, economic, and social considerations. We are seeing more climate adaptive buildings being developed in response to the variability of our environment. The aim is to create a comfortable living environment while reducing the ecological impact and energy consumption.

A climate responsive design in building considers climatic parameters which have direct influence on indoor thermal comfort and energy consumption in buildings. These approaches include the use of Building Integrated Photovoltaic (BIPV) materials, mixed-mode ventilation systems, stormwater recycling through landscapes and more.

More cities and buildings are also built for resiliency, to prevent damage or to plan for quick recovery back to normalcy following a natural disaster shock. Architects are now able to utilise simulation tools to inform designs. For instance, for instance, Surbana Jurong's Flood Resiliency Analysis tool leverages digitisation concepts to help cities withstand flooding threats by precisely targeting existing and future flooding hotspots, validating effectiveness of solutions and quantifying flood risks.

SEAB: How can architects take action

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

JOY: With buildings accounting for nearly 40 percent of global energy consumption, the building sector should play a key role in effective climate policy. A good building design should always take full advantage of the prevailing natural forces such as wind, temperature and sunlight, to be sustainable and ecologically sensitive.

In tropical climates, buildings should be designed to maximise daylight and natural ventilation while minimising heat gain, glare, noise, rain splash and outdoor



Surbana Jurong Campus was recently been awarded the Green Mark for Super Low Energy by the Building and Construction Authority of Singapore. Photo: © Safdie Surbana Jurong

on climate change?

JOY: Through utilising an effective mix of passive and active design and technologies coupled with smart use of sustainable materials, architects can play an integral role to address climate change. Architects are often seen as the lead in a multi-disciplinary team and when the leader of the team designs sustainably and responsibly, the rest of

the design and management team will follow suite.

Being the lead in the design process, having an open mindset on sustainable design is key to driving a successful project. Through intensive climate responsive design analysis, effective feedback should be captured and integrated into the Architecture and Engineering systems, with both passive

and active design considerations in mind.

Early engagement with the Sustainability Design team through design charrettes, regular feedback and engagement with the Clients are also important steps to ensure the alignment of the sustainability vision as we take projects from concept to reality.



CHAD OPPENHEIM

Principal, Oppenheim Architecture + Design

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

CHAD: We will need to rethink our relationship with the site and landscape. Areas that were previously inhabitable will now become inaccessible. Entire new typologies will emerge. We will need to plan for buildings that are more resilient to survive the imminent crisis while offering solutions that help diminish our carbon footprint and reduce energy needs.

SEAB: How does climate change affect the design of buildings?

CHAD: The building industry is one of the most significant contributors to the carbon footprint. The design can be reactive to climate change – to shield the inhabitants from its effects. For example, by building on stilts to avoid flooding or using stronger structure and glass to resist hurricanes. But design can also be proactive – by offering solutions that limit the amount of energy consumed, and can even generate a positive effect.

SEAB: How can architects take action on climate change?

CHAD: Architects need to think about



these issues holistically – from the onset. By incorporating sustainability at the start of design thinking, we achieve more significant results and a mindset that can tackle the critical challenges ahead.

Oppenheim Architecture has designed a water treatment plant in MuttENZ, Switzerland. It gives greater civic transparency to source and process the making of clean drinking water – one of the most important resources. Photo: © Börje Müller



Photo: © Els Zweerink

BEN VAN BERKEL

Founder and Principal Architect, UNStudio

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

BEN VAN BERKEL: Climate change, densification, and digitization are three of the most pressing and challenging global issues that we are currently facing in architecture and construction; complex issues that not only ideally

need to be tackled in a holistic way, but the solutions for which should also be sought across all scales. The impact of climate change specifically has for some time presented a very real urgency, so the impact is already being strongly felt and solutions are being sought and developed at a rapid pace. The effect this has had on architecture in recent years has meant that architects are now integrating active and passive sustainable solutions, along with new technologies and products, into their designs – in addition to adopting circular strategies with respect to material use and incorporating flexibility and resilience. At UNStudio and UNSense, in collaboration with external experts, we have even gone so far as to develop and bring to market two new products that can be scaled-up for use by other architects. (See further details in Q3.)

SEAB: How does climate change affect the design of buildings?

BEN VAN BERKEL: Most significantly,

climate change has led to a pervasive mindset that has taken the focus away from the 'image' of architecture and onto the performance of buildings. Climate change has brought about a shift in emphasis, which has meant that designing buildings now involves considerations that were not deemed to be necessary as little as twenty years ago. These include active and passive strategies to reduce CO2 emissions and sustainable, circular approaches to design. But when we move on to the city scale, these strategies become even more complex, as then we have to consider underlying or connective systems, such as waste management and sustainable forms of mobility.

SEAB: How can architects take action on climate change?

BEN VAN BERKEL: On the whole, it has to be a joint effort. Architects, designers and urban planners need to work alongside innovative developers, city councils and teams of experts from different



Socio-Technical City, urban vision for the 'Central Innovation District' (CID), The Hague, NL, 2018: The concept for the Socio-Technical City by UNStudio answers two of the biggest challenges facing cities - urbanisation and sustainability, and investigates how an area like the CID can become self-sufficient and energy-neutral, despite extremely high density in the future. Image: © Plompmozes

fields to find and test real life, integral solutions to current challenges in the built environment.

As architects specifically, we not only need to incorporate active and passive measures related to energy efficiency and material use at the time of construction, we also need to design future-proof buildings that can withstand change and thus have a long lifespan. It is not only about resilience in terms of strength, but is connected to all kinds of new regulations and values that we give to buildings today, such as circularity (the potential to re-use materials) and energy transition. But it is also related to concepts of flexibility in the design which enable the building to

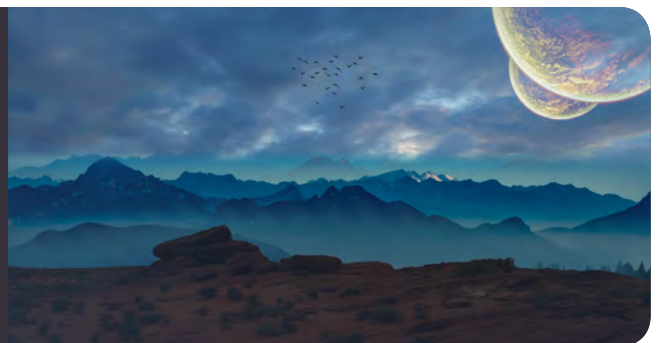
be re-purposed if necessary in the future, and at minimal expense. At UNStudio we have a Futures Team that, rather than focusing on these pragmatic solutions, are in fact tasked with forecasting how changes within society may affect certain building typologies and our cities in the future.

This enables us to design very much with the future in mind. In addition, by partnering with industry leaders, we are also in a position to design on a smaller scale; to supply the combination of a product mindset, engineering know-how and a strategic vision for building technologies that enable the development of new products that can be up-scaled for widespread

use. For instance, at UNSense we recently launched a new bespoke, integrated photovoltaic cladding system (Solar Visuals) that will make it possible to harvest energy from every facade of a building, rather than just from traditional roof panels.

Our research team at UNStudio also recently joined forces with Monopol Colors, the paint specialists from Switzerland, to develop 'The Coolest White', an ultra-durable paint with a Total Solar Reflectance value that sets entirely new standards. This new paint, more than any other, can protect buildings and urban structures from excessive solar radiation - thus slowing down the urban heat island effect.

“The greatest threat to our planet is the belief that someone else will save it.”
— Robert Swan





TRAVIS SOBERG

AIA, LEED AP, Principal, Goettsch Partners

we have not begun to fathom. In this way, climate change is not unique; it joins a broader spectrum of variables that influence and inform our vision of the future. The embodiment of these considerations, and our prioritisation of their importance, defines our reaction to their influence and creates an architectural character uniquely of our time.

SEAB: How does climate change affect the design of buildings?

TRAVIS: As the forces of climate change become more extreme, it is increasingly important that we are sensitive to its impact on the environment and the buildings that we design. By the definition of climate change, buildings now need to anticipate an environmental evolution, developing an adaptive relationship to their context. It seems unlikely that the philosophy of the recent past in which we attempted to control and harness nature will prove to be successful. Instead, we see a future that

embraces a multi-layered approach of natural environmental integration and technological innovation, where one supports the other, in an adaptive and transformative balance.

SEAB: How can architects take action on climate change?

TRAVIS: It is no longer enough to reduce our ecological footprint by minimising our consumption and destruction of natural resources. While we must continue to be vigilant in these efforts toward a sustainable future, we must also recognise that we are unsure what that future will look like. Evolving climate conditions mean the world we know today will not be the one we inhabit tomorrow. Yet in every challenge there exists the opportunity to craft a better outcome than the one before us. As architects, we have the capability to embrace the challenges of a changing climate and provide the leadership and vision for what a more environmentally engaged future might look like.

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

TRAVIS: While the initial effects of climate change are becoming more clear, the full impact of its potential has yet to be understood. Indeed, climate change will continue transforming our understanding of the world in ways



The North American headquarters of Swiss-based Zurich Insurance Group, designed by Goettsch Partners, features many green features and it is certified LEED Platinum. Photo: © James Steinkamp Photography, courtesy Goettsch Partners



Photo: © NAARO

BIDISHA SINHA

Senior Associate, Zaha Hadid Architects

the steel industry, substituted up to 70 percent the cement in the concrete of the London Aquatics Centre. Additionally, over 80 percent of aggregates used in the building were from a recycled source, contributing to achieving over 4,000 tonnes of embodied CO2 savings. Sustainable transport processes also eliminated over 20,000 vehicle movements during the centre's construction.

SEAB: How does climate change affect the design of buildings?

BIDISHA: Architecture can offer solutions in the design of buildings that will, throughout their life cycle, enable all of its users to contribute to a much more ecologically sustainable society.

We can now create buildings that optimise their environment to meet the specific requirements of their users, as well as changing weather patterns, at any given moment. We also continue our ongoing research into materials, design techniques and construction methods that bring significant environmental benefits.

We must continue this progress – marrying the ongoing advancement of effective design and operational systems with the incredible advances in ecologically sound materials and construction practices. We must not look only at the disparate parts, but

understand them as a whole to deliver solutions to this defining challenge of our era.

SEAB: How can architects take action on climate change?

BIDISHA: Processes that embed sustainability into the design, procurement, construction and operation of a project can be established that adopt a hierarchical approach: initially limiting the need to consume resources; where resources are required, minimising their consumption; and finally offsetting any consumption of resources through the harvesting of renewable systems.

Client/contractor/design team relationships must be wholly integrated; maximising opportunities to improve systems that prioritise environmental issues, yet also deliver cost-effective sustainability.

Through stakeholder engagement, specific sustainability targets throughout the supply chain can be established at the start of procurement, and include sustainability in all subsequent tender activity. The collaborative approach to material selection and its supply chain can significantly influence the ecological sustainability of any construction.

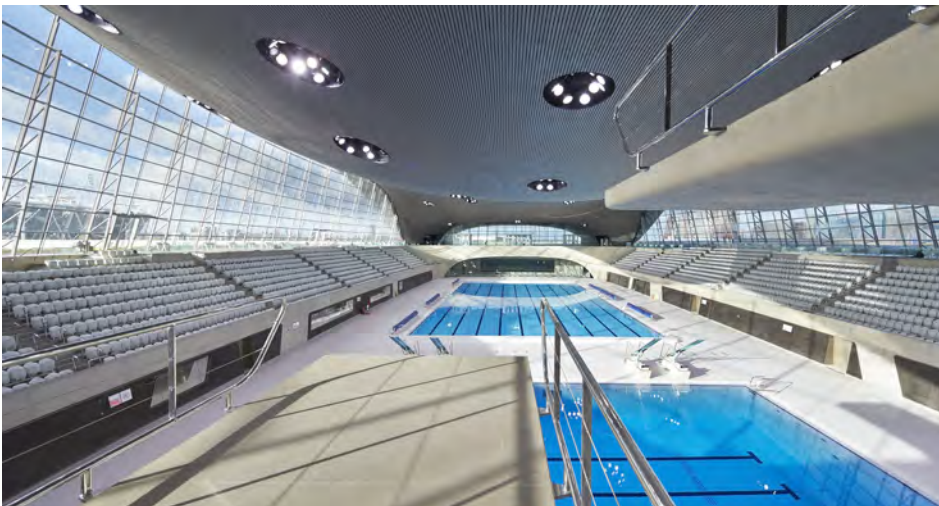
By simplifying the sustainability agenda with understandable action plans, it becomes accessible to every member of the team, encouraging ownership and accountability – which inspires everyone involved to participate and contribute to a more sustainable built environment.

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

BIDISHA: Climate change awareness will have a direct impact on how we design and construct our built environment and architecture will need to adapt. As the development of active and passive approaches to sustainability come together, we are beginning to find solutions to urgent ecological challenges we face today.

Converting waste from being something that is a consumptive by-product of society to something that can be core to society's future will be critical.

Ground granulated blast-furnace slag (GGBS), a waste by-product of



The London Aquatics Centre, designed by Zaha Hadid Architects, is a concept inspired by the fluid geometry of water in motion, creating spaces and a surrounding environment in sympathy with the river landscape of the Olympic Park. It has many sustainable features and has achieved BREEAM Innovation Credit. Photo: © London Aquatics Centre by Zaha Hadid Architects, Photograph by Hufton+Crow



Photo: © SUTD

PROF ERWIN VIRAY

Head of Pillar, Architecture and Sustainable Design, Singapore University of Technology and Design (SUTD)

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

ERWIN: Climate change does not only affect architecture, but also the environment and our lives. It is an existential challenge. Architecture, being the profession that creates the space, the places, the environment we are in, is greatly affected. It is a mindset that looks at how we live our lives, and develop practices to improve that life, space and environment, creating a better world.

SEAB: How does climate change affect the design of buildings?

ERWIN: Architects have to be mindful of sustainable ways to create the built environment. The spaces we have, that become places where we live, are not created in a vacuum, but with materials and conditions that already exist. So architects must be aware of the materials used, the methods of construction, etc. Architects also have to keep in mind the welfare of people and the environment while creating spaces and places.

One guide that architects can keep in mind is the United Nations Sustainable Development Goals (www.un.org/sustainabledevelopment/sustainable-development-goals) notably,

- Goal 9 (Build resilient infrastructure, promote inclusive and sustainable

- industrialisation and foster innovation),
- Goal 11 (Make cities and human settlements inclusive, safe, resilient and sustainable),
- Goal 12 (Ensure sustainable consumption and production patterns),
- Goal 17 (Strengthen the means of implementation and revitalise the global partnership for sustainable development)

In being mindful of sustainability, architects are mitigating the environmental impact of buildings. Increasingly, the trend gravitates towards net zero-carbon buildings where the built environment pledges to both reduce energy demand and achieve net zero carbon emissions. What this also means is a commitment to high energy efficient buildings that are fully powered by renewable energy sources. The challenge for architects then is to create smart designs, bearing in mind the profile of the building's energy use, while minimising its carbon footprint.

SEAB: How can architects and academicians take action on climate change?

ERWIN: Architects and academicians, in fact, all of us, can take action on climate change starting with our everyday practices; our mindset: are we considerate of others and our environment – are we being sensitive and responsive; how we live our lives – the food we eat (where does it come from, how is it produced), our consumption patterns (our carbon footprint), etc.

It is as simple as being mindful of:

- do I consume responsibly,
- do I consider recycling some of the things I consume and use, etc.
- And as mentioned in goal 12 of the UN sustainable development goals, we should remember that more things are possible when we collaborate with others.

At the university level, it is the conscious conversations on climate change, on sustainable ways and means, that are the staple of discussions, and the subjects of investigation in student projects and faculty research.

A case in point is the Orangutan Haven studio project led by SUTD's Architecture and Sustainable Design (ASD) pillar, in collaboration with Future Cities Laboratory and the Sumatran Orangutan Conservation Programme. The project explored new integrated sustainable strategies for the design of critical infrastructure to house Orangutans as part of a species conservation effort. In advocating sustainability, bamboo, a sustainable material, was chosen as the primary resource to work with in our design interventions.

In yet another example, a thesis project on flooding in Jakarta inspired the conversation of sustainability through landscape urbanism. Landscape urbanism allows one to use landscape as an infrastructural device that operates both in urban and architectural experience, and as explored in the project provides a solution to flooding through carefully planned planting and phytoremediation strategies as well as promoting urban forestation.

We try to live consciously – a sustainable life, in our studies and explorations. At SUTD ASD, we put these sustainable goals into practice by raising awareness of these issues through studio investigations such as upcycling in Architecture of a Circular Economy studio and shared economies and resources in Shared Opportunisms studio. Conscious efforts have also been taken to research on and use sustainable materials; for instance, the use of bamboo in project Sombra Verde's 3D Printed Bamboo Structure (<https://airlab.sutd.edu.sg/2018/03/15/sombra-verde>).

Besides a sustainable living mindset,



The Orangutan Haven studio is a project led by SUTD's Architecture and Sustainable Design (ASD) pillar, in collaboration with Future Cities Laboratory and the Sumatran Orangutan Conservation Programme. The project explored new integrated sustainable strategies for the design of critical infrastructure to house Orangutans as part of a species conservation effort. In advocating sustainability, bamboo, a sustainable material, was chosen as the primary resource to work with in our design interventions. Photo: © SUTD

smart tools (computing capabilities) can also aid architects by opening up possibilities for greater precision in crafting the built environments. Through data analytics, we can better understand the conditions we are working with

and respond in informed ways, with robotic tools and digital capabilities - we are able to design, simulate and project the effects and consequences of urban solutions offered to the city and the environment. SUTD's focus in

humanities, arts and social sciences as well as cross disciplinary collaborations also enables us to comprehend people, the flow of history, and the processes, helping us to create a better world by design.



Photo: © KPF

CARLOS CEREZO DAVILA

Senior Associate Principal, Kohn Pedersen Fox Associates PC

variability, etc. have direct impacts on how we design buildings and cities, which will become only more pressing as the century advances. As stewards of the built environment, among our most profound duties are to ensure longevity in established communities and defray land and resource degradation. Both IPCC's 5th Assessment Report and 2018 Special Report on Global Warming highlight the critical role of architectural design and construction in both mitigation and adaptation, and a widespread theoretical shift in our discipline towards climate responsibility is already redefining how architects interact with our clients and partners. Climate risks related to flooding are already redefining real estate values, and the carbon caps and fines introduced by NYC last April are

putting in question otherwise extremely profitable properties built in the 60s and 70s, and creating new markets for building retrofits.

The buildings we design will have to minimise their energy use and material related emissions significantly to avoid the most challenging warming scenarios. Cities like NYC or London, and professional institutions like AIA are introducing policies that expect buildings to become carbon neutral by 2030, which will fundamentally change how we practice. We will need to design structures capable of accommodating more frequent heat waves and emergency conditions. Architecture will also be required to rethink how individual buildings participate of larger urban energy systems. We already know that through

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

CARLOS: The effects of climate change on the environment such as global warming, sea level rise, weather

rooftop solar panels we will never have a carbon-neutral built environment, and that it is only through a smarter, cleaner electric grid that we can aspire to net-zero carbon buildings by 2030-2050. To enable this transition, buildings need to become active hubs where energy is stored, produced or controlled at a larger scale, bringing a new area of inquiry for design.

Finally, the question of climate equity – who will bear the costs of the change – is becoming more relevant every day, which will directly affect our designs. We need to ask: do they put occupants at risk in the future? Do they force a retrofit in 20 years for lack of preparation in systems? Will they increase urban heat and flooding risks around? Architects' responsibility over their work's long-term performance will have a significant impact on practice.

SEAB: How does climate change affect the design of buildings?

CARLOS: Climate change requires architects to think in the longer term, and move from the question of "how efficient or how comfortable" to "for how long." Although it does not change the fundamental drivers in the design of a building, because a good building uses resources effectively and delivers a healthy and safe environment, it adds a very important layer of urgency and complexity to our work. In the context of global warming, this means designing for thermal survivability now and in 50 years, by creating robust façade solutions that allow for passive ventilation cooling and control solar exposure. In the hot and humid climates of Southeast Asia, this thermal resilience will protect occupants in the event of a blackout or a storm. In a more temperate context where space cooling might not be necessary today, it postpones the need for a building to depend on mechanical systems further in the future. This is a key principle in the design of KPF residential projects in London, or our commercial offices in California.

It is of course not only a question of temperature, and as sea levels rise through the 21st century and extreme weather events become more frequent, the base assumption of infrastructure reliability in our designs need to change



Since the aftermath of Super-storm Sandy in NYC, KPF has been working with NYCHA to envision a new urban infrastructure paradigm for the Red Hook Houses project, in which all shared critical urban systems and public spaces are elevated and conceived to protect the resident in future flood conditions. Photo: © KPF

as well. Since the aftermath of Super-storm Sandy in NYC, KPF has been working with NYCHA to envision a new urban infrastructure paradigm for the Red Hook Houses project, in which all shared critical urban systems and public spaces are elevated and conceived to protect the resident in future flood conditions.

From a mitigation perspective, this means only building when necessary, and revisiting existing structures in order to minimise lifecycle embodied carbon of materials. We need structures robust enough to accommodate the programmatic and environmental changes we already see coming. KPF's recent adaptive reuse of 390 Madison, an office building in Manhattan is a great example of how density can be increased while reusing existing resources and improving thermal façade conditions. Some of these ideas reflect established understanding, but probably the largest changes in the way we design buildings will appear in unexpected places. How will increasing temperatures affect how a construction site is operated? How will we decide where to build safely? The cascading effects in the built

environment will give us new challenges in the coming decades.

SEAB: How can architects take action on climate change?

CARLOS: Architects have an incredible and exciting role to play in enabling a low carbon future and a built environment which can adapt to these new conditions. As discussed above, first and foremost we need to develop capabilities and partnerships to design, analyse, and create buildings with close to zero emissions, and capable of maintaining their performance in the long term. Our buildings can embody in a tangible way the goals that we need to achieve as a society, but that will take decades to materialise at a larger scale.

But, given how central the built environment will be in our global response to climate change, we have the responsibility to take action in other ways as advocates, consumers, and innovators. As mediators between our clients, municipalities, consultants, etc. we have to make sure they understand the consequences of our design decisions, and bring to the table challenges and technologies that

they might not have considered. This disciplinary role has been recognised by professional organisations, including the AIA through its code of ethics.

At KPF, helping our clients measure their climate-related impact is a key task for our Environmental Performance (EP) team which uses building performance simulation tools to quantify energy use, carbon emissions, and thermal comfort, both in current and future weather conditions. For example, in the context of NYC and its new emissions law, we advise our clients to rethink the timeline for the

retrofit of existing properties, to help the city achieve its 2030 reduction goals. As consumers, we have the power to drive or support technologies and building products that minimise carbon emissions but are not yet mainstream in the construction industry. We are currently developing a low carbon cross limited timber (CLT) structural solution for a commercial office building in the US, contributing to make similar systems more affordable.

In addition to design work, our group is rooted in research and innovation,

another area where we as architects have a chance to take action by applying new technologies in our work. While working as a researcher at the Sustainable Design Lab at the Massachusetts Institute of Technology (MIT) I had the chance to assist municipalities in the US and abroad to analyze their existing building stock by developing new urban scale energy modeling methods. This and similar tools that the EP group continues developing within KPF can enable change at a large scale.



JONATHAN PILE

Director, The Oval Partnership

materials.

Renewables and smart technologies have their place, but there is no excuse for not getting the basics right first. They are free, require no special maintenance and are permanent. And generally speaking, passive design makes for better spaces.

SEAB: How can architects take action on climate change?

JONATHAN: There are many kinds of architects. Some were addressing these issues in the fifties and sixties long before environmental awareness became more widely understood.

Architects are, by the very nature of their vocation, optimists. We build for the future therefore we must have some belief in that future. But we are also realists, because the raw material of our art is stuff itself – tangible, mutable, entropic stuff. We also understand scale. And are capable of communicating complex ideas in simple, accessible ways.

So, because we walk this line between imagination and reality, we are in theory in a powerful position to influence change and win hearts and minds. Climate change may in fact be an opportunity to reassert the importance and true value

of good design in the built environment, encouraging durable, sustainable place-making after decades of cynical, short-term land speculation.

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

JONATHAN: It might make it better.

SEAB: How does climate change affect the design of buildings?

JONATHAN: It should focus the mind across the board, from inception and briefing through design to implementation, occupation and post-occupancy monitoring.

In terms of design I believe the most important matters are initial briefing (Is the building even necessary? Is it in the right place? Who is it for? What is the design-life of the building? Is it flexible and adaptable to future change?) and passive design – form, orientation and



"Innhouse" is an eco guest house project in Kunming, China, designed by The Oval Partnership. Photo: © The Oval Partnership



Photo: © LMN Architects

SAM MILLER

Partner, LMN Architects

are the system weaknesses that contribute to vulnerability such as aging infrastructure or poor planning. Using a recent example, Hurricane Sandy was the shock and many buildings with their electrical infrastructure in their basements was a stressor.

We can't eliminate shocks but we can design to improve the stressors. One particularly interesting consideration is that social networks are an important part of the resilience of a community and better functioning neighborhoods are more capable of withstanding difficulties.

SAM: Architects can and should play a leading role in addressing climate change. Our training to resolve complex, multi-disciplinary problems is well suited to the challenging issue of climate change. I believe that advocacy is the most important approach – advocating with our clients for higher project performance goals; advocating with our consultant and contractor partners to advance best practices with the industry; and advocating with public officials to legislate more stringent codes and standards. One project won't solve the problem, but one architect can make a large difference in the fight against climate change.

SEAB: The climate is changing. What kind of potential impact does it have on architecture?

SAM: While it is imperative that architects continue to do everything possible to reduce the carbon footprint of our projects, it is clear we are already experiencing climate change related impacts. Climate change is requiring us to design more resilient buildings and communities to provide safety and comfort through a wider range of weather and natural disasters. Depending on location, we are seeing greater extremes in temperatures, precipitation, wind, flooding, fire danger and drought.

SEAB: How does climate change affect the design of buildings?

SAM: Resilient design is a powerful approach that anticipates threats and incorporates mitigating strategies into comprehensive design solutions. These often include passive, place-based design approaches that allow for the building or community to withstand risks. One of the key principles of resilient design is to evaluate the shocks and stressors that threaten the project or community.

Shocks are triggering events like floods, fire or an earthquake. Stressors

SEAB: How can architects take action on climate change?



As LMN Architects celebrates 40 years of practice, the firm looks ahead to the future of architecture. For nearly two decades LMN has been involved in guiding the Seattle waterfront re-imagining efforts. The new Seattle Aquarium Ocean Pavilion, part of the waterfront design, will incorporate strategies for carbon reduction, water use reduction, and improved material selection towards improving ocean health, serving as a beacon for learning about the beauty of nature and the dangers of ocean acidification. Photo: © LMN Architects



Pump the future into your building systems

Global demand for green, smart and efficient buildings has grown significantly over the past decade and the construction industry expects the trend to continue. In line with the trend, KSB Singapore (Asia Pacific) Pte. Ltd. (a wholly owned subsidiary of KSB SE & Co. KGaA in Germany) is proud to have 31 Etanorm pump models certified with four ticks (Leader) rating under the widely endorsed Singapore Green Building Product (SGBP) labelling scheme.

In addition, 21 Omega pump models also received certification ranging from two ticks (Very Good) to three ticks (Excellent). These certifications have enabled KSB Singapore to market their pumps to the buildings and construction sector with proven sustainability performance to meet green building needs. Thereby, leading to higher acceptance level by the customers.

For decades, KSB have been supporting customers with dedicated project management experience globally with high level of technical expertise in pumps, valves and its related systems and services. The solutions recommended are tailor made to meet the specific project requirements. To participate in national landmark or iconic mega scale projects for the commercial building segment such as the Singapore Sports Hub and Jewel Changi Airport; where the highest standard in planning, design, construction and equipment supply are set, KSB's pumps such as the Etanorm and Omega rise above the crowd to gain recognition and acceptance for the projects' green building needs.

Key features of the Etanorm / Etanorm R pumps include:

1. High energy efficiency (in accordance with Commission Regulation 547/2012/EC, Etanorm has MEI \geq 0.7)
2. Energy saving
3. Operational reliability
4. Diversity of variants
5. Versatility
6. Service-friendly



SGBP 2017-965
Selected models only

The Etanorm / Etanorm R pumps are suitable for handling clean or aggressive fluids not chemically and mechanically aggressive to the pump materials. Applications include water supply systems, cooling circuits, swimming pools, fire-fighting systems, general irrigation systems, drainage systems, heating systems, air-conditioning systems and spray irrigation systems.

Key features of the Omega pumps include:

1. High operating reliability
2. Low maintenance costs
3. Service-friendly design
4. Reliable sealing



SGBP 2018-1273
Selected models only



SGBP 2018-1272
Selected models only

The Omega pumps are suitable for handling pure, raw and waste water as well as seawater in air-conditioning systems, water works, irrigation and drainage pumping stations, power stations, industrial water supply, fire-fighting systems, marine and offshore engineering, general applications in the petrochemical industry and seawater desalination.

dormakaba for hotels: Security and convenience with integrated access solutions

From family-run guesthouses, hostels or resort complexes, right up to luxury hotel chains – wherever you go the guests expect everything they have at home, and usually more.

Individuality, unique design and quality are the fundamental factors that ensure guests feel personally valued.

Simply the way the door opens into the hotel reception says it all. A friendly welcome does not just come from the staff, it is also dependent on seamless interaction between convenience, design and technology.

Appeal to the guests' senses: keep check-in brief, use digital technology to control access authorisations. Get doors to open and close by themselves to ensure immediate relaxation. To achieve that, dormakaba will support you from the first planning step right up to full-time operation.

dormakaba's innovative access solutions let you organise and secure operations in different areas of your hotel facility.



Main entrance:
attractive entrance systems for access to the hotel.



Access management and administration:
an overview of all access rights for guests and staff.



Hallways and passageways:
security and accessibility in corridors and passageways.



Access to guest rooms:
electronic hotel fittings and locks – simple, secure and convenient.



Design and convenience for guest rooms:
enhanced comfort, thanks to contemporary room systems.



Spa and fitness studio:
exclusivity and flexibility with aesthetically pleasing access and room systems



Access control at the reception, to the conference rooms and staff areas:
reception, conference rooms and staff areas, systematically controlled



Access solutions for restaurant areas:
intelligent and flexible access systems for an enjoyable atmosphere.



Versatile accessibility:
barrier-free access solutions for a variety of requirements.



Service:
customized service packages from planning to maintenance of access systems.



Niagara 4 opens up new opportunities to achieve operational excellence

With nearly half a million instances worldwide, Tridium's Niagara Framework is quickly becoming the operating system of the Internet of Things. Its open API, open distribution business model and open protocol support give you the freedom to choose how you work, what you build and with whom you partner. Niagara enables you to connect and control devices, while normalising, visualising and analysing data from nearly anywhere or anything.

From buildings and data centres to manufacturing systems and smart cities, the Niagara Framework improves strategic decision-making, allowing for optimized performance and cost reductions that can help businesses be more competitive and more profitable. And with the release of Niagara 4 and the JACE® 8000 controller, the opportunity to achieve operational excellence is even greater than before.

Niagara 4 – Open for performance

Niagara 4 builds on the legacy of the Niagara Framework® in new and exciting ways. It is less reliant on browser plug-ins, faster and easier to use. Now end users can directly access, analyse and act on a wide range of operational data. A truly open framework, Niagara 4 delivers a variety of notable improvements to help businesses take full advantage of the Internet of Things, including advanced visualisation and new search, security and navigation tools.

Niagara 4 – Key features

- Modern UX framework and design language (HTML5)
- End users are able to easily customise dashboards
- Advanced charting and visualisation
- Data tagging
- Tag-based navigation
- Device templating
- Data cleansing capabilities
- Niagara station search
- Workbench workflow improvements



- Role-Based Access Control (RBAC)
- Pluggable authentication schemes
- Improved UI developer experience (BajaScript 2.0)
- Station templating
- Niagara AX to Niagara 4 station migration tool

JACE 8000 controller – A modular approach for global design

Optimised for Niagara 4, Tridium has created an all-new hardware platform: the JACE 8000 controller. This "next-generation" controller features a new global design that functions with legacy systems and has the ability to scale for future needs.

JACE 8000 controller – Key features

- Powerful Niagara 4 hardware platform with easy software upgrade capability
- Modular hardware design for fast and easy installation
- Tool-less installation
- Expandable with up to four option modules



- Native Wi-Fi capability
- 24VAC/DC – standard global power supply
- Standard open drivers included
- Easy to select the right capacity license
- Intuitive user interface
- Rich choice of different colors, materials and finishes for differentiated OEM brand identification

Tridium's native Niagara Fox protocol will work between the Niagara AX and Niagara 4 software systems, and the Niagara 4 software will work with any currently available JACE hardware.

Reliable, sustainable and efficient – The advantages of oil-free systems abound

Oil-free HVAC systems enable greater efficiency, lower costs, and increased reliability while keeping a step ahead of the refrigerant transition. In this article, we explain the benefits of going oil-free, and the advantages it presents to OEMs and end customers. *Text by Raymond Good, Global Oil-Free Applications Engineering Manager, Danfoss Cooling and Edward Rodriguez, Strategic Marketing Manager, Danfoss Cooling, Turbocor® Compressors. Photos provided by Danfoss*



Raymond Good



Edward Rodriguez

HVAC equipment developers face two urgent challenges: the transition to new, lower Global Warming Potential (GWP) refrigerants, and the need to significantly improve energy efficiency – especially under part-load conditions. Oil-free systems can offer short and long-term solutions for the increasing regulatory requirements. The primary goals are to minimise GWP and flammability while maximising efficiency when focusing on refrigerants and the long-term transition.

In this context, an oil-free system has many strengths; footprint, sound level, maintenance, and system complexity are all reduced; there's less risk of performance degradation and failure due to lack of oil-return, and the efficiency gains give a rapid return on the extra initial investment while lowering resulting emissions.

This article addresses the industrial and environmental drivers for going oil-free, refrigerant perspective, and what advantages can be had – including how oil-free technology is helping engineers to harness the potential of air-cooled and other more challenging HVAC systems.

The time is right for oil-free

At Danfoss, we created the world's first oil-free magnetic bearing compressor for the HVAC industry. But oil-free systems are only now becoming a truly mainstream option because they offer answers to some of today's most pressing challenges.

As global energy prices continue to rise, and warmer climates drive increased HVAC equipment demand, growing regulation requires new systems to become increasingly efficient – at both full and part loads. Danfoss Turbocor® oil-free centrifugal compressors feature variable speed, direct-drive, magnetic bearing technology.

This specialised technology helps reduce energy consumption, and crucially, cut operating cost across the

entire lifecycle.

Oil-free systems also help to address costs and risks around the switch to new refrigerants. The most promising medium-term prospects, like R513A, sit squarely in the technology's operating map, while compatibility with ultra-low-GWP options like HFO1234ze gives the opportunity to future-proof systems for the long term. Oil flushing and replacement is not required in oil-free systems which eliminates one more area of risk associated with refrigerant changes in oil lubricated systems.

Practical benefits in use

Two of the most significant cost factors with cooling systems are increasing energy consumption from performance degradation and maintenance, including component replacements. In a conventional system, parts wear, and performance degrades. With oil-free compressors, however, magnetic bearings have no contact and no deterioration in performance for the life of the compressor.

Another issue with traditional systems – especially in public environments and residential areas – is the sound and vibration HVAC equipment makes during operation. But with contact-free compression in an oil-free system, sound levels are dramatically reduced. There is also no need for attenuation equipment.

The advantages of going oil-free are significant

Oil-free systems reduce operating costs, especially in part-load conditions, as well as maintenance costs in all applications.

Applications in remote areas, where downtime can be catastrophic, will also benefit from significantly enhanced reliability.

We have identified four key advantages oil-free systems have over conventional oiled systems.



1. Refrigerant transition

The past couple and the next few regulatory changes will increase efficiency and change refrigerants to lower-Global Warming Potential (GWP) in every region. In parallel, the increasing pace of energy cost increases is also expected to continue in every region, corresponding to the related transition to lower emissions sources and increasing grid-scale storage.

The next generation of refrigerants must achieve minimised GWP values and flammability while maximising efficiency. The most promising refrigerants in this class require compression technologies which are optimised for low and medium pressure refrigerants. Oil free magnetic bearing centrifugal compressors are ideal for such refrigerants. Taking this into consideration and strictly focused on this factor, we see an opportunity for centrifugal oil-free systems in applications where higher pressure positive displacement solutions have formerly been predominant.

The best long-term solutions minimise the direct impact

of global warming by using a refrigerant with a low GWP but even more importantly by maintaining high efficiency which reduces the much greater indirect impact that utility emissions contribute to global warming. Optimised high efficiency chiller designs with ultra-low-GWP refrigerants simultaneously satisfy low GWP refrigerant requirements and higher energy efficiency standards. Consequently, they offer the added benefit of lower operating costs which will frequently offer an attractive payback for the initially higher first cost of oil free technology.

2. Performance

All Danfoss oil-free compressors utilise two stages of centrifugal compression and offer an integrated economizer port between the two stages. If an economizer circuit is connected to this intermediate port the capacity of the chiller system is increased. The resulting increase in capacity gives a higher cooling performance and far less energy usage. The

	Full Load Efficiency (EER)	IPLV (EER)
Oil-Free Centrifugal	12.7	23.7
Variable Speed Screw	11.2	19.0

Table 1. Oil-free versus Variable Speed compressors.

amount of refrigerant is also reduced, which makes it an ideal way to reduce charge in regions where refrigerant prices are rising.

The performance table for nominal 300-ton air-cooled chillers clearly illustrates the benefits of oil-free chillers. Both the full and part load efficiencies are higher, enabling lower operating costs for oil free chillers.

Oil free compressors eliminate annoying tonal effects and offer sound levels up to 8 dBA less compared to traditional oiled screw compressors. This allows customers to avoid paying for expensive compressor sound attenuation and minimises customer noise complaints.

3. Long-term Performance (Studies)

Several studies by ASHRAE and Tsinghua University have shown that most chillers contain excess oil which accumulates in the heat exchangers which along with compressor mechanical wear is a major contributor to significant performance degradation over time.

The study¹ by Tsinghua University looked at screw and centrifugal water-cooled chillers installed globally with equipment ages from 1 to 12 years. It sought to determine actual performance relative to the manufacturer's ratings and resulting annual performance

degradation.

The study focused on 36 oil-filled chillers with a mix of centrifugal and screw compressors and flooded and DX heat exchangers. Researchers found a wide variation in annual performance degradation:

- Chillers with centrifugal compressors ranged from 2.8 percent to 6.3 percent – losing 2 percent on average
- Chillers with screw compressors varied from 2.5 percent to 8 percent – with an average 4 percent degradation

Performance degradation was also broken down into specific averages:

- **Waterside fouling** – 25 percent of the total degradation
- **Mechanical degradation of the compressor and other components** – 45 percent of the total degradation
- **Oil fouling of the refrigerant side** – 30 percent of the total degradation

Danfoss has also conducted its own study to see if oil-free compressors can maintain consistent performance over a long period of time. The study compared the performance of oil-free Danfoss Turbocor compressors after more than 10 years and thousands of operating hours in a water-cooled chiller located

in Hershey Pennsylvania.

The two compressors were sent to the Danfoss laboratory in Tallahassee Florida where power consumption and mass flow were measured to see if there was any deviation from the original ratings from 2007. One of the compressors showed only a 2 percent change in power consumption and mass flow, while the other compressor showed less than 1 percent change in both parameters.

Overall, these test results confirm that oil-free compressors, which do not have any wearing parts and which do not use any oil, maintain "as new" performance throughout their operating life. This gives confidence that with recommended heat exchanger maintenance, the originally rated chiller performance is achievable throughout the life of the equipment and without the maintenance headaches associated with oiled systems.

Remove the need for oil, and the chiller is set up to perform optimally throughout its entire lifecycle. It also means that oil-free systems better maintain optimized efficiency throughout their operating lives – a vital requirement for saving energy and cutting maintenance costs.

4. Serviceability

In a conventional chiller system using oil, a complex system of electro-mechanical components is necessary to maintain the oil temperature, pressure, cleanliness, and circulation. Each component in this system is a critical link in the functioning of the chiller system and most require regular maintenance. Simply monitoring and maintaining the oil management system can be a job in itself, where the risks of missed service and cutting corners can be catastrophic.



Figure 1. The campus of Tsinghua University in Beijing, China.



Figure 2. Danfoss Turbocor compressors from Pennsylvania site in Tallahassee testing facility.



Oil-free systems, however, do not have the complexity of conventional oiled systems and eliminate parts such as oil separators, oil heaters, oil coolers, oil pumps, oil pressure switches, and oil filters.

The result, more peace of mind with fewer components to fail and maintain, with the bonus of higher reliability and efficiency.

5. Return on investment (ROI)

While the initial purchase cost of an oil-free HVAC system may be slightly higher; the payback is usually fast – especially in applications with high operating hours and energy intensity. Consider the costs of running a 250-ton capacity chiller for a year. For an existing chiller fitted with a traditional oiled screw compressor, energy consumption could cost the user over \$50,000 annually to just keep the system running.

By comparison, an oil-free system could cost less than \$30,000.

That's because in traditional systems, part-load conditions can have a significant impact on energy consumption, especially if the system is not optimised for these conditions. With an oil-free system, efficiency can improve by up to 20-25 percent, which can result in operating costs of up to 50 percent less compared to a traditional system. But these are simply averages

Payback [Years]	Estimated Energy Savings per Equipment Annual Running Hours																
	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000	5,500	6,000	6,500	7,000	7,500	8,000	8,500
0.05	21.97	12.71	8.94	6.28	4.47	3.34	2.77	2.38	2.09	1.87	1.70	1.58	1.49	1.42	1.36	1.31	1.27
0.06	25.87	15.26	10.79	7.61	5.47	4.10	3.40	2.90	2.49	2.15	1.90	1.74	1.61	1.50	1.41	1.34	1.29
0.07	31.99	19.36	13.46	9.59	6.92	5.10	4.16	3.53	3.01	2.63	2.34	2.14	1.98	1.84	1.73	1.64	1.58
0.08	39.65	24.26	17.07	12.44	9.07	6.71	5.38	4.53	3.88	3.36	2.94	2.69	2.47	2.29	2.15	2.03	1.94
0.09	49.16	30.77	21.63	15.34	11.23	8.20	6.44	5.37	4.58	3.93	3.37	2.98	2.69	2.47	2.29	2.15	2.03
0.10	60.93	38.67	27.04	19.47	14.07	10.23	7.83	6.41	5.37	4.58	3.93	3.37	2.98	2.69	2.47	2.29	2.15
0.11	75.28	48.66	34.79	24.94	18.11	13.18	9.93	8.13	6.77	5.63	4.76	4.04	3.43	2.97	2.59	2.37	2.21
0.12	92.53	60.35	43.48	30.84	22.39	16.41	12.49	10.23	8.53	7.13	5.96	5.04	4.27	3.63	3.14	2.74	2.48
0.13	113.06	74.41	53.71	37.94	27.11	19.87	15.10	12.30	10.07	8.36	6.96	5.83	4.91	4.09	3.41	2.97	2.66
0.14	137.28	90.54	65.19	45.51	32.50	23.89	17.99	14.88	12.12	9.95	8.20	6.87	5.69	4.74	3.91	3.21	2.84
0.15	165.53	109.41	78.61	54.84	39.54	28.81	21.81	17.99	14.88	12.12	9.95	8.20	6.87	5.69	4.74	3.91	3.21
0.16	198.28	131.66	93.71	65.54	47.11	34.51	26.11	21.11	17.11	14.01	11.51	9.51	7.81	6.41	5.21	4.21	3.51
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0.18	279.28	187.66	131.41	93.41	66.41	48.41	36.41	29.41	23.41	18.41	14.41	11.41	9.41	7.41	6.11	4.91	4.01
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0.20	384.28	257.66	178.41	131.41	93.41	66.41	48.41	36.41	29.41	23.41	18.41	14.41	11.41	9.41	7.41	6.11	4.91
0.25	511.03	336.41	231.41	171.41	121.41	86.41	61.41	46.41	36.41	29.41	23.41	18.41	14.41	11.41	9.41	7.41	6.11
0.30	651.28	429.66	291.41	221.41	151.41	106.41	76.41	56.41	46.41	36.41	29.41	23.41	18.41	14.41	11.41	9.41	7.41

Table 2. Estimated Energy Savings per Equipment Annual Running Hours.

and estimates.

To get an exact figure of your potential savings, you need to use your data. That's why we've created the DanfossChillerROI app. It enables you to calculate the financial payback of using oil-free technology by inputting your design conditions, efficiency, and CapEx costs to produce an accurate annual cost comparison.

The payback can be quite fast for any high-efficiency chiller replacement, but the additional cost of purchasing higher performance oil-free chillers can likewise be an attractive investment. For the 300-ton comparison above, we've calculated the approximate payback range at different energy rates and hours of operation. As the next table illustrates, the small incremental cost of oil-free technologies will likely be justified in a large number of applications, and over a wide range of energy rates.

Enhancing efficiency in oil-free air-cooled chiller systems

Air-cooled systems offer many advantages over water-cooled systems in both cost and maintenance. The added cost and maintenance of cooling towers, condenser pumps, water consumption and water treatment are eliminated with air cooled systems. Other benefits include reducing the contamination with Legionella and other pathogens associated with water-cooled systems. However, if the strengths of oil-free systems can be used to offset these drawbacks, by improving efficiency and reducing vibration and noise, you could achieve the best of both worlds. The result is the simplicity and serviceability of an air-cooled, oil-free system, with performance and efficiency similar to

a water-cooled equivalent.

And because a Turbocor® compressor can deliver high lift, an oil-free, air-cooled chiller system could become an increasingly popular option – delivering:

- Reduced size and weight – smaller overall size due to fewer components for easier installation and open to more applications
- Improved efficiency and environmental impact – highly efficient part and full load consumption for low-cost operations and reduced water consumption
- Low sound and vibration – increasing location flexibility, improving compliance and reducing the risk of customer complaints
- Wide operating range – ability to operate in a variety of conditions, including high ambient temperature
- Eliminates water usage and cooling towers – No water, no water treatment, no tower maintenance, and the risk associated with Legionella and other water-borne pathogens is eliminated.

¹ Effects of lubricant on thermodynamic performance of chiller (1): survey on long term degradation by Baolong Wang, Penglei Zhang: Journal of HV&AC, 2016, 9: 15-20 (In Chinese).

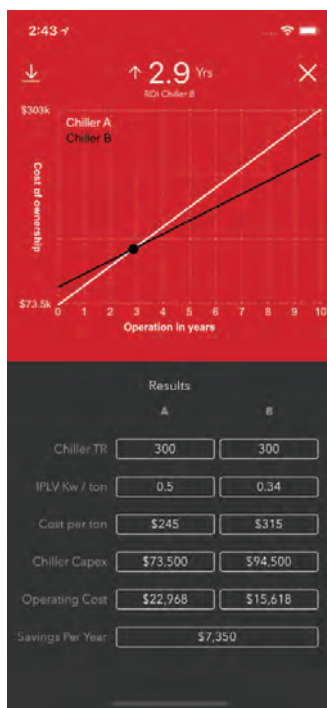
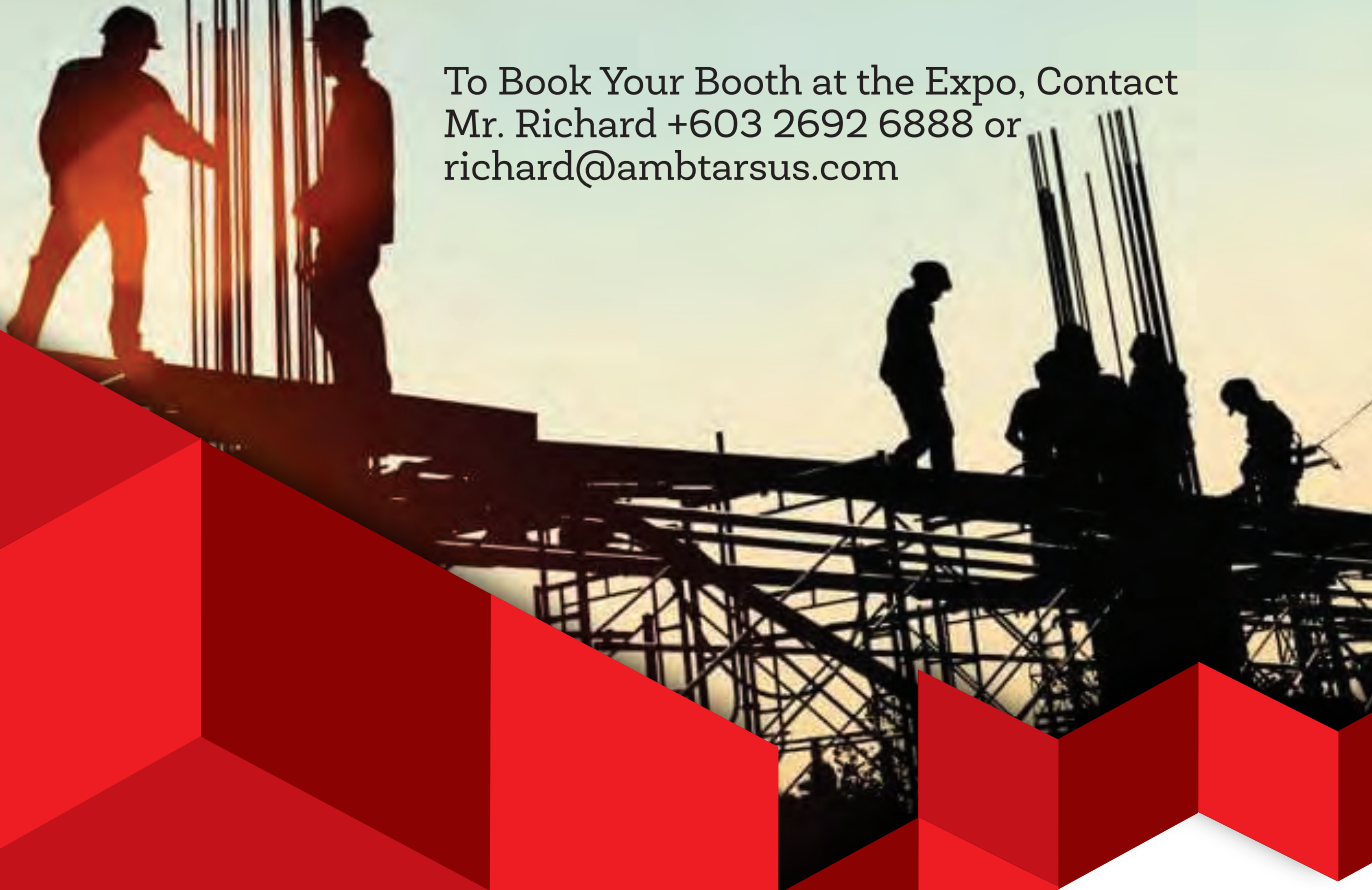


Figure 3. Danfoss Chiller ROI mobile application snapshot

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Intelligently adapting to water demands in buildings

Text by Leong Chee Khuan, Area Managing Director for South Asia and General Manager for Grundfos Pumps Sdn Bhd.



Leong Chee Khuan

Asia has achieved remarkable economic success over the past five decades. Hundreds of millions of people have been lifted out of poverty, and successive waves of economies have made the transition to middle-income and even advanced-economy status. The progress we are witnessing has come with an unprecedented demand for key resources – namely water and energy. Water demand in the Asia Pacific region is forecasted to increase by 55 percent¹ by 2050, while our energy demand is expected to grow by two-thirds by 2040².

One of the key contributors to the region's growing reputation as a consumption powerhouse is a landmark of economic development and civilisation – buildings. Notably, this includes buildings such as office buildings, schools, hotels, hospitals, restaurants, and other commercial and institutional facilities. These buildings use a significant amount of water in their daily operations, whether it is cooling the entire building or providing a reliable water supply for all tenants and to constantly move large amounts of water takes a lot of energy.

Owners and managers of these types of facilities are increasingly aware of the need to use water more efficiently to reduce their risk of water shortages and increasing energy costs incurred from delivering water around the building. There is a strong business case to be made for water efficiency. It is imperative to ask ourselves – how can we use our water resources in commercial buildings more efficiently?

The role of pumps in commercial buildings

In order for us to truly achieve water savings in commercial buildings, we need to examine deeper, right down to the hardware of the buildings. Take for example pumps, which play a key role in controlling and transporting water within a building and are responsible for a staggering 10 percent of global electricity consumption.

Conventional pumps typically generate maximum pressure 24–7, in order to secure the adequate pressure to circulate water under various conditions. What this means for energy consumption is that the pump is running on greater energy use than it needs to. However, such methods may not be the most efficient and cost effective.

The constant water pressure could also lead to greater wear and tear to parts in the water system and subsequently greater waste of resource through water leakages.

Managing water intelligently

For pump manufacturers like Grundfos, the pursuit of digitalisation has meant incorporating intelligence into its products to make them more intuitive and connected, enabling efficient performance. Grundfos calls this iSolutions – a range of products with a focus on connectivity, intelligent monitoring and adjustment features to optimise water efficiency across the entire system.

Digitalisation opens the door to a more sustainable business model that not only allows companies to produce more with less, but also helps them avoid unnecessary waste of resources such as energy and water.

With digitalisation, building operators can use technologies that intelligently adjust water flow according to the demand with remote sensors. This reduces any excess water pressure, which in turn limits water leakages and losses, minimising cost and energy.

Pumps, sensors, meters and pump controllers can now all be connected to a centrally hosted server via an internet-based system. This allows for changes in performance and energy consumption to be tracked and documented, even automatically generating reports and trend graphs, giving an indication of wear or damage to businesses and enabling periodic planned service and maintenance accordingly. Digitalisation therefore can empower distribution models that can prompt the building operators when assets need to be replaced as well.

The road ahead

Water is intrinsically linked to the survival of mankind. As our cities become smarter and more developed, the resulting strain on water demand becomes ever so more pronounced. The effects of a water shortage can be catastrophic. In the years to come, by continuing to leverage on technology and innovation, Grundfos hopes to continue to be at the forefront of overcoming Asia's water related issues by providing intelligent and efficient solutions that work.

¹ <https://www.adb.org/sites/default/files/publication/189411/awdo-2016-brochure.pdf>

² <https://www.eco-business.com/opinion/its-decision-time-for-southeast-asia-as-power-demand-soars/>

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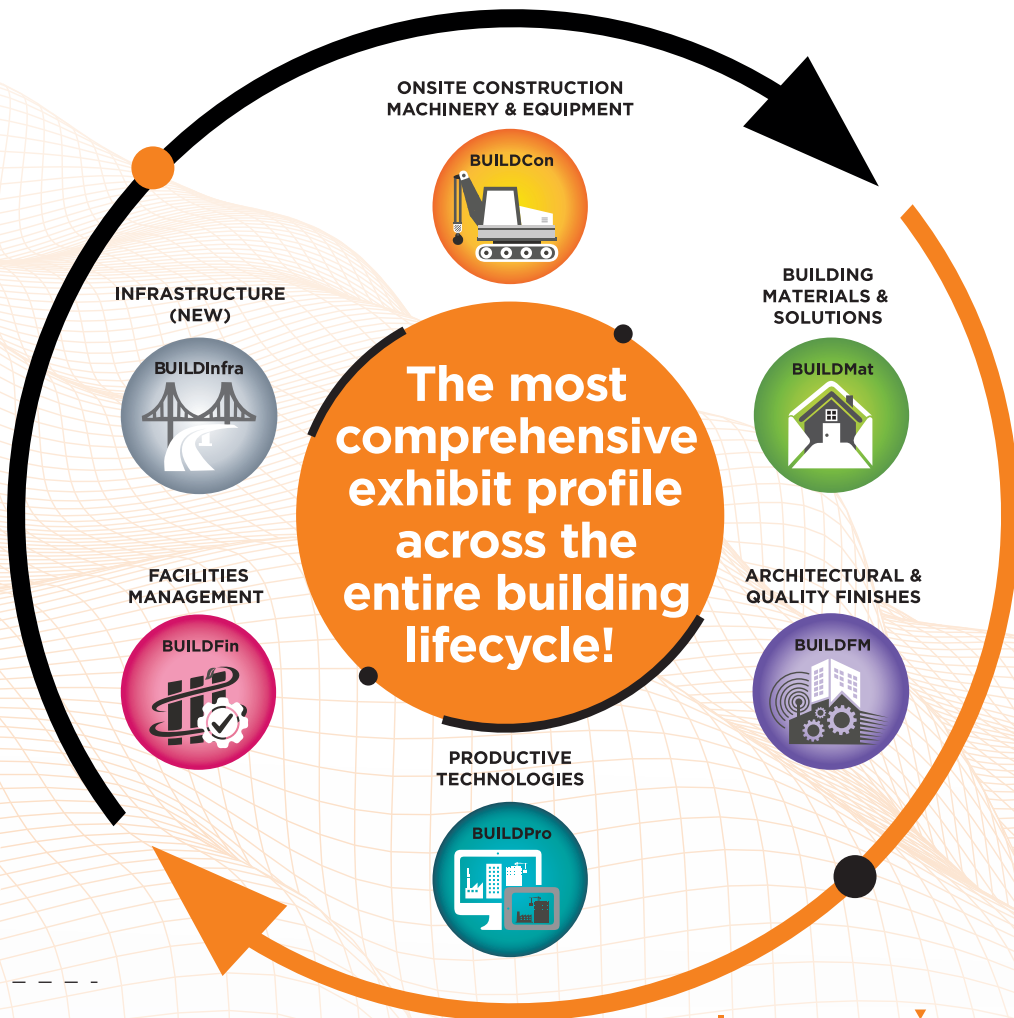


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