Issue 03/2013

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Greetings and a warm welcome to our third issue of Build Green.

We have seen in our last issue how new Green Mark schemes are engaging tenants and occupants in adopting sustainable practices. This issue, we focus on yet another sector that has joined in the green journey: schools. Read more about what four schools did to earn them the prestigious BCA Green Mark Platinum Award and what examples they are setting to the young.

We would like to remind our readers that the mandatory submission of building information and energy consumption data started on 1 July. This was announced two years ago. However, you may be happy to read about how our new Building Energy Submission System (BESS) will make it so easy for you to make your submission. There are also enhancements to our Green Mark Incentive Scheme – Design Prototype.

Find out more also about the payback period you can expect from green cost premiums. In this issue, we are introducing a new ‘Beyond R&D’ series on green building research projects in Singapore. We begin by focussing on two innovations, one on improving indoor air quality and another on recycling aggregates into indoor wall panels.

Indeed, these are exciting times for the green building industry. In May this year, we have crossed the milestone of 20% green buildings in Singapore. This is yet another step towards greening 80% of our building stock by 2030.

And to strengthen our position as a global leader in green buildings in the tropics and sub-tropics, we are formulating our 3rd Green Building Masterplan. BCA convened a new International Panel of Experts meeting in June 2013. The panel, comprising 5 international and 6 local experts reviewed our green building policies, regulations and measures on sustainability of the built environment and gave views on green building directions going forward. More than 150 participants from government agencies, NGOs, developers, designers and building owners joined in the sessions to contribute ideas on how to take the local industry forward in achieving a more energy efficient and lower carbon emission built environment in Singapore.

Taking the green discussion further, we encourage you to participate in Sustainable Building 2013 and the International Green Building Conference – both key events under the Singapore Green Building Week taking place in September. It is truly the green building event in the region, and this year promises more lively exchanges and a prominent line-up of expert speakers from around the world.

Mark your calendar and we look forward to meeting you at the Singapore Green Building Week!

Dr John Keung
Chief Executive Officer
PLATINUM DISTINCTION FOR SCHOOLS

FOUR SCHOOLS UNDER THE MINISTRY OF EDUCATION SET THE GREEN EXAMPLE FOR THE YOUNG BY CLINCHING THE BCA GREEN MARK PLATINUM AWARD.

Schools are expanding their role in education by serving as green showcases to raise environmental awareness and enrich the learning experience for students. Leading the way, four new schools – Alexandra Primary School, Crest Secondary School, Spectra Secondary School and West Spring Primary School – carried out pilot feasibility studies to introduce innovative design strategies and green features within the schools.

Their efforts helped them reduce their energy consumption by over 30% and earned them the honour of being the first primary-secondary schools to earn the BCA Green Mark Platinum accolade.

These schools began at the design stage to consider numerous passive design and resource efficiency strategies as well as renewable energy sources. Using advanced ventilation simulation software, they optimised cross-ventilation and positioned most window openings with a north-south orientation. Such measures allow for maximal wind and circulation within the buildings, providing a more conducive learning environment.

In addition, to minimize the Urban Heat Island effect, hardscape areas were designed with a Solar Reflectance Index of more than 29. To reduce heat ingress into the school, window-to-wall ratios were kept below one-third. Direct West facing facades and windows were kept to a minimum. The schools also used double-glazed low-e glass, insulation layers and sunshading devices.

Other green features include energy-efficient LED and T5 lighting, incorporation of motion sensors and sunpipes, photovoltaic panels to and sustainable building materials.

Alexandra Primary School

ETTV: 29.9 W/m²
WWR: 0.25
100% of windows facing N-S
40% improvement in lighting over code
8% replacement of total building energy consumption by PV cells
EEI: 29 kWh/m²/yr
CUI: 0.5 m³/m²

Alexandra Primary School has green roofs and an Ecological Trail consisting of exhibits scattered around the school at various vantage points to serve as an outdoor classroom on nature and sustainability.
**Crest Secondary School**

ETTV: 39.3 W/m²  
WWR: 0.2  
77% of windows facing N-S  
29% improvement in lighting over code  
6% replacement of total building energy consumption by PV cells  
EEI: 22 kWh/m²/yr  
CUI: 0.6 m³/m²

45% of this specialized school’s GFA consists of conserved retaining buildings, hence reducing material wastage. Widening the windows by removing some walls and replacing with louvered openings have helped enhance the airflow behaviour and improve natural ventilation.

**Spectra Secondary School**

ETTV: 36.2 W/m²  
WWR: 0.3  
100% of windows facing N-S  
42% improvement in lighting over code  
8% replacement of total building energy consumption by PV cells  
EEI: 50 kWh/m²/yr  
CUI: 0.4 m³/m²

Using nature to enhance the learning experience and instil values, this school-within-a garden features a storm water treatment system designed to PUB’s ABC guidelines. 61.9% of the site area includes treatment of storm water run-off.

**West Spring Primary School**

ETTV: 36.0 W/m²  
WWR: 0.2  
69% of windows facing N-S  
37% improvement in lighting over code  
10% replacement of total building energy consumption by PV cells  
EEI: 42 kWh/m²/yr  
CUI: 0.4 m³/m²

West Spring Primary School links to a park connector and has a green wall lining its central pedestrian spine to provide shelter from the afternoon sun. Solar tubes will also be designed as a learning tool in the learning space of the Media Resource Library Deck.
Treetops Executive Residences, which promises a resort-style living in the heart of the city, received the BCA Green Mark Platinum rating in 2012 for its sustainability efforts. Its green journey included recently installing a tri-generation plant and signing an Energy Savings Performance Contract.

**Power from Within**

The tri-generation plant consists of three 200kW diesel generators operating on synchronisation to supply power to the entire building. Waste heat from exhaust and jacket water are used to run the absorption chiller which in turn produces chilled water for use within the building and domestic hot water for the estate.

After its commissioning, the plant reduced the energy bill by a significant 27% in the first month. Plant efficiency has also improved by about 40%, from 0.76 kW/ton to 0.45 kW/Ton. As fine tuning works are still in progress, Treetops expects to achieve an energy improvement of 49% against its original energy consumption, or a 33% decrease of total building electricity consumption ultimately.

**Sustained Savings for Seven Years**

Treetops has also signed a seven-year Energy Savings Performance Contract with Comfort Management, an air conditioning, mechanical and electrical specialist focusing on engineering for energy conservation.

Comfort Management helps Treetops simplify the procedures to adapt energy-efficiency retrofits with little or no investment outlay, under the contract. It also installed digital energy meters to monitor the daily energy consumption of chillers, pumps, cooling towers, AHU, car park fans and other building equipment. These meters are wired to a central computer where the energy consumption data is accessed remotely on a daily basis for deviation analysis.

By monitoring energy usage, Comfort Management guarantees that Treetops will sustain the energy efficiency throughout the seven-year contractual period so that it can renew the Green Mark certification in 2015.

**NEED FINANCING FOR ENERGY-SAVING RETROFITS?**

The energy-efficiency retrofit works at Treetops were partly funded by two BCA schemes. While the Green Mark Incentive Scheme for Existing Buildings is now fully committed, owners of existing buildings requiring financial assistance can still apply for the Building Retrofit Energy Efficiency Financing scheme. More information can be found at [www.bca.gov.sg/GreenMark/breef.html](http://www.bca.gov.sg/GreenMark/breef.html).
BENCHMARK YOUR HOTEL’S COOLING LOAD

In a typical air-conditioning design for hotel projects, the design peak building cooling load used to size major air-conditioning equipment is usually in the range of 120-260 W/m². However, similar to office buildings, the actual operating peak load is often lower than the design peak load due to the diversity of air-conditioning usage, design assumptions and safety factors causing excess capacity. Hotels generally operate around the clock. According to measured data, the cooling load at night is typically only 60-70% of the day-time load. While designing and selecting plant equipment, plant operating efficiencies for both day and night should be taken into consideration.

The energy audits of 24 existing hotels (of various star ratings) show that the cooling load per air-conditioned floor area is in the range of 42 W/m² to 98 W/m². Based on this sample, five-star hotels are in the range of 85-98 W/m². This data may be affected by seasonal changes as the measurements were taken at different times of the year. It may be used for reference but is not intended for use in air-conditioning design and sizing.

<table>
<thead>
<tr>
<th>COOLING LOAD/AIR-CON AREA (W/m²)</th>
<th>RANGE</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>42 – 98</td>
<td>64 W/m²</td>
<td>64 W/m²</td>
</tr>
</tbody>
</table>

Based on data from Building and Construction Authority and the National Environment Agency
The Health Promotion Board (HPB) not only wants to build a nation of healthy people. Equally concerned for the health of the environment, it recently reengineered and retrofitted its chiller plant for energy savings at its HPB Building.

The project was identified from a detailed energy audit study of the building carried out under a Guaranteed Energy Saving Performance contract initiated by the National Environmental Agency back in 2011. It was clear that the chiller plant at HPB Building had the potential to reap energy savings. However, instead of doing a one-to-one chiller replacement, the entire chiller plant was redesigned and reengineered to minimise the investment outlay as well as operational and maintenance costs.

Four existing chillers were replaced with three high-efficient chillers. Both chilled water and condenser water pipes were modified to minimise the friction losses and to increase the flexibility of operations. The design also considered the very low night load and provided for future expansion. A permanent high precision measurement and verification system was installed to monitor and log the chiller plant system performance in one-minute intervals.

After its retrofit, the new chiller plant achieved 40% of energy savings during the peak load operation (plant efficiency improved from 1.01kW/RT to 0.62kW/RT) and 60% of energy savings during the off-peak load operation (plant efficiency improved from 1.75kW/RT to 0.68kW/RT). The calculated simple payback for the chiller plant retrofit project is approximately seven years.

A contract awarded to Siemens, as the accredited energy service company, will ensure that the chiller plant efficiency and energy savings will be maintained for five years after the retrofit.
THE YEAR’S BEST ACHIEVEMENTS

BCA AWARDS 2013 NAMED JTC CORPORATION THE GREEN MARK CHAMPION AND PRESENTED THE HIGHEST NUMBER OF PLATINUM AND GOLDPLUS AWARDS EVER.

The annual BCA Awards, held this year on 16 May 2013, again celebrated the built environment’s achievements in sustainability. In the presence of more than 2,000 guests, Mr Lee Yi Shyan, Senior Minister of State, Ministry of Trade and Industry & Ministry of National Development, presented the BCA Green Mark Champion Award and the BCA Green Mark Awards in addition to other awards in the areas of safety, quality and user friendliness.

Milestone in BCA Green Mark Awards

A total of 177 building projects, consisting of 49 Platinum, 45 Goldplus, 67 Gold and 16 Certified, were awarded the BCA Green Mark Award this year. This was the highest number of Platinum and Goldplus projects awarded since the launch of the Green Mark scheme in 2005.

Significant projects this year include the South Spine Learning Hub and the AXA Tower which claimed the Platinum award in the new non-residential building and existing non-residential building categories.

**South Spine Learning Hub**
(Platinum New Non-Residential Building)

**Prominent features**
- Use of better glass design to enhance thermal comfort in the building.
- Use of passive displacement ventilation throughout the development.
- Extensive use of landscape and garden green roof for the development.
- Use of hydrophylic polymer for planting to increase soil absorption and distribution of moisture to eliminate the need for irrigation system.
- Use of Ground Granulated Blast Furnace Slag and recycled concrete aggregate for construction.
- Extensive use of SGLS-labelled green products and excellent WELS rating products.
GREEN HIGHLIGHTS

AXA Tower
(Platinum Existing Non Residential Building)

Prominent features
• Long-term performance based contract to monitor the energy use and system efficiency on daily/monthly basis and guarantees the energy savings.
• Improved plant efficiency from 0.81 kW/RT to 0.67 kW/RT.
• Recovery of AHU condensate water and rain water.

Honours for JTC Corporation
The highlight of the sustainability awards was the BCA Green Mark Champion Award, which went to JTC Corporation this year. Mr Png Cheong Boon, JTC Corporation’s CEO, was present to receive the award trophy from guest-of-honour Mr Lee that evening.

To qualify for this award, an organisation must have at least 10 buildings rated Green Mark Gold and above, at least six rated Goldplus and above and at least three rated Platinum. Past winners of this award include CDL Developments, Housing & Development Board, Ascendas, CapitaLand Group and National University of Singapore. Moving higher, organisations can aim for the BCA Green Mark Platinum Champion award which, to date, has been clinched only by CDL Developments in 2011.

Criteria for BCA Green Mark Champion Award

<table>
<thead>
<tr>
<th>Total number of buildings rated</th>
<th>BCA Green Mark Champion</th>
<th>BCA Green Mark Platinum Champion</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCA Green Mark Gold and above</td>
<td>At least 10</td>
<td>At least 50</td>
</tr>
<tr>
<td>BCA Green Mark Goldplus and above</td>
<td>At least 6</td>
<td>At least 30</td>
</tr>
<tr>
<td>BCA Green Mark Platinum</td>
<td>At least 3</td>
<td>At least 15</td>
</tr>
</tbody>
</table>
JTC: LEADING IN INDUSTRIAL INFRASTRUCTURE AND SUSTAINABILITY

JTC Corporation won the Green Mark Champion Award with 10 projects awarded Green Mark Gold and above, including six Platinum and three GoldPlus awards. With sustainability as a key driver of JTC’s innovative culture, green building strategies and eco-friendly features are actively incorporated in its developments, while innovative technologies and initiatives are test-bedded to optimise resources.

Well-established as Singapore’s leading industrial infrastructure specialist, JTC has won a string of accolades. These include the Green Mark for Districts award for CleanTech Park, the Green Mark for Existing Building (Platinum) for The JTC Summit, the Green Mark for Existing Building (GoldPlus) for Fusionopolis Phase 1 and Biopolis Phase 1, and the Urban Design Mark (Platinum) for the United World College of South East Asia (East Campus).

First to clinch BCA’s Platinum Green Mark for Districts award, CleanTech Park is a 50-hectare eco-business park which boasts energy-efficient infrastructure and public amenities that can potentially help save more than 40% of energy consumption and 25% of potable water usage. This iconic development has unique green features such as a sky trellis, landscaped sky gardens and a green perforated façade that provides optimal solar orientation. JTC has also planned for a district-level energy monitoring and automatic control system to monitor and optimise energy consumption and performance of the buildings in the park.

When JTC bagged the BCA Green Mark Platinum Award for JTC Summit, it also exemplified its sustainability and land intensification efforts. But moving further, JTC is also proud to have developed innovative eco-friendly sustainable features in the building of United World College Southeast Asia (East Campus). The campus features “green” walls, naturally ventilated interaction zones, as well as an elevated podium that connects the various schools, thus freeing up space beneath for other uses. This provides a green environment conducive for the campus community, enabling it to win the BCA Universal Design Award 2013.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Type of Development</th>
<th>Award</th>
<th>Year of Award</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusionopolis Phase 2A @ one-north</td>
<td>New Non-Residential Building</td>
<td>Platinum</td>
<td>FY11</td>
</tr>
<tr>
<td>United World College South East Asia (East Campus)</td>
<td>New Non-Residential Building</td>
<td>Platinum</td>
<td>FY09</td>
</tr>
<tr>
<td>CleanTech One</td>
<td>New Non-Residential Building</td>
<td>Platinum</td>
<td>FY10</td>
</tr>
<tr>
<td>JTC’s CleanTech Park Green Core</td>
<td>New Parks</td>
<td>Platinum</td>
<td>FY10</td>
</tr>
<tr>
<td>JTC Summit</td>
<td>Existing Non-Residential Building</td>
<td>Platinum</td>
<td>FY12</td>
</tr>
<tr>
<td>CleanTech Park</td>
<td>District</td>
<td>Platinum</td>
<td>FY12</td>
</tr>
<tr>
<td>Mediapolis</td>
<td>District</td>
<td>GoldPlus</td>
<td>FY10</td>
</tr>
<tr>
<td>Biopolis Phase 1</td>
<td>Existing Non-Residential Building</td>
<td>GoldPlus</td>
<td>FY12</td>
</tr>
<tr>
<td>Fusionopolis 1 @ one-north</td>
<td>Existing Non-Residential Building</td>
<td>GoldPlus</td>
<td>FY12</td>
</tr>
<tr>
<td>15 Changi Business Park Central 1</td>
<td>Existing Non-Residential Building</td>
<td>Gold</td>
<td>FY12</td>
</tr>
</tbody>
</table>
GREEN COST PREMIUM

ALTHOUGH IT IS MORE COSTLY TO CONSTRUCT A GREEN BUILDING, BCA FINDINGS SHOW THAT THE PAYBACK PERIOD FOR PLATINUM PROJECTS CAN BE AS SHORT AS 2.5 YEARS.

The green cost premium is the extra construction cost incurred in constructing a green building over a code–compliant building. It is typically less than 5%. There has also been a general reduction in the green cost premium over the years.

However, green buildings also generate cost savings. Taking the green cost premium over the sum of annual energy and water cost savings accrued, BCA has computed the payback period for Green Mark buildings to be as short as 2.5 years for Platinum projects.

<table>
<thead>
<tr>
<th>Green Mark Awards</th>
<th>Commercial</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awards</td>
<td>Green Cost Premium (%)</td>
<td>Payback (years)</td>
</tr>
<tr>
<td>Certified</td>
<td>0% to 2%</td>
<td>0 to 3</td>
</tr>
<tr>
<td>Gold</td>
<td>1% to 3%</td>
<td>1 to 4</td>
</tr>
<tr>
<td>GoldPlus</td>
<td>2% to 4.5%</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Platinum</td>
<td>3% to 5%</td>
<td>2.5 to 6.5</td>
</tr>
</tbody>
</table>

Data is based on FY11 and FY12 projects at 95% confidence interval. Outliers and abnormalities were removed to prevent bias and skewness of the results. The cost data was normalised to a base year.
SPURRING THE PRIVATE SECTOR

PUSHING THE
ENERGY EFFICIENCY
FRONTIER

BCA IS ENHANCING ITS GREEN MARK INCENTIVE SCHEME – DESIGN PROTOTYPE TO TAKE BUILDING ENERGY EFFICIENCY FURTHER. THE CHANGES, WHICH WERE MADE FOLLOWING INDUSTRY FEEDBACK AND A REVIEW OF THE SCHEME, TOOK PLACE FROM 1 MAY 2013.

Outcome-Based Support
The level of funding support is revised to be more outcome-based. The amount of funding obtained will depend on the real energy savings verified during the building operation phase, subject to the funding cap.

Revised level of funding support

<table>
<thead>
<tr>
<th>Supportable Cost</th>
<th>Disbursement Stage</th>
<th>Proposed Disbursement Amount</th>
<th>Milestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design workshop fees / Simulation studies</td>
<td>1st disbursement</td>
<td>40% of funding amount</td>
<td>Upon acceptance of the design report and commitment by developer to proceed.</td>
</tr>
<tr>
<td></td>
<td>2nd disbursement</td>
<td>Nil</td>
<td>Achieve &lt; 35% energy savings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15% of funding amount</td>
<td>Achieve ≥ 35% to &lt; 38% energy savings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30% of funding amount</td>
<td>Achieve ≥ 38% to &lt; 40% energy savings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60% of funding amount</td>
<td>Achieve ≥ 40% energy savings</td>
</tr>
</tbody>
</table>

Note: The co-funding basis with up to 70% support of qualifying costs still applies

Energy Efficiency Index Requirement
BCA is also introducing the Energy Efficiency Index (EEI) as an additional pre-requisite requirement. The EEI will serve as a best practice benchmark indicator for energy efficiency.

Target EEI for different building types

<table>
<thead>
<tr>
<th>Type of Development</th>
<th>EEI Target (kwh/m²/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>150</td>
</tr>
<tr>
<td>Retail</td>
<td>280</td>
</tr>
<tr>
<td>Mixed Development</td>
<td>180</td>
</tr>
<tr>
<td>Hotel</td>
<td>200</td>
</tr>
<tr>
<td>Institutional</td>
<td>140</td>
</tr>
</tbody>
</table>

For more information, please visit www.bca.gov.sg/greenmark/gmisdp.html

Jem™ is one of the projects accepted for GMIS-DP funding
SPURRING THE PRIVATE SECTOR

GROWING INDUSTRY INTEREST IN GREEN BUILDING INCENTIVE AND FINANCING SCHEMES

(A) Green Mark Incentive Scheme for Existing Buildings (GMIS-EB)
Statistics as at May 2013

- Trending of GMIS-EB Applications - Based on Green Mark Rating (As at May 2013)
  - 39% Gold
  - 31% GoldPlus
  - 30% Platinum

- Trending of GMIS-EB Applications - Based on Development Type (As at May 2013)
  - Office: 30%
  - Hotel: 10%
  - Retail: 15%
  - Mixed Developments: 30%
  - Autonomous Institutions: 21%

For more information, please visit http://www.bca.gov.sg/GreenMark/gmiseb.html

(B) Green Mark-Gross Floor Area Scheme (GMGFA)
Statistics as at May 2013

- Trending of GM GFA Applications - Based on Development Type (As at May 2013)
  - Commercial: 24%
  - Hotel: 14%
  - Industrial: 5%
  - Institutions: 1%
  - Mixed Developments: 21%
  - Residential: 13%

For more information, please visit http://www.bca.gov.sg/GreenMark/gmgfa.html

(C) Building Retrofit Energy Efficiency Financing Scheme (BREEF)
Statistics as at May 2013

5 loans which totalled up to S$5.92 million have been approved for energy efficiency upgrades of 5 existing buildings

For more information, please visit http://www.bca.gov.sg/GreenMark/breef.html
Q: What is the purpose of this project?
A: This project, the Visible Light Activated Photo-Catalytic Oxidative Air Cleaner, looks at improving indoor air quality in air-conditioned spaces, which at times contain formaldehyde or volatile organic compounds. The study focuses on how we can use visible light in the photo-catalytic oxidation process to convert these unwanted air pollutants into carbon dioxide and water.

Q: How unique is this air cleaner?
A: Conventional photo-catalytic oxidation has been using broad-spectrum UV light to break down formaldehyde, volatile organic compounds and microorganisms. However, the drawback of using UV light is that it consumes higher energy and is harmful to human skin when exposed in large amounts. Our prototype achieved photo-catalytic oxidation using visible light, which is readily available in an indoor environment and much safer than UV light. When compared with an off-the-shelf air-cleaner, the energy efficiency to clean air delivery rate ratio is also significantly better.

Q: Who would be the target users of this air cleaner?
A: We designed this air cleaner prototype for medium-sized offices with 20 to 30 occupants. The removal efficiency of the pollutant would depend on the size of the room, flowrate, and the concentration levels. This prototype can be used as a stand-alone air cleaner or integrated into the air conditioning and mechanical ventilation system in a building. The size of the air cleaner prototype can be further reduced to fit small households if there is a demand.

Q: Moving forward, what are your plans for the project?
A: One of our key objectives is to ensure the outcomes are applicable for use by the industry. We are exploring with BCA the opportunity to test-bed the prototype at the Zero Energy Building, to gather more data and to validate the performance. We have also been in discussion with a multinational company to explore the possibility of commercialising the product.

For more information about the Visible Light Activated Photo-Catalytic Oxidative Air Cleaner, please contact Assistant Professor Victor Chang Wei-Chung at WCChang@ntu.edu.sg.
For more information on the Green Wall Panel, please contact Professor Koh Chan Ghee or Dr Tamilselvan S/O Thangayah at mpett@nus.edu.sg.

Installation of 3.8m tall Green Wall Panel

Green Wall Panel made from different recycled materials such as fine recycled concrete aggregates, spent washed copper slag and fine recycled brick aggregates

SUSTAINABLE CONSTRUCTION AT LOWER COST

PROF KOH CHAN GHEE AND DR TAMILSELVAN S/O THANGAYAH FROM THE NATIONAL UNIVERSITY OF SINGAPORE DESCRIBE THEIR GREEN WALL PANEL, WHICH USES RECYCLED AGGREGATES.

Q: What is the Green Wall Panel?
A: The Green Wall Panel is a light-weight concrete hollow core wall panel. It is produced by partially replacing natural sand with fine recycled aggregates processed from construction and demolition waste.

Q: How did this project originate?
A: We saw how the demolition of buildings provided abundant concrete and masonry waste that can be processed into recycled aggregates for use in concrete. At the same time, the construction industry needs a large amount of concrete wall panels for internal partitions in buildings. The opportunity was there to turn the enormous volume of recycled aggregates into concrete wall panels. Concrete wall panels are also an alternative to the clay brick wall, promoting a more sustainable construction.

Q: What did your research reveal?
Performance tests carried out on a 100% fine recycled aggregate wall showed compliance with the severe duty requirements of SS 492:2001, “Performance requirements for strength and robustness for partition walls”. Furthermore, we found a 50% replacement of natural sand with fine recycled aggregates delivered a similar performance with a wall made with 100% natural sand. In other words, up to 50% replacement of natural sand with fine recycled aggregates had virtually no detrimental effect on the quality of the wall. The wall also has good fire and acoustic resistance that easily meet the needs of the industry. The low water permeability of the wall panel also makes it suitable for use as external wall in buildings.

Q: Has the Green Wall Panel been adopted by the industry?
A: The Green Wall Panel has already been installed in actual construction projects. These include projects at the National University of Singapore, Goodwood Residences and Raffles City Linkway.

R&D AS AN ENabler

From this issue, Build Green begins the ‘Beyond R&D’ series to feature successful green building research projects. Such projects are key enablers to accelerate knowledge application and capability building in Singapore’s drive to promote green and energy efficient buildings. This will eventually lead the way to a more viable and cost-effective applications of green building design and technologies.

Since 2007, the Ministry of National Development Research Fund has awarded grants to 48 applied R&D projects covering broad areas on sustainable development, urban design and planning. Some of these projects were successfully completed and adopted by the industry or have high potential to be adopted in the near future.
BESS MAKES IT EASIER

FOR YOU TO SUBMIT YOUR BUILDING INFORMATION AND ENERGY CONSUMPTION DATA!

By now, targeted building owners would have received the written notice from BCA on the annual submission of building information and energy consumption data required from 1 July 2013.

To make this exercise as easy as possible, building owners can enter their information through BCA’s new Building Energy Submission System (BESS).

Using the BESS ID or SingPass, building owners can submit their building information through BESS from 1 to 31 July 2013.

For the first year’s submission, building owners will need to provide all the necessary information.

- Ownership and Activity Type (Ownership, occupancy type, activity type etc.)
- Building Data (Gross floor area, air-conditioning floor area, renovation/retrofitting works etc.)
- Service Information (Lifts, ACMV, lightings and hot water systems)
- Energy Consumption (Electricity, diesel, natural gas, town gas etc)

Subsequent annual submissions only require updates with the latest data.

BCA will be using the data to monitor the energy efficiency of buildings in Singapore and to formulate the national energy benchmark. The benchmarking data will be made available publicly so that you can pro-actively improve your building’s energy performance and also help to contribute towards improving the energy efficiency of existing buildings to achieve the national stretched target of ‘greening’ 80% of the building stock by 2030.

This way, we can ensure that Singapore will continue to be a good living environment for ourselves and future generations!

For more information on the submission procedures – including a user submission manual, technical guide and demonstration video – please visit the useful links at https://www.bca-bess.gov.sg.
ASIA’S PREMIER GREEN BUILDING EVENT IS BACK

JOIN INTERNATIONAL GREEN BUILDING EXPERTS, POLICY-MAKERS, ACADEMICS AND BUILT ENVIRONMENT PRACTITIONERS TO COLLABORATE ON HOW TO ACHIEVE A GREENER PLANET.

The International Green Building Conference 2013 (IGBC 2013), organised by BCA, will be held in September 2013 at the Marina Bay Sands. This year, the event is themed “Build Green. Live Green” to inspire a holistic focus on resource efficiency and environmental sustainability as core to driving business strategies and innovation throughout an organisation.

The event expects to attract more than 1,000 participants from over 30 countries, including policy-makers, key government officials, and leading practitioners from several growth markets, who will give their unique perspective on green building solutions, policies and plans.

Among the prominent international speakers lined up are:
- Mr. Harvey Bernstein, VP Industry Insights & Alliances, McGraw Hill
- Mr. Gary Lawrence, Chief Sustainability Officer, AECOM
- Mr Thomas Heatherwick, Founder & Principal, Heatherwick Studio
- Ms. Jane Henley, CEO, World Green Building Council

IGBC 2013 is the anchor event of the Singapore Green Building Week which features other key international events such as Sustainable Building Conference 2013, World Engineer Summit 2013, BEX Asia Exhibition, CEOs Breakfast Talk and other concurrent events.

Mark your calendars now. For more information on registration and participation, please visit www.sgbw.com.sg.
## IGBC Programme

<table>
<thead>
<tr>
<th></th>
<th>Morning</th>
<th>Late Morning</th>
<th>Afternoon</th>
<th>Late Afternoon</th>
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<tbody>
<tr>
<td>11 Sept Wed</td>
<td>IGBC 2013 / WES 2013 / BEX Asia Opening Panelists - Green Building Drivers in Asia Pacific Region</td>
<td>Opening Plenary: Conversation with Green Trends</td>
<td>Track 1 - Global and Regional Green Building</td>
<td>Track 3 - Green Technology and Innovation</td>
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<td>Track 2 - Managing and Operating Green Facilities</td>
<td>Track 4 - Urban Solution for Green Cities</td>
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<td>12 Sept Thu</td>
<td>Spotlight Plenary: Addressing the GREEN Consumer; where Design, Technology &amp; Business Converge</td>
<td>Track 5 - Green Building Design Strategies</td>
<td>Track 7 - Indoor Environment Quality and Occupants’ Behavior in Green Building</td>
<td>Networking Tea Break at Exhibition Floor</td>
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<td>Track 6 - Business Case of Green Building</td>
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<td>13 Sept Fri</td>
<td>BCA Breakfast Talk for CEOs (by invitation only)</td>
<td>Workshop 2 - Optimising Building Performance Through Modeling Tools and Artificial Intelligence System</td>
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<td>Green Mark Tours</td>
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<td></td>
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<td>Workshop 1 - Green Mark Scheme and Green Building Financing - Updates</td>
<td>Workshop 3 - Innovative Lighting Solution to Enhance Energy Efficiency and Users’ Productivity</td>
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<td>Workshop 4 - Sustainable Designs</td>
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## Green Mark Tours

<table>
<thead>
<tr>
<th>Route</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>W Singapore and Quayside Isle (Hotel and F&amp;B)</td>
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<tr>
<td>2</td>
<td>Solaris (Office Building)</td>
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<td>3</td>
<td>JCube (Shopping Mall)</td>
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<td>4</td>
<td>CleanTech Park - Central Green Core (District)</td>
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<td>5</td>
<td>Jem Retail Mall (Shopping Mall)</td>
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<td></td>
<td>PARKROYAL at Pickering (Hotel)</td>
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<td></td>
<td>Autodesk Asia (Office Interior)</td>
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<td>BP Office (Office Interior)</td>
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<td>Lend Lease Regional Office (Office Interior)</td>
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<td>Treetops Executive Residences (Service Apartments)</td>
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## Distinguished Speakers

<table>
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<tr>
<th>Speaker</th>
<th>Title</th>
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<tbody>
<tr>
<td>Thomas Heatherwick</td>
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<td>Addressing the GREEN Consumer; where Design, Technology &amp; Business Converge</td>
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<tr>
<td>Professor Michael Siminovitch</td>
<td>Director, California Lighting Technology Center, University of California, Davis</td>
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<td></td>
<td>Innovative Lighting Solution to Enhance Energy Efficiency and User’s Productivity</td>
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<td>Gary Lawrence</td>
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<td>Urban Solution for Green Cities</td>
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<td>Harvey Bernstein</td>
<td>VP Industry Insights &amp; Alliances, McGraw-Hill Construction</td>
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<td>World Green Building Trends</td>
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<td>Principal, Ashok B Lall Architects</td>
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<td>Green Building Drivers in Asia Pacific</td>
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<td>Tan Tian Chong</td>
<td>Group Director, Technology Development</td>
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<td>Group Building and Construction Authority (BCA), Singapore</td>
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<td>Singapore 3rd Green Building Masterplan</td>
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PERCENTAGE OF GREEN BUILDINGS IN SINGAPORE

AS AT MAY 2013

2004 | 0%

2013 | 20%

2030 | 80% (Target)