

3rd GREEN BUILDING MASTERPLAN

Building and Construction  Authority

We shape a **safe**, **high quality**, **sustainable** and **friendly** built environment.



FOREWORD

BUILDING A GREENER TOMORROW

In 2005, the Singapore Government embarked on the green building movement by launching the BCA Green Mark scheme. **The BCA Green Mark scheme, a leading green building rating system in the tropics and sub-tropics, serves as a benchmark for evaluating environmental sustainability in buildings.** It also formed the backbone for Singapore's first Green Building Masterplan developed in 2006 to encourage, enable and engage industry stakeholders to adopt new green buildings.

The second Green Building Masterplan was launched in 2009 to tie in with the Inter-Ministerial Committee on Sustainable Development (IMCSD)'s report on Sustainable Singapore. The focus then shifted to greening the large existing building stock in order to achieve the key target in the IMCSD report of having "at least 80% of the buildings in Singapore to be green by 2030". With the two Masterplans in place, the green building momentum spearheaded by BCA took off in Singapore and achieved much international recognition.

With more than 25% of buildings already 'greened', we began an ambitious plan to accelerate the green building agenda. **The third Green Building Masterplan was developed to engage building tenants and occupants more actively to drive energy consumption behavioural change and to address the well-being of the people.**

To formulate the new Masterplan, we held a series of consultations, feedback and discussion sessions with key industry players and stakeholders. This included a 3rd International Panel of Experts on Sustainability of the Built Environment (IPE-SBE) in June 2013.

With this publication, we wish to share our aspiration and approach for Singapore to become **"A global leader in green buildings with special expertise in the tropics and sub-tropics, enabling sustainable development and quality living"**.

The initiatives under **the three strategic goals of our 3rd Green Building Masterplan, namely (i) Continued Leadership, (ii) Wider Collaboration and Engagement, and (iii) Proven Sustainability Performance**, will accelerate the proliferation of green buildings and contribute towards Singapore's overall efforts to provide a quality living environment for its people. In so doing, we also hope to become a climate-resilient global city well-positioned for green growth.

Sustainable development remains a national priority given our resource constraints, demands of our growing city, and the global challenge of climate change. It is necessary for us to play our part to combat climate change and strengthen Singapore's position as a global city committed to balancing its development with care for the environment.

The time to act is now. We urge all in the built environment sector, as well as the community and individuals, to join us in this challenging yet fulfilling journey. Together, we can do our part for the environment and create a sustainable built environment and quality living for us and our future generations.

Mr Quek See Tiat
Chairman
Building and Construction Authority

Dr John Keung
Chief Executive Officer
Building and Construction Authority

VISION

Since 2006, BCA has rolled out a comprehensive suite of initiatives and policies under the 1st and 2nd Green Building Masterplans. These measures aimed to speed up the pace of green building development towards meeting the 80% national target, with an emphasis on achieving higher energy efficiency in buildings.

Our efforts have borne fruit. Since the launch of the BCA Green Mark scheme in 2005, the number of green buildings in Singapore has grown exponentially, from 17 in 2005 to more than 2,100 in 2014. This translates to about 62 million square metres of gross floor area (GFA), equivalent to 25% of the total built-up areas in Singapore.

Together with industry partners, we formulated an integrated strategic plan that will provide direction and targets for Singapore's built environment in the next 5 to 10 years.

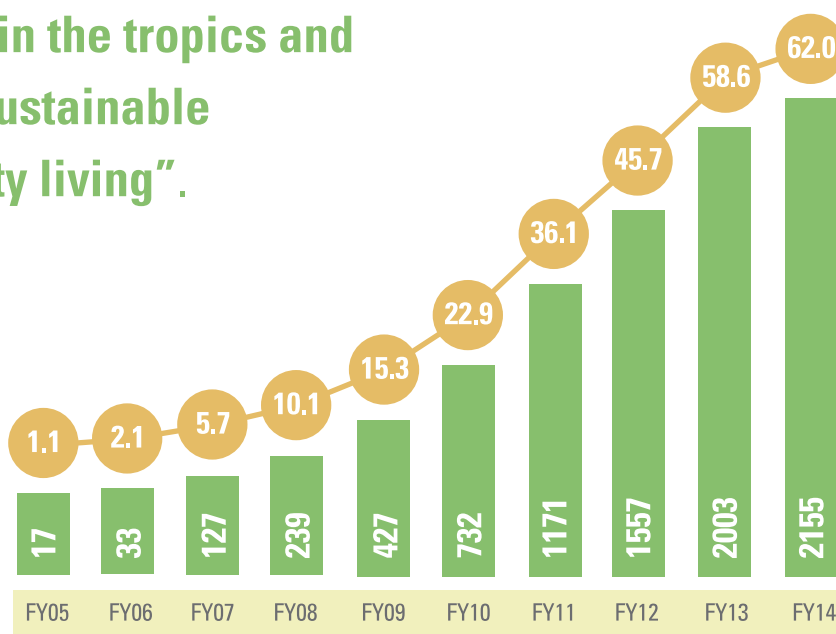


As part of this plan, Singapore has set an ambitious vision of becoming
“A global leader in green buildings with special expertise in the tropics and sub-tropics, enabling sustainable development and quality living”.



BCA GREEN MARK

 **GFA (million m²)**
 **Number of building projects**



Number of Green Buildings – as at July 2014

Guided by the national target and Vision, BCA will engage stakeholders and partners to progressively roll out economically sound, innovative and pragmatic measures under our 3 Strategic Goals to further green the large existing building stock in Singapore. We will also engage building owners, facility managers, tenants and occupants as well as the young to play a bigger role in Singapore's green building movement.

We believe Singapore has good potential to be a global leader in the tropics and sub-tropics.

We can continue to lead in the region, addressing challenges and exploring solutions in the development of green buildings, while placing greater emphasis on occupants and their well-being.



CONTINUED LEADERSHIP

1ST STRATEGIC GOAL

BCA has been driving sustainable development in the built environment through initiatives such as Public Sector Taking the Lead in Environmental Sustainability (PSTLES), grooming a green-collar workforce, and sharing our experiences internationally.

BCA will continue to lead and support green building advancement in the industry and region. This will be done through capability building and establishing the BCA Green Mark scheme as the green building rating tool of choice in the tropics and sub-tropics.

In addition, BCA aims to work towards setting industry standards with innovative solutions to achieve zero or net positive energy low-rise buildings and low energy high-rise buildings that address the high density characteristics of cities worldwide.

Moving forward, Research, Development and Demonstration (RD&D) will play a more critical role in the next phase of development for green buildings.



KEY INITIATIVES



DEVELOPING BCA'S ROTATABLE TEST FACILITY

- Asia's 1st rotatable test facility for building technologies
- To study actual performance of building systems and components under real world conditions at different orientations to the sun



PUBLIC SECTOR TAKING STRONGER LEAD IN ENVIRONMENTAL SUSTAINABILITY (PSTLES)

- Efforts within the public sector will be enhanced by strengthening organisational processes to manage resource use



GREEN MARK AS LEADING GREEN BUILDING RATING SYSTEM OF THE TROPICS & SUB-TROPICS

- Undergoing review with extensive industry consultations for a new Green Mark version with emphasis on quality of indoor environment and the health, comfort and well-being of the users and occupants
- Green Mark Version 5 to be developed with advancements in climatic responsive passive design, complemented with smart building management, greater resource efficacy, and an enhanced renewable energy adoption



EXPANDING VARIETIES OF SUSTAINABLE BUILT ENVIRONMENTS

- More Green Mark schemes with specific criteria will be progressively added to address the requirements of different building facilities
- Green Mark for Districts scheme to be expanded to a wider variety of built environment such as industrial parks and educational campuses



GROOMING GREEN SPECIALISTS

- Comprehensive training framework with holistic approach towards building up industry's capabilities in the design, maintenance and management of green buildings
- Competency developed in the individuals will in turn drive the growth of their organisations towards better competitiveness in both local and international markets



S\$52 MILLION GREEN BUILDINGS INNOVATION CLUSTER (GBIC)

- Developing and demonstrating novel and market-proven solutions in a mix of building types
- To validate performance, raise and build awareness and capability
- To proliferate energy efficiency across the built environment



S\$5 MILLION GREEN MARK INCENTIVE SCHEME FOR DESIGN PROTOTYPE (GMIS-DP)

- Introduced since 2010 to encourage greater emphasis at design stage
- Developments targeting beyond Green Mark Platinum standards are to demonstrate > 40% energy savings as compared to prevailing building energy efficiency standards



S\$15 MILLION SUSTAINABLE CONSTRUCTION CAPABILITY DEVELOPMENT FUND

- Introduced since 2010 to develop capabilities in resource efficiency
- Promotes the recycling of waste arising from demolition of buildings and use of recycled materials for construction



S\$5 MILLION INNOVATION GRANT (IGRANT)

- Facilitates the introduction of novel tools, methodologies and technologies with high impact and high potential for scale-up adoption and commercialisation
- For small scale, fast track, Proof-of-Concept type of R&D projects

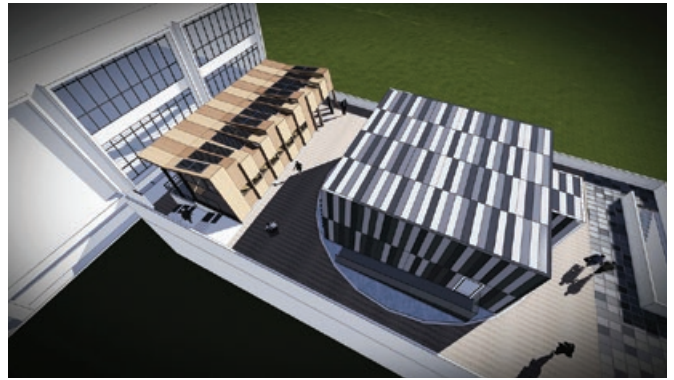


S\$15 MILLION ENERGY INNOVATION RESEARCH PROGRAMME (EIRP) FOR BUILDING ENERGY EFFICIENCY GRANT CALL

- Supports development of energy efficient and cost-effective technologies and solutions in the tropics
- Collaboration with private sector companies
- Opportunity for deployment and commercialisation of technologies

BCA's Rotatable Test Facility

Banking on the success of BCA's Zero Energy Building (ZEB) – the first ZEB in South-east Asia retrofitted from an existing building – Singapore is now developing Asia's first rotatable test facility for building technologies. In collaboration with and modelled after the U.S. Lawrence Berkeley National Lab's FLEXLAB, the facility will allow building systems and components, such as lighting, air conditioning and façade, to be tested in 'real world' conditions in the tropical belt. Upon its completion and launch in 2015, researchers will be able to study the actual performance of various building technologies through a configurable test setup and at different orientations relative to the sun in tropical climatic conditions.



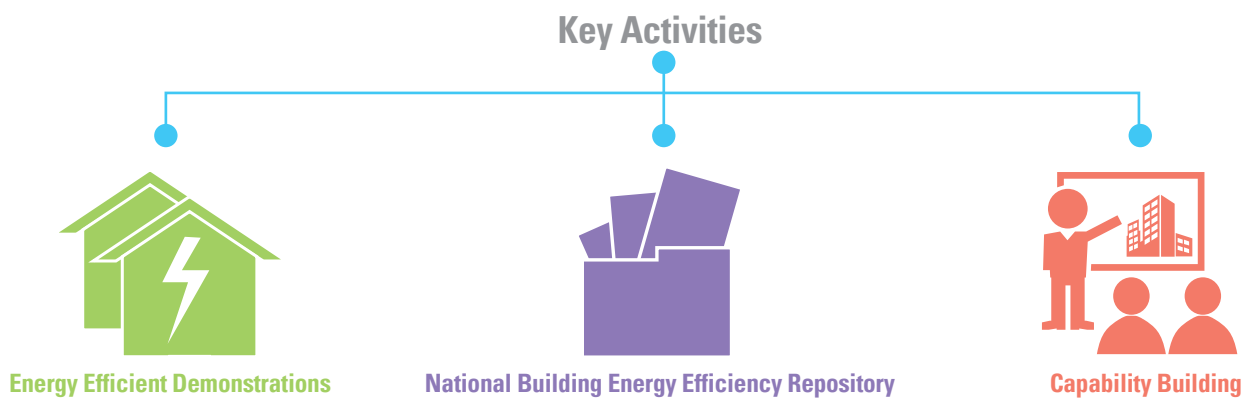
\$S\$52 Million Green Buildings Innovation Cluster (GBIC)

An R&D roadmap on building energy efficiency in Singapore has been developed through a multi-agency effort led by BCA. This roadmap charts a viable pathway towards wide-scale deployment of energy efficient building solutions by leveraging on technology and addressing barriers to implementation.

Based on this roadmap, the National Research Foundation, through the Energy Research, Development & Demonstration (RD&D) Executive Committee (ExCo), will allocate \$S\$52 million in establishing an integrated Building Energy Efficiency RD&D Hub. Also known as the Green Buildings Innovation Cluster

(GBIC), the hub will underline the robust link between research and translation to policy.

The GBIC aims to integrate efforts in developing large scale and high impact demonstration projects for promising technologies and solutions. GBIC will also tightly couple research with translation to market for widespread adoption of energy efficient solutions and practices, as well as streamline, coordinate and disseminate building energy efficiency related activities through a central focal point.



Green Mark – Leading Green Building Rating System of the Tropics and Sub-Tropics

The BCA Green Mark scheme will undergo a comprehensive review, further cementing the scheme as the green building rating tool of choice in the tropics and sub-tropics. There will be extensive industry consultations to set clear directions and practical pathways in a new Green Mark version.

The Green Mark Version 5 for new developments, targeted for launch in the 3rd quarter of 2015, will be developed with advancements in climatic responsive passive design. This will be complemented with smart building management, greater resource efficacy, and an enhanced renewable energy adoption. More importantly, the focus will shift towards user-centricity with a greater emphasis on quality of the indoor environment, as well as the health, comfort and well-being of the users and occupants.



BCA Green Mark Schemes



Since its launch in 2005, the BCA Green Mark scheme has helped guide the design, construction and operation of buildings in increasing energy efficiency and enhancing environmental performance.

The BCA Green Mark scheme has evolved since its inception. Today, the BCA Green Mark scheme is not just applied to new and existing individual buildings, but also deployed to promote environmental sustainability beyond buildings. This includes parks, supporting infrastructures, districts, rapid transit systems, and even occupant-centric spaces within buildings such as in supermarkets, restaurants and healthcare facilities.

New Buildings

BCA Green Mark for New Non-Residential Buildings
BCA Green Mark for New Residential Buildings
BCA Green Mark for Landed Houses

Existing Buildings

BCA Green Mark for Existing Non-Residential Buildings
BCA Green Mark for Existing Residential Buildings
BCA Green Mark for Existing Schools

Beyond Buildings

BCA-NParks Green Mark for Existing Parks
BCA-NParks Green Mark for New Parks
BCA Green Mark for Infrastructures
BCA-LTA Green Mark for Rapid Transit System (RTS)
BCA Green Mark for District

Within Buildings

BCA Green Mark for Office Interior
BCA Green Mark for Restaurants
BCA Green Mark for Supermarket
BCA Green Mark for Retail
BCA Green Mark for Data Centre
BCA Green Mark for Healthcare Facilities

International Reach of Green Mark – as at July 2014



To mark our leadership in green buildings in the region, the BCA Green Mark scheme has expanded beyond Singapore to 71 cities in 15 countries with more than 250 projects.

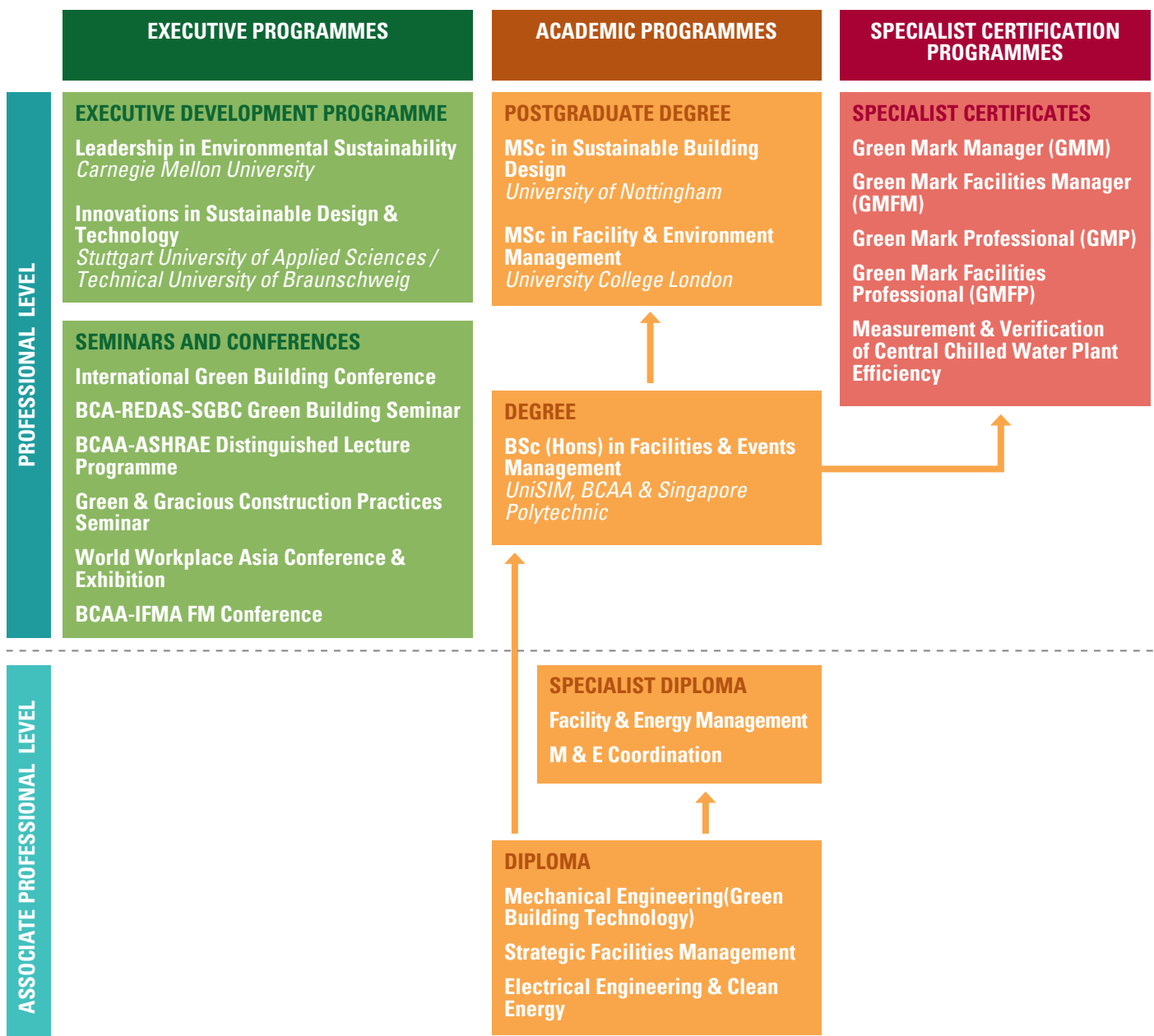
Grooming Green Specialists

In order to build up the industry's capability in the whole chain of green building design, construction, maintenance and management, the BCA Academy has developed a comprehensive training framework to groom green building professionals, specialists and experts who can design and manage sustainable buildings.

The holistic approach provides flexibility for aspiring students and practitioners seeking the best route for acquiring knowledge, qualifications and specialisation that will develop and advance their education and careers. In turn, higher competency levels from practitioners can enable them to steer their organisations towards greater competitiveness in the local and international markets.



Training Framework to Build Green Collar Workforce



WIDER COLLABORATION & ENGAGEMENT

2nd STRATEGIC GOAL

The value and market demand for green buildings are consumer-driven and they are important to sustain the future of the green building movement. Results from the inaugural BCA Building Energy Benchmarking Report (released in September 2014) show that electricity usage by building owners and tenants accounts for 50% of electricity consumption in commercial buildings. With the development of state-of-the-art systems and facilities in green buildings, there is a limit to how far we can drive sustainability if there is no change in building users' behaviour and consumption patterns.

To drive sustainable operations and efficient resource use among tenants and end-users, BCA will forge wider, yet closer, collaborations and partnerships with key stakeholders including industry players, school community, general public, building owners and tenants. Such collaborations will drive changes in energy consumption behaviours in the longer term and develop an environment that addresses the people's well-being.



Green Partnership Initiative with Minister for Manpower, CEO of BCA and six developers – namely, CapitaLand, City Developments, Keppel Land International, Mapletree Investments, Ascendas, and Lend Lease



Tenants' Green Pledge with Minister for Manpower, CEO of BCA and nine organisations – namely, NetApp Singapore, J's Salon, Autodesk Asia, Dairy Farm Singapore, Greenpac, NTUC Fairprice Co-operative, Visa Worldwide, National Climate Change Secretariat, and BP Singapore

KEY INITIATIVES

\$S50 MILLION GREEN MARK INCENTIVE SCHEME FOR EXISTING BUILDINGS AND PREMISES (GMIS-EBP)



BUILDING RETROFIT ENERGY EFFICIENCY FINANCING (BREEF) SCHEME

- Incentivises existing small and medium enterprises (SMEs) tenants and building owners, or building owners with at least 30% of its tenants who are SMEs to adopt energy efficiency
- Co-funds up to 50% of the retrofitting cost for energy improvements, or up to S\$3 million for building owners and up to S\$20,000 for tenants
- To aid building owners in overcoming upfront costs of energy efficiency retrofits and in adopting Green Mark standards for existing buildings
- Increased risk share of 60% for any loan default with participating financial institutions

GREEN MARK GROSS FLOOR AREA (GM GFA) INCENTIVE SCHEME



- Encourages private sector to work towards achieving higher-tier Green Mark ratings
- Applicable to all new and existing private developments that undergo substantial energy efficiency enhancements

REACHING OUT TO BUILDING OWNERS/TENANTS



- Green Mark Portfolio Programme to certify similar spaces across a portfolio of projects
- Green Lease Toolkit to provide good practice guidelines and to set sustainability targets between building owners and tenants
- Improve sustainability standards in tenants' fitout and daily operations through Green Partnership Initiative Programme
- Building capability and elevating industry's professionalism through professional accreditation
- Green Mark Pearl Award to recognise developers and building owners who demonstrate thought leadership and efforts in engaging their tenants

GREENING SCHOOLS AND COMMUNITY FOR GREATER AWARENESS



- Green School Roadmap to facilitate greening of schools
- Assists schools to conduct energy audits through Greenovate Challenge Programme
- Achieve net zero energy in schools through installation of photovoltaic panels



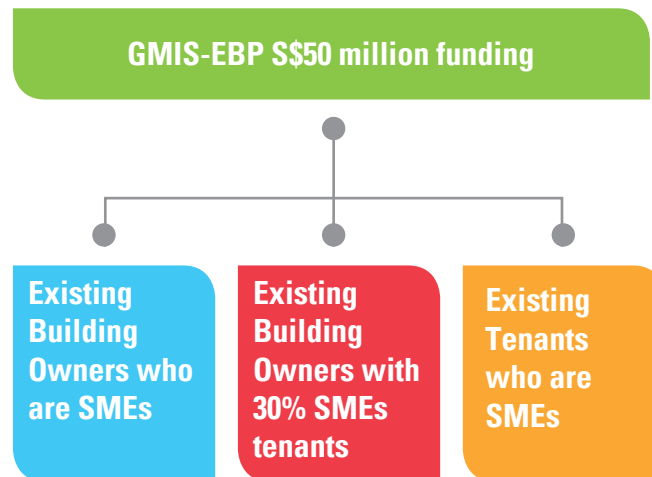
S\$50 Million Green Mark Incentive Scheme for Existing Buildings and Premises (GMIS-EBP)

Launched in September 2014, the S\$50 million GMIS-EBP encourages and incentivises building owners, occupants and tenants to undertake and adopt energy efficiency improvements and measures within their buildings and premises. The incentive applies to existing small and medium enterprises (SMEs)* tenants and building owners, or building owners with at least 30% of its tenants who are SMEs. The SMEs will be required to meet:

- (i) minimum 30% local shareholding; and
- (ii) annual sales turnover of not more than S\$100 million; or
- (iii) employment size of not more than 200 employees.

This measure will also help build up the industry's capability to undertake retrofitting works in medium-sized buildings and premises. The scheme will co-fund up to 50% of the retrofitting cost for energy improvements, or up to S\$3 million for building owners and up to S\$20,000 for occupants and tenants.

* SPRING's SMEs definition.



Green Mark Pearl Award

We hope to encourage developers, building owners and tenants to work together in greening their spaces and adding value to their businesses. As such, we are launching a new Green Mark Pearl Award that recognises developers and building owners who demonstrate thought leadership and efforts in actively engaging their tenants to shape behaviour and operational practices that result in improved total building performance. Through this award, our green tenanted GFA is expected to increase to at least 50% to 70% for each building that is given this award.

Green School Roadmap

A Green School Roadmap will be developed, giving the younger generations a first-hand experience in sustainability issues. The roadmap aims to green and facilitate schools in achieving overall net zero energy. These can be achieved by:

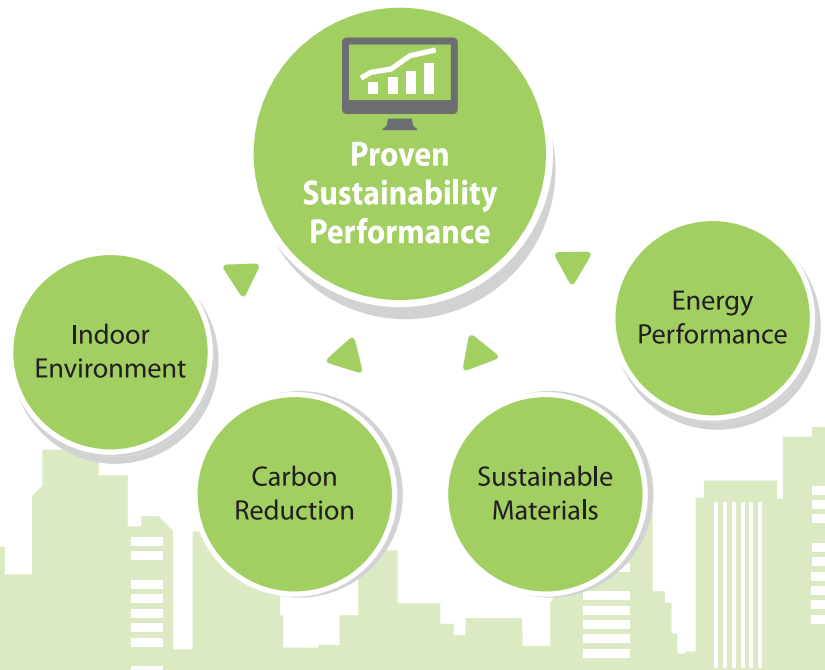
- Helping schools conduct energy audits of their premises through the Greenovate Challenge programme;
- Attaining the BCA Green Mark for Existing Schools award; and
- Installing photovoltaic panels in schools to achieve net zero energy.



PROVEN SUSTAINABILITY PERFORMANCE

3rd STRATEGIC GOAL

Realising the importance of sustainable energy consumption and management to achieve proven sustainability performance, BCA is addressing information barriers and closing the energy efficiency loop through monitoring, sharing of information, and demonstrating building energy performance, taking the whole life cycle of buildings into consideration. By doing so, it also serves as a platform to improve the quality of the built environment and occupant well-being.



KEY INITIATIVES



ANNUAL MANDATORY SUBMISSION OF BUILDING INFORMATION AND ENERGY CONSUMPTION DATA

- Developed the inaugural BCA Building Energy Benchmarking Report (BCA BEBR) to share on the national building benchmarks
- Monitors buildings' energy consumption to encourage pro-activeness in energy efficiency improvements and sustainable energy consumption behaviour of building occupants and users



MANDATORY MINIMUM ENVIRONMENTAL SUSTAINABILITY STANDARD FOR EXISTING BUILDINGS

- Meet minimum environmental sustainability standard upon installation and replacement of building cooling system
- Applicable to both single and mixed-use developments of hotel, retail and office buildings with Gross Floor Area of 15,000m²



MANDATORY PERIODIC ENERGY AUDIT OF THE EFFICIENCY OF BUILDING COOLING SYSTEMS AND COMPLIANCE WITH MINIMUM STANDARDS

- Carry out energy audit on building cooling system to ensure systems operate throughout its life cycle
- Applicable to existing buildings which have undergone major energy-use change on and after 2 January 2014



ENHANCED INDOOR ENVIRONMENT QUALITY (IEQ) & POST OCCUPANCY EVALUATION

- Review various building codes to achieve good indoor environmental quality
- Ensure Green Mark certified facilities conduct regular indoor air quality audits



From left: City Square Mall - Green Mark Platinum Award for Existing Non-Residential Buildings, Supreme Court - Green Mark Gold Award for Existing Non-Residential Buildings.

Legislation on Environmental Sustainability Measures for Existing Buildings

The key initiatives under the 3rd Strategic Goal aim to drive reduction in energy consumption and carbon emissions through legislative controls that take the whole life cycle of buildings into consideration. This will ensure that buildings continue to comply with higher energy standards and operate at an optimal level after retrofitting. Part IIIB – Environmental Sustainability Measures for Existing Buildings was introduced to the Building Control Act on 1 December 2012, requiring building owners to:

- achieve the minimum environmental sustainability standard (Green Mark Standard) for existing buildings when installing or retrofitting a cooling system (effective from 2 January 2014);
- carry out periodic energy efficiency audits on the building cooling system(s) and compliance with design system efficiency (effective from 2 January 2014); and
- submit building information and energy consumption data annually through BCA's Building Energy Submission System (BESS) (effective from 1 July 2013).

We recognise that we cannot manage and improve upon what we do not measure. The annual mandatory submission serves to monitor the buildings' energy consumption, encouraging building occupants and users to be pro-active in improving building energy efficiency and energy consumption. Based on the data collated, the inaugural BCA Building Energy Benchmarking Report, released in September 2014, will share national building benchmarks with the industry. The report is an important first step in making information on building energy performance and consumption readily available to a wider audience as we move towards mandatory energy disclosure in the coming years.

Carbon Reduction

Through new standards applied to revised building codes as well as the upcoming versions of the BCA Green Mark scheme, the environmental performance of green buildings will also address its carbon footprint and sustainable material sources. Working with Non-Governmental Organisations (NGOs) and the academia, a carbon footprint assessment software toolkit and industry training will be developed to meet new standards requiring:

- quantification of the carbon footprint of key components of building projects;
- ability to conduct sensitivity analysis; and
- carbon footprint reporting through established protocols.

Sustainable Materials

To support the longer term objective of carbon reduction, standards will also be rationalised and tightened to mandate a structured approach towards adoption of green materials at the:

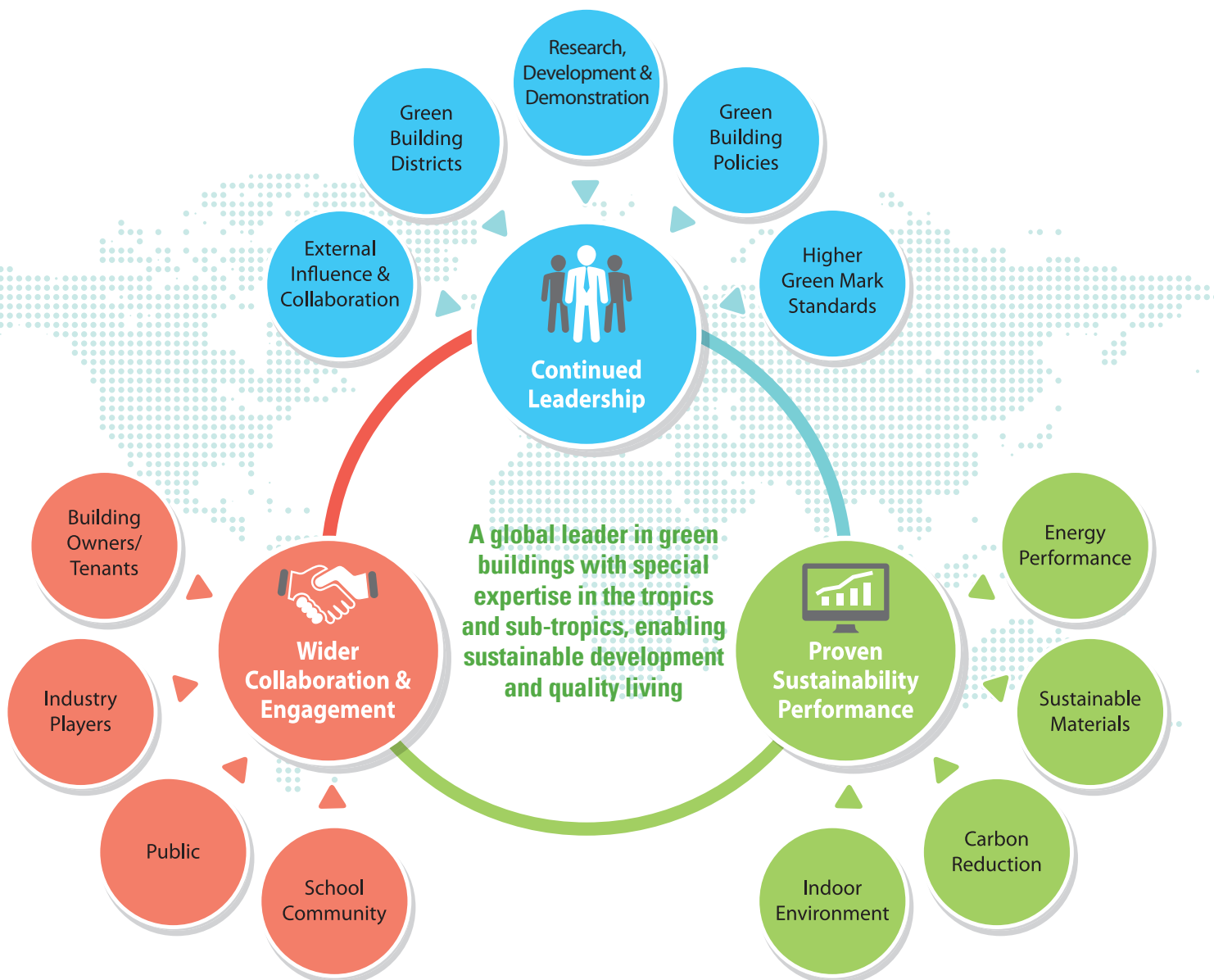
- systems and components level, and
- finishing level involving the selection of green products.

Occupant Well-Being through Enhancing Indoor Environment Quality (IEQ)

To ensure that the environmental performance of buildings is effective in improving users and occupants' comfort and well-being, the assessment of indoor environmental quality will be enhanced. BCA is working with the industry to review various building codes involving ventilation, lighting, as well as health and safety. These will cover the areas of design, operation and maintenance to achieve good indoor environmental quality. There will be provisions to ensure that Green Mark certified facilities use only products that do not release harmful gases, and have in place measures to conduct regular audits of the facilities' indoor air quality.

A GREENER TOMORROW

Building a greener tomorrow requires us to look beyond sustainability in buildings alone. By promoting initiatives and joint efforts that focus on occupant and user behaviour, we can work towards achieving a high-performing and resource-efficient built environment. This brings us closer to our vision of transforming this island into a sustainable and highly liveable city.





We shape a **safe**, **high quality**, **sustainable** and **friendly** built environment.

<http://www.bca.gov.sg>