Journey of Singapore, the Green Dot.

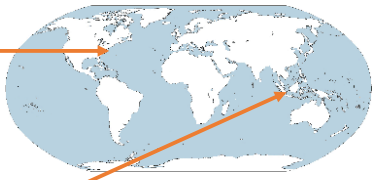
Dr. John Keung
Chairman, BCA Centre for Sustainable Buildings and Dean, BCA Academy
Building and Construction Authority, Singapore

Building and Construction Authority

Scope of Presentation

- Going **Green** in Singapore – a **High-rise, High-density**, **Hot** and **Humid** Tropical City
- Our **Zero** Ambition
- Towards Zero and The Way Ahead – **how to scale up?**

Comparing NYC and Singapore



	New York City	Singapore
	8.5 mil	5.61 mil
	784 sq.km	720 sq.km
	-3 °C - 31 °C	25 °C - 35 °C
	68% (RH)	84% (RH)

Source: ny.gov; singstatgov.sg

Background of Singapore

Singapore	1960	2018*
Population	**1.64** mil	**5.61** mil
Land Area	**580** sq.km	**720** sq.km
GDP Per Capita	US$**428**	US$**55,949**

**Updated as of 11 Apr 2018*

Towards a Green City in the Tropics
- Challenges in going Green in a High-rise, High-density, hot and humid city in the Tropics

solidiance
Ranked 2nd in Top 10 Global Cities for Green Buildings 2016

BCA GREEN MARK

Phase 1 Greening New Buildings
Phase 2 Greening Existing Buildings
Phase 3 Greening Occupants & Tenants

2005 — Launched BCA Green Mark Scheme
2006 — 1st GREEN BUILDING MASTERPLAN
2009 — 2nd GREEN BUILDING MASTERPLAN
2014 — 3rd GREEN BUILDING MASTERPLAN

2005
Green Building: **0.5%** of the entire building stock (by GFA)

2018*
Green Building: **34%** of the entire building stock (by GFA)

A Global Leader
in Green Building in the Tropics and Sub-Tropics

BCA Centre for Sustainable Buildings Singapore
A Centre Collaborating with UNEP

14 Countries, **80** Cities Regionally
Nearly 300 Projects

Sub-tropics
Tropics
Sub-tropics

UNEP
BCA

Promote and establish sustainable building policies and practices in the Southeast Asia region

1st Challenge

Concern over Cost premium and Skepticism over the Value of Green Buildings

Actions

(1) Walking the Talk

New Public Buildings – Green Mark Platinum

Existing Public Buildings
>5,000 m² to meet Gold standard

Office Interior
GM certification to be obtained for new lease or renovation

More than **34%** of the entire building stock greened

(2) Incentivising the Industry

Green Mark Incentive Schemes

Additional Gross Floor Area *58,000 m² Committed*	**S$50m** Existing Building and Premises *NEW!*
S$100m Existing Buildings *Fully Committed*	**$20m** New Buildings *Fully Committed*

S$5m Design Prototype *S$2m Committed*

(3) Enabling Mindset Change

Business Case for Green Buildings –

BCA Green Mark Award Type	Green Cost Premium	Payback Period (years)
Platinum (>30% energy savings)	3% ~ 5%	2.5 ~ 6.5
Gold Plus (>25% energy savings)	2% ~ 4.5%	2 ~ 4
Gold	1%~3%	1 ~ 4

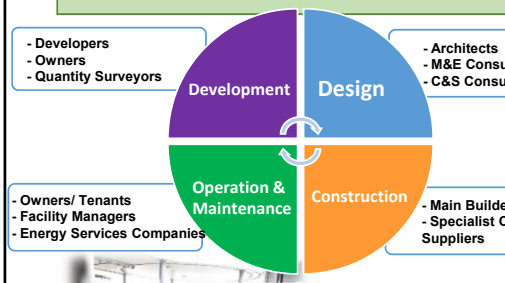
(2011) NUS + Leading Real Estate Consultancy Firms
>2% Increase in Capital value for Retrofitted Commercial Buildings

2nd Challenge

Lack of Expertise in the Industry

Actions

Building Capability



NUS National University of Singapore
NANYANG TECHNOLOGICAL UNIVERSITY
SIT SINGAPORE INSTITUTE OF TECHNOLOGY
SUTD SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN
BCA ACADEMY
Temasek POLYTECHNIC
NYP NANYANG

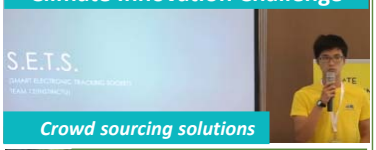
>16,000 professionals trained to date

Targeting **25,000** Green Collar Professionals by **2025**
through a Comprehensive Suite of Green Building Courses in BCA Academy and other training institutions

3rd Challenge

Low Level of Green Awareness among Consumers and Youths

Actions

(1) Co-creation with Public and Youths	(2) Outreach Programmes for Public and Youths	(3) Annual Singapore Green Building Week
Climate Innovation Challenge		
 *Crowd sourcing solutions*	 Green Living Expo	 More than 28,000 participants
 *Students as green ambassadors* Back to School Programme	 BiG Day Out	 Singapore Green Building Week 2017

Our Zero Ambition

- Challenges and Actions

Overall Solar Target: Achieve 350 MWp of Installed Solar Capacity by 2020

Renewable Energy -- Solar Development in Singapore

Solar Programme

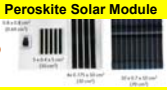
SolarNova Programme (HDB)

Singapore's largest public developer, Housing Development Board aims to implement **220 MWp** of solar panels across **5,500** HDB blocks by 2020

Current Research Projects

Highly Efficient Solar Cell at 66%??

Peroskite Solar Module



Chalcogenide Solar Cell

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Energy Research Institute @NTU

Under R&D

Renewable Energy Integration Demonstrator Spore (REIDS)

Hybrid micro-grid testing includes Solar, Wind and Tidal technologies at Semakau Landfill

Upcoming SolarLand (JTC)

Movable Solar Panels at Jurong Island, Singapore

Floating PV Test-bed

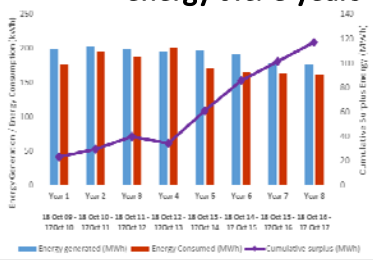
Building Integrated PV

Zero Energy Building @ BCA Academy

The 1st Existing Building in Southeast Asia Retrofitted to Achieve Net Zero Energy

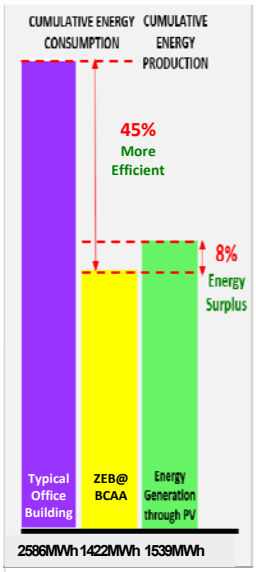
2007 Past to Present 2018

8% surplus energy over 8 years



Solutions Deployed

Zero Energy Building @ BCA ACADEMY



From 18th October 2009 till 13rd February 2018

Enhancement to ZEB: From Zero Energy to Positive Energy through Retrofitting

Zero Energy Building

Retrofitting process

Positive Energy Building

Key targets

Net surplus energy

From 8% → >40%

EEI Improvement

>20%

Key features

- Hybrid Cooling System
- High Performance Glazing with Heat Reflective Film
- User Interface Space Settings
- Monitoring and Switching Plug Loads

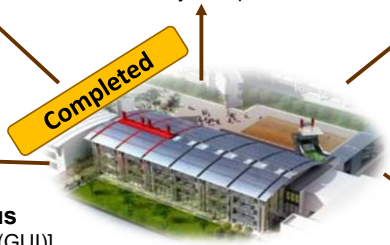
Other Zero Energy Projects in Singapore

National University of Singapore
School of Design & Environment (SDE4)

Defence Science and Technology Agency
Kranji Camp III

Ministry of Education
Tampines Secondary School

Headquarters of Kampung Kampus
[Non-profit Organsiation: Ground-Up Initiative (GUI)]
comprising of organic farming plots, camping grounds, amphitheatre, heritage centre and prototyping zone



BCA Academy
Zero Energy Building

Singapore Management University
SMU-X

Towards Zero and the Way Ahead
- How to scale up?

Our Aspiration:

BCA Sky Lab
World's 1st High-Rise Rotatable Laboratory For the Tropics

Lead Organisation BCA *International Collaborator*

R&D Funding

>$180 mil RESEARCH FUNDING FOR GREEN BUILDINGS

Outcomes

INNOVATIVE
Green Building Solutions

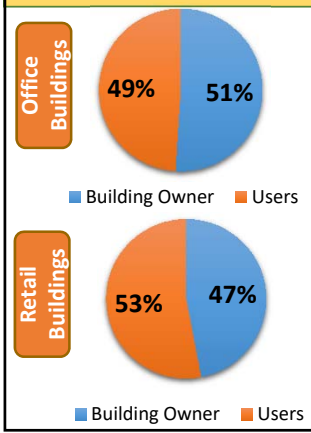
=

COST EFFECTIVE
Green Building Solutions

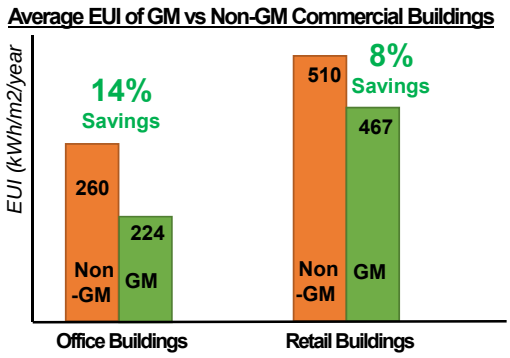
Towards Net Zero: What more can the users do? Behavioural Change, IoT?

Annual BCA Building Energy Benchmarking Reports

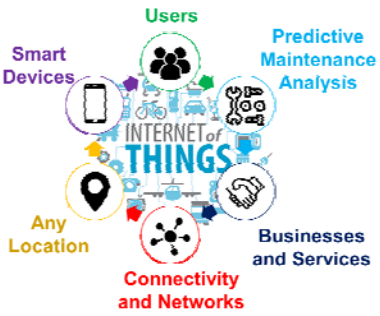
(1) Highlight Energy Consumption by Users



(2) Green Mark Buildings are more Energy Efficient



(3) Internet of Things (IoT)



Leading green buildings *in the tropics and sub-tropics – enabling sustainable development and quality living*

80% of the entire building stock in Singapore to be **greened** by 2030

Towards Nett Zero through **design innovation**, **technology breakthrough** and **user contribution**

Doing our part to enable **cities in the tropical and sub-tropical belt to go green**

Thank you!