Application of SS 553 and SS 554 in BCA Green Mark Schemes

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Agenda

- Highlight on Changes in Code
- Application in Green Mark Schemes
- Energy Modelling Study

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Changes To Code – SS 553 (2016)

MECHANICAL FAN EFFICIENCY

Fan System	2006 [w/cmh]	2015 [w/cmh]	Tightening of Code Percentage
Fan power limitation in mechanical ventilation systems [CAV & VAV]	0.47	W/CMH: 0.35 Wi/CMH: ≤ 0.3 + A	25.5%

AIR – CONDITIONING FAN EFFICIENCY

No change in Air – Con Fan system Efficiency from pervious version

	Limit	Constant Volume	Variable Volume
Option 2: Fan system input kWi	Allowable fan system input Wi/CMH	≤ 0.42 + A	0.58 +A

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Changes To Code – SS 554 (2016)

Main Change 1

Amendments to acceptable limit in Table 1 – Recommended IAQ parameters
In particular, use of air temperature of 23°C to 25°C instead of operative temperature 24 °C to 26°C.

Main Change 2



5.1.4.5.2 Air filters

In the event of poor outdoor air quality (such as that during haze events) or presence of indoor source of fine particles, the use of fine dust filters of at least a rating of Minimum Efficiency Reporting Value (MERV) 14 (ASHRAE Standard 52.2 : 2012) or F8 (EN 779 : 2012), is required.

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Application to BCA Green Mark

Implementation will take place in GM NRB: 2015 and the criteria introduced thereafter.

BCA GREEN MARK

BCA Green Mark: Non-Residential Buildings

GM NRB: 2015

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Air Conditioning Total System and Component Efficiency

Pre-requisite P.04 Air Conditioning Total System and Component Efficiency

a) Air Cooled Chilled-Water System/ Unitary Air-Conditioning System

Green Mark Rating	Peak Building Cooling Load (RT)		Remarks
	<500 RT	≥500RT	(η_c, η_a) are also required to be complied. η_c: System kW/ton excluding the air distribution equipment η_a: Air distribution equipment kW/ton $\eta_t = \eta_c + \eta_a$
	Minimum Design Total System Efficiency η_t (kW/RT)		
Gold	NA (0.9, N.A.)	N.A. (0.68, N.A.)	
Gold^{PLUS}	1.10 (0.85, 0.25)	0.9 (0.65, 0.25)	
Platinum	1.03 (0.78, 0.25)		

b) Water Cooled Chilled Water System

Green Mark Rating	Peak Building Cooling Load (RT)		Remarks
	<500 RT	≥500RT	(η_c, η_a) are also required to be complied.
	Minimum Design Total System Efficiency η_t (kW/RT)		
Gold	NA (0.75, N.A.)	NA (0.68, NA)	
Gold^{PLUS}	0.95 (0.7, 0.25)	0.9 (0.65, 0.25)	
Platinum	0.93 (0.68, 0.25)		

Improvement over baseline will be credited under *Energy Performance Points Calculator*

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Pre-requisite

P.11 Filtration Media for Times of Pollution

Intent

The effective removal of harmful pollutants in outdoor air from the building ventilation system through high efficiency filters can enhance indoor air quality and the health and well-being of the occupants.

Scope

Applicable to air handling units (AHUs) or systems for dedicated treatment of outdoor air in air conditioned building developments.

Assessment

AHUs or dedicated outdoor air units in the building shall be designed to accommodate fine dust filters of least a rating of **Minimum Efficiency Reporting Value (MERV) 14** (ASHRAE 52.2: 2012) or F8 (EN779: 2012), when the outdoor pollution level is in the unhealthy range in accordance with MOH's guidelines.

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4.01a Occupant Comfort

(i) Indoor Air Quality (IAQ) Surveillance Audit

0.5 or 1 point can be scored respectively for an IAQ surveillance audit based on the indicative or reference methods described in *SS 554 : 2016 Code of Practice for Indoor Air Quality for Air-Conditioned Buildings*, and committed to be conducted for the building within one year after occupancy. The audit should use the benchmarks within Clause 6 of *SS 554 : 2016* or NEA's *Guidelines for Good Indoor Air Quality in Office Premises* to demonstrate good IAQ performance.

(iii) Indoor Air Quality Display

0.5 point can be scored for the provision of display panels for temperature and relative humidity information at each floor/ tenancy, to raise awareness among building occupants on the internal conditions of the space.

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4.01a Occupant Comfort

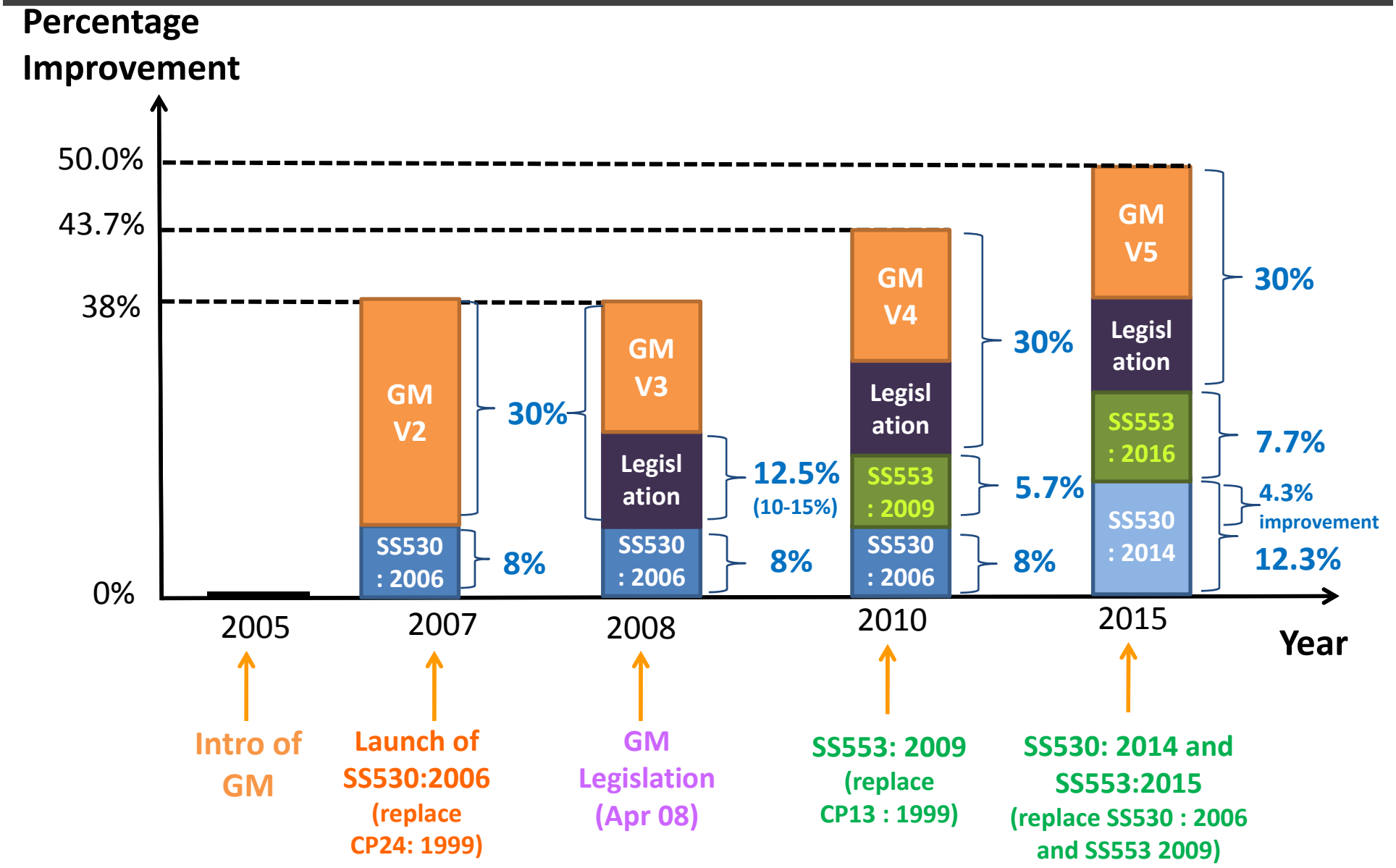
Indoor Air Quality Trending (Advanced Green Effort)
A maximum of 2 points can be scored for the provision of monitoring and trend logging for the following parameters, linked to a centralised system, per floor:
Temperature, relative humidity – 0.5 point
Common indoor air pollutants such as formaldehyde - 1.5 point

4.01b Outdoor Air

(ii) Enhanced Filtration Media
0.5 point or 1 point can be scored for the permanent provision of Minimum Efficiency Rating Value (MERV) 14, (ASHRAE 52.2) or F8 (EN779) class of filter or equivalent to all PAHUs or all AHUs respectively.

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EE Impacts from Various Initiatives



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Energy Modelling Study Methodology

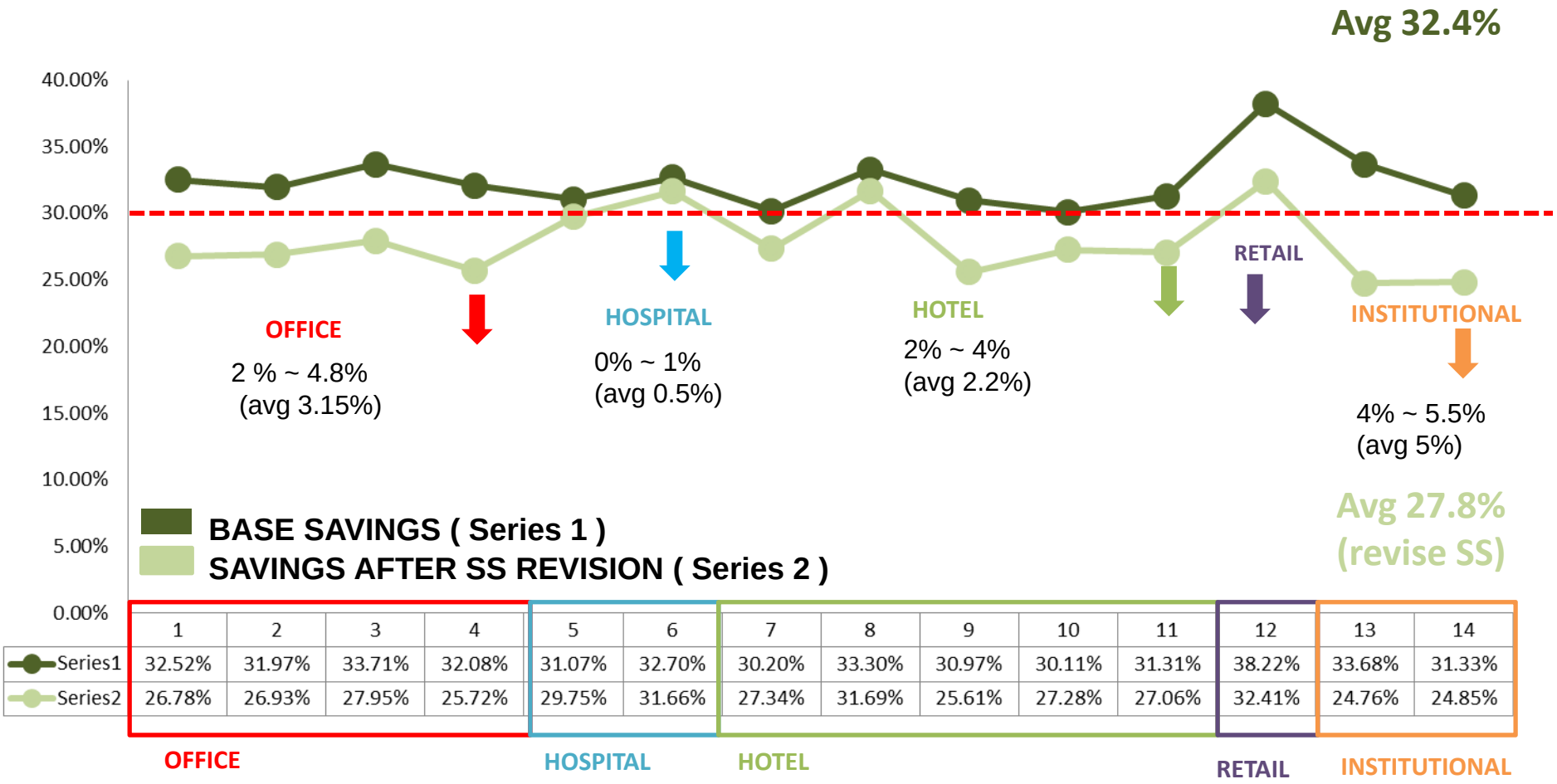
1. **Sampling Buildings:** 14 Platinum projects (V4.1 & 4) was selected. The selected buildings belonged to the following topology;

- Office (4)
- Hospital (2)
- Hotel (5)
- Retail (1)
- Institutional (2)

2. **The reference case was revised** based on latest code:
   - Lighting power budget
   - Chiller
   - VRF
   - MV fans

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Results – Tightening Of Code



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Series1	32.52%	31.97%	33.71%	32.08%	31.07%	32.70%	30.20%	33.30%	30.97%	30.11%	31.31%	38.22%	33.68%	31.33%
Series2	26.78%	26.93%	27.95%	25.72%	29.75%	31.66%	27.34%	31.69%	25.61%	27.28%	27.06%	32.41%	24.76%	24.85%

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Energy Efficiency Technologies and Other Measures

EE Technologies	Current Platinum Norms	Feasible Technology at Market *	Potential % saving contribution to overall building's consumption*
Lighting – Office	9 W/m^2	7 W/m^2	Up to 3% (depend on size of office area)
Lighting – M&E Space	No saving	< 6 W/m^2 Baseline: 10W/m^2	≅ 0.2%
Chiller Plant System	0.60 kW/RT	0.56 kW/RT	Up to 2%
AHU	Current	DC or Direct Drive	Up to 2%
Heat Pump (For Hotels and Hospitals)	COP 3.2	Efficient Heat Pump	Up to 1% (depend on hot water usage)

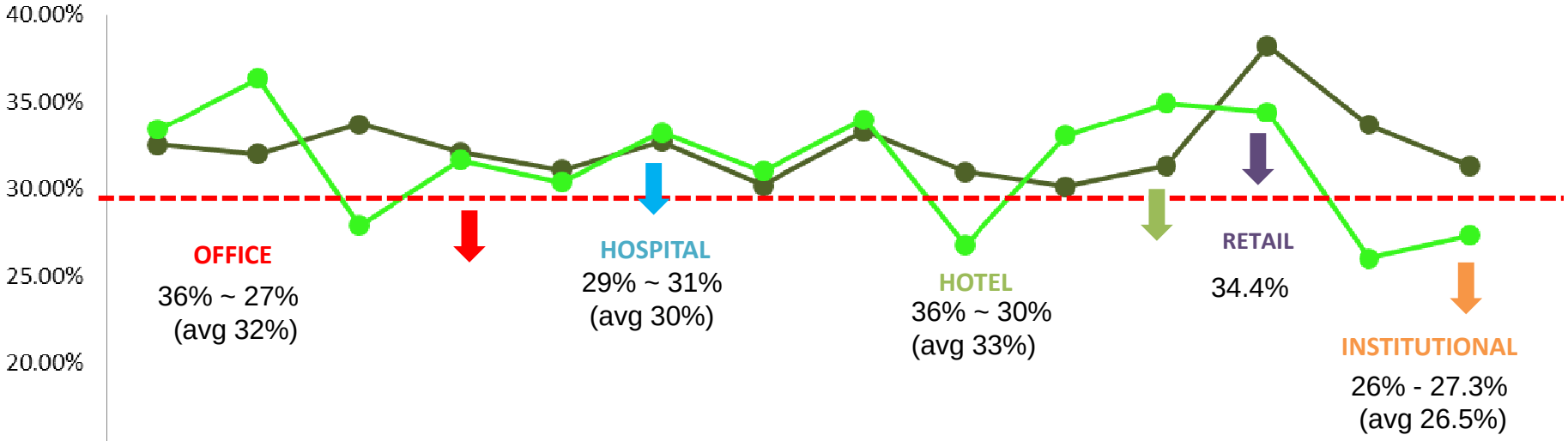
EE Measures	Current GM Norms	Proposed GM Norms	Potential % saving contribution to overall building's consumption*
PV	N.A in GM 4.1	GM2015	Up to 3%
Passive Design	GM4.1	GM2015	Up to 2%
Receptacles Load (For Office only)	16 w/m^2 (No saving for receptacle load)	Baseline: 16W/m^2 11W/m^2 achievable (saving allowed)	Up to 3.5 %

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* Estimated values

Results – Introduction Of EE Technologies

30% energy savings is still achievable even after revision of SS code and with incorporating additional best in class EE technology.



Avg 31.5% from EE Tech & Measures

Potential of another 5% energy savings from Passive Design (2%) and PV(3%)

BASE SAVINGS (Series 1)

SAVINGS AFTER SS REVISION + REMOVAL OF CARPARK + EE (Series 3)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Series1	32.52%	31.97%	33.71%	32.08%	31.07%	32.70%	30.20%	33.30%	30.97%	30.11%	31.31%	38.22%	33.68%	31.33%
Series2	33.38%	36.35%	27.9%	31.65%	30.35%	33.23%	31.01%	33.99%	26.78%	33.03%	34.93%	34.43%	26.04%	27.34%

OFFICE HOSPITAL HOTEL RETAIL INSTITUTIONAL

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Conclusion

- Overall tightening of EE by estimated 2-5% (combining SS530:2014 and SS553:2016)
  - Baseline energy consumption level may reduce by 2-5%
  - Current GM Energy Modelling energy saving may drop by 1-4%
  - Can be bridged with improved technologies
- Improvement of IAQ with SS554:2016

CLIMATE CHANGE (COP21) Paris Agreement in Dec 2015

KEEP GLOBAL TEMPERATURE RISE

Well Below 2°C	With aspiration to 1.5°C

Singapore's target

Reduce Emission Intensity by 36% (peak around 2030)

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- A Bird's Eye View of the Sustainable Built Environment
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- Data Revolution of Cities and Buildings
- Greening Inside-Out
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- Green Tours



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Singapore Green Building Week 2016

Day 3: 9 Sep 2016

Workshop | 10 Essential Strategies to Mastering Green Mark for Non-Residential Buildings GM NRB: 2015

PM

This workshop will involve the **sharing of best practices** and **essential strategies** to excel in the new scheme while staying **cost and time efficient**.

Jeffery Neng | Dy. Group Director, Environmental Sustainability Group / Asst. Managing Director, Built Environment Research and Innovation Institute, BCA

Workshop | Green Mark for Residential Buildings GM RB: 2016

AM

This workshop provides a **detailed introduction to the GM RB: 2016**. This new Green Mark scheme assesses the outcomes of the residential building design processes and ultimately align themselves with best corporate practices. It also brings the focus of sustainability into the early stages of project development, through the construction phase, and finally the building operations stage.

Dr. Edward Ang | Deputy Director, Green Mark Department (New Development), Environmental Sustainability Group, BCA