BCA GREEN MARK

Quick Overview on
BCA GREEN MARK NON-RESIDENTIAL BUILDINGS: 2015

GM NRB: 2015

Leow Yock Keng
Green Mark Department

Building and Construction Authority

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

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1. Introduction to Green Mark NRB: 2015

- Climatic Responsive Design
- Building Energy Performance
- Resource Stewardship
- Smart & Healthy Building
- Advanced Green Efforts



2. Overview of Green Mark NRB: 2015

(particularly in relationship to A/C)

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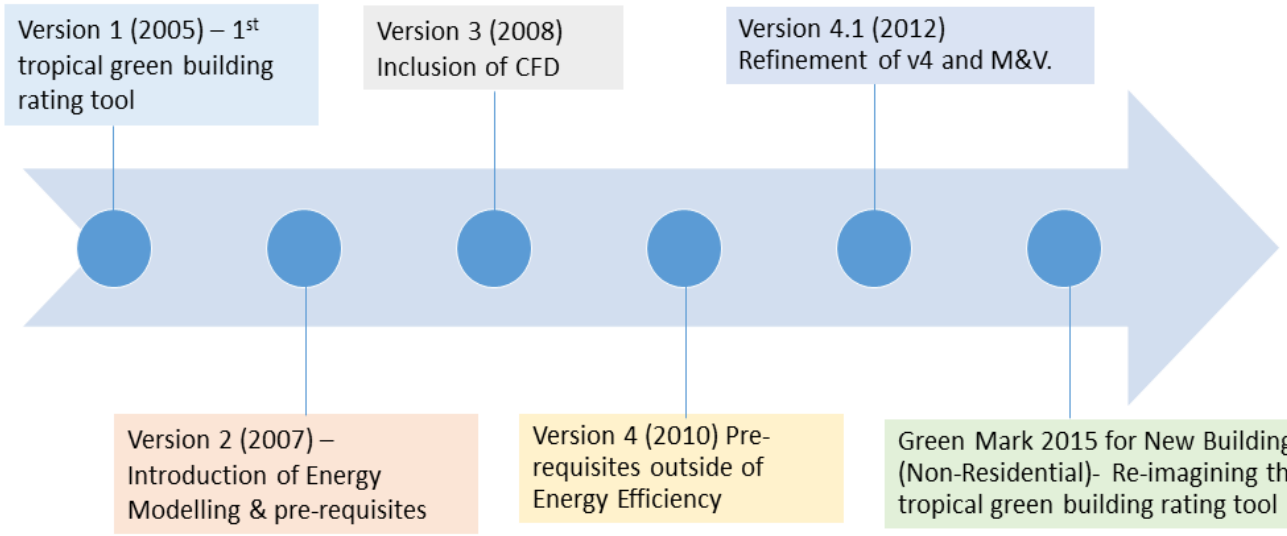
BCA Green Mark Scheme

BCA GREEN MARK

A green building rating system to evaluate building for its environmental impact and performance

Launched in Jan 2005 – a rating system for the tropics

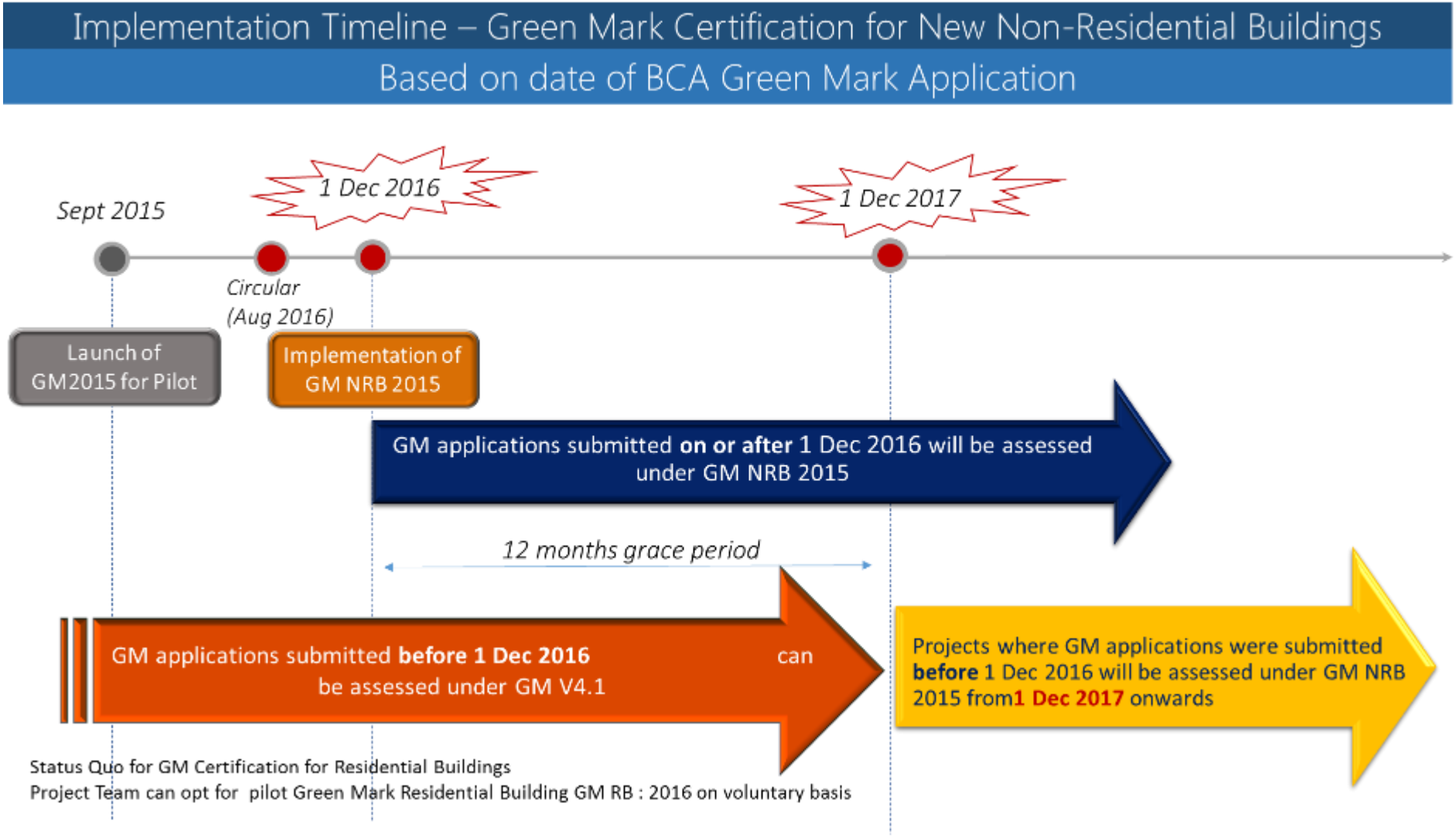
- **New Buildings** including Non-Residential, Residential and Landed Housing
- **Existing Buildings** including Non-Residential, Residential and Schools
- **User Centric** including Office Interior, Retail, Supermarket, Restaurant and Data Centres
- **Beyond Buildings** including Districts, Parks, and Infrastructure



10 years of BCA GREEN MARK

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BCA GM NRB:2015 Implementation Timeline



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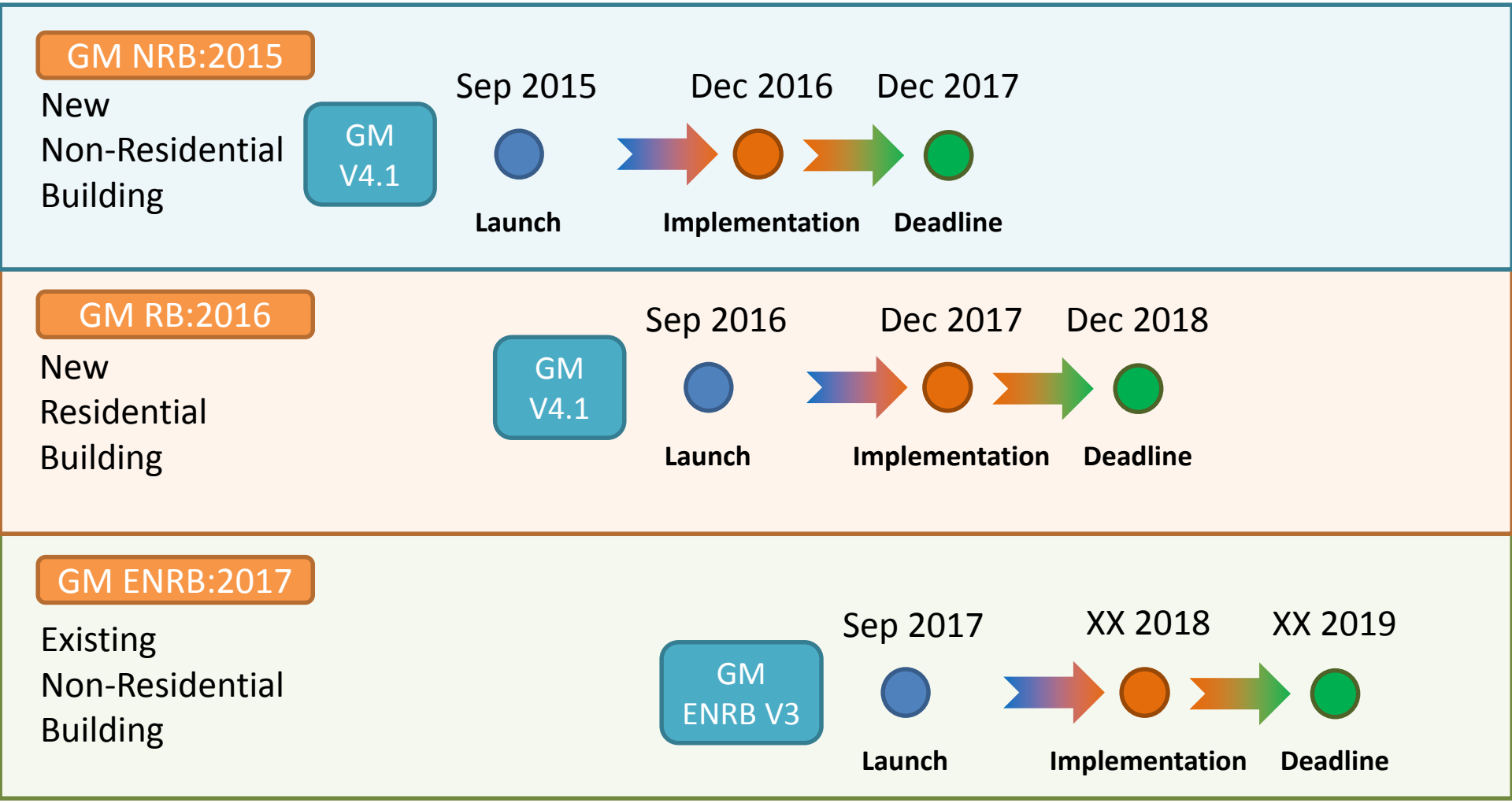
Effective Date of GM NRB:2015

- The BCA GM NRB: 2015 has come into effect since 1 December 2016 (Effective Date).
- Projects with Green Mark applications submitted before the Effective Date are given a grace period of 12 months from the Effective Date (1 Dec 2017) to be assessed based on Green Mark V4.1 for New Non-Residential Buildings.
- For more information, pls refer to the circular in Corenet.

https://www.corenet.gov.sg/media/2032977/circular-to-professional-institutes-associations-revised-bca-green-mark-criteria-for-new-non-residential-buildings-green-mark-for-non-residential-buildings-2015-gm-nrb-2015-.pdf

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BCA Green Mark Building Schemes



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Outcomes of Green Mark NRB: 2015



Climate



Ecology

BCA GREEN MARK



Resources



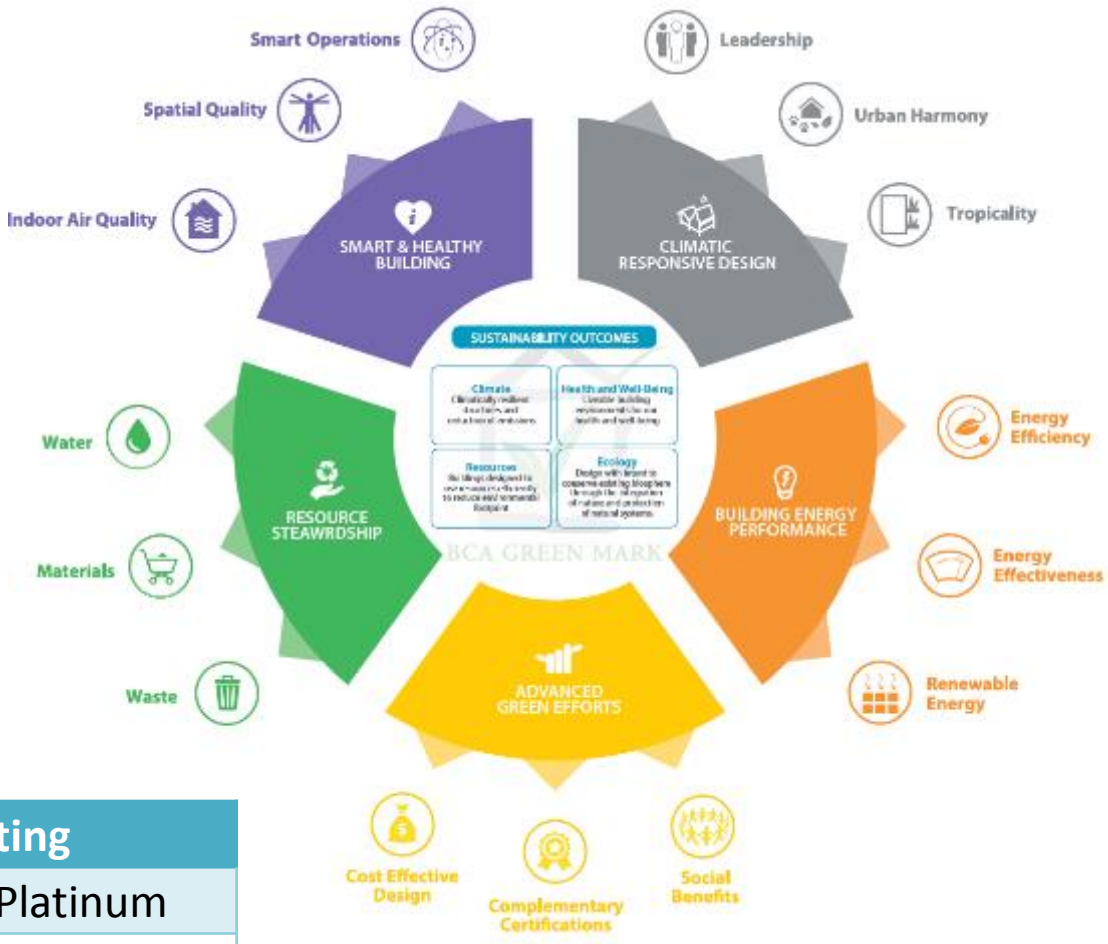
Wellbeing

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BCA Green Mark NRB: 2015

Green Mark NRB: 2015 has been extensively restructured:

- 4 sustainability outcomes
- 5 Scored Sections
- 16 Green Mark Criteria
- 52 Sustainability Indicators
- 120 Points + 20 Points on Advanced Green Efforts



Green Mark Score	Green Mark Rating
70 and above	Green Mark Platinum
60 to < 70	Green Mark Gold^{PLUS}
50 to < 60	Green Mark Gold

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Pre-requisite Requirements

- 15 Pre-requisite requirements before points can be scored in sections 1-5.

- Additionally there are few minimum performance requirements for Gold, Gold^{PLUS} and Platinum

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Minimum Points Requirements

Indicator	Pre-Requisite Requirement	Minimum Points Requirement		
		Gold	Gold^{PLUS}	Platinum
1.01a	Climatic & Contextually Responsive Brief		1 pt	
1.01b	Integrative Design Process			2 pts
1.1e	User Engagement	Green Fit-out Guideline - 1 pt		
1.02b	Integrated Landscape and Waterscape		• Commercial – 2 pts • Others – 1 pt	
1.03c	Ventilation Performance – Ventilation Simulation		For Gold^{PLUS} and Platinum projects with ≥ 2,000m^2 of naturally ventilated occupied spaces, the following wind speeds must be met via ventilation simulation: • Gold^{PLUS} – 0.4 m/s • Platinum – 0.6 m/s *Complementary methods to compliance are available as described in *1.03c*	
2.03a	Solar Energy Feasibility Study	For buildings with a footprint greater than or equal to 1000m^2 – 0.5 pt		
3.02a	Sustainable Construction	0.5 pt	2 pts	3.5 pts
3.02b	Embodied Energy		1 pt	
3.02c	Sustainable Products	2 pts	3 pts	4 pts
4.01a(i)	Indoor Air Quality Audit	0.5 pt		
4.01a(ii)	Post Occupancy Evaluation		0.5 pt	
4.01b(ii)	Enhanced Filtration Media		0.5 pt	
4.03d	System Handover and Documentation		1 pt	

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Energy Savings & EEI Requirements

Level of Green Mark Award	Minimum Energy Savings
Gold^{PLUS}	25%
Platinum	30%

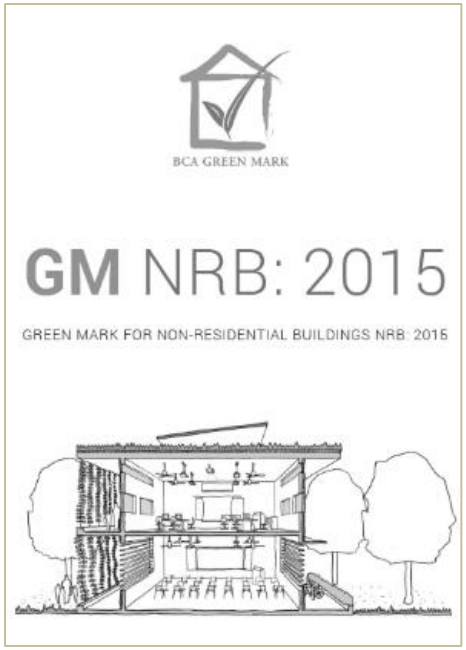
Level of Green Mark Award	Cooling Load Savings	Energy Consumption Savings (exclude DCS plant)
Gold^{PLUS}	10%	27%
Platinum	15%	33%

(For buildings served by existing DCS plants eligible for Path B)

Building Type	Benchmark for Energy Efficiency Index (EEI) (kWh/m^2/yr)
Office and Institutional	160
Hotel	260
Retail	360

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2. Overview of Green Mark NRB: 2015 (particularly in relationship to A/C)

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Section 2.Building Energy Performance

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P.04 AC System & Component Efficiency

Minimum Design System Efficiency of ***Water Cooled Chilled Water Plants***

Green Mark Rating	Peak Building Cooling Load (RT)		Remarks
	<500 RT	≥500RT	(η_c, η_a) shall meet their respective thresholds η_c: System kW/ton excluding the air distribution equipment η_a: Air distribution equipment kW/ton $\eta_t = \eta_c + \eta_a$
	Minimum DSE 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)		

For example, a Platinum project with cooling tons ≥500RT must minimally attain total system efficiency of 0.9 kW/RT, chiller plant efficiency of 0.65 kW/ton and airside efficiency of 0.25 kW/ton

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P.04 AC System & Component Efficiency

Minimum Design System Efficiency of ***Air Cooled Chilled Water Plants / Unitary Systems***

Green Mark Rating	Peak Building Cooling Load (RT)		Remarks
	<500 RT	≥500RT	(η_c, η_a) shall meet their respective thresholds η_c: System kW/ton excluding the air distribution equipment η_a: Air distribution equipment kW/ton $\eta_t = \eta_c + \eta_a$
	Minimum DSE η_t (kW/RT)		
Gold	NA (0.9, N.A.)	NA (to be assessed on case by case basis)	
Gold^{PLUS}	1.10 (0.85, 0.25)		
Platinum	1.03 (0.78, 0.25)		

Unitary operational load is calculated based on the weighted operational installed capacity of the system (excluding standby units), calculated in the same manner as the weighted COP,

i.e. $RT_{Weighted} = 0.4 \times RT_{100\%} + 0.6 \times RT_{50\%}$

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Building Energy Performance



Energy Efficiency
(11 points)



Energy Effectiveness
(11 points)



Renewable Energy
(8 points)

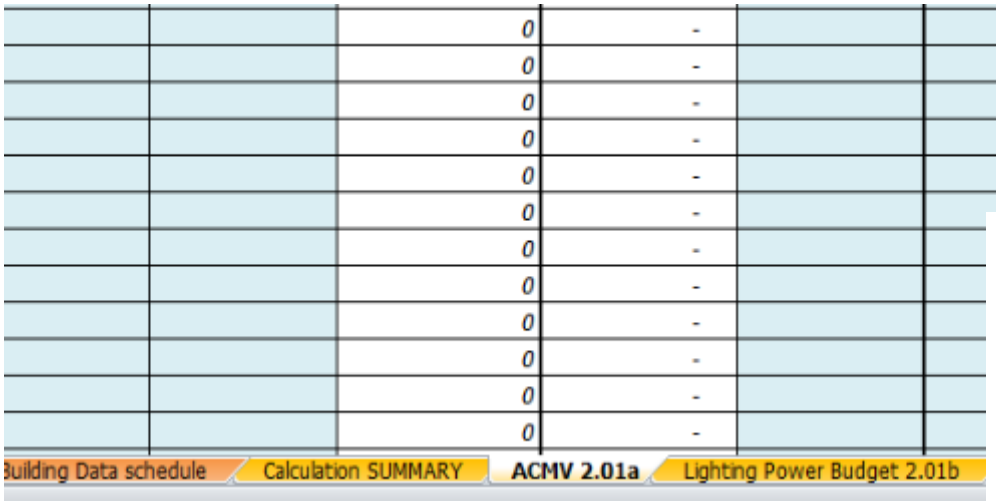
- 2.01a Air Conditioning Total System Efficiency (5 points)

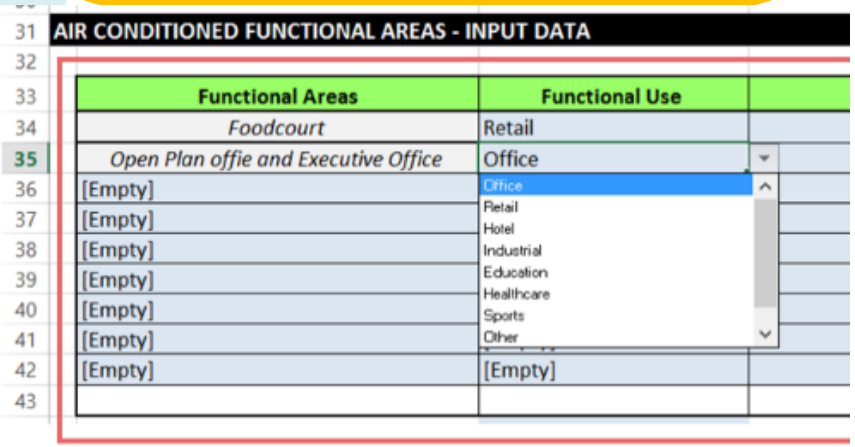
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Energy Performance Points Calculator

- Excel Based Points calculator: Integrated template for energy components in a building to generate the points for the majority of this section.

- Easy to check (Consultants + Assessors)
- Easy to use (Consultants)
- Provides consistency (pre-programmed)
- Whole of Building Energy Consumption
- Encourages **reduction** of AC areas
- Based on normalised kWh/yr





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2.01a AC Total System Efficiency

Total system efficiency of **all** the air conditioning systems and equipment normally in operation in the building, inclusive of chillers, unitary systems, associated pumps, cooling towers **and air distribution systems**.

Non-air-conditioned building projects shall score full points under this indicator.





	Peak Building Cooling Load (RT)	
	<500 RT	≥500RT
	Total Design System Efficiency (kW/RT)	
Baseline	1.08	0.98
Points scored = 0.2 x (% improvement from baseline)		

(Capped at 5 Points)



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2.02 Energy Effectiveness

The Energy Performance Points Calculator shall be used to generate the percentage improvement of the design energy consumption of the base building against the notional reference. The consumption should exclude carpark and receptacle loads – Capped at 11 points

Points scored = ((% improvement from baseline))/3

Advanced Green Efforts (Enhanced Performance)

Energy Savings beyond Energy Modelling Requirements (Advanced Green Efforts)

1 point for every 5% improvement from the Platinum prerequisite for energy modelling savings. Capped at 2 points.

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2.02 Energy Effectiveness

Energy Use	Reference Building Electricity (kWh/Yr)	Proposed Building Electricity (kWh/yr)	% Savings	% of Proposed Consumption
Air Conditioning System	2,886,091.35	2,260,928.62	21.7%	55.4%
Lighting	1,735,230.38	1,128,753.88	35.0%	27.6%
Mechanical Ventilation	819,652.00	509,031.00	37.9%	12.5%
Vertical Transportation	34,911.00	31,420.00	10.0%	0.8%
Hot Water Generation	-	-	0.0%	0.0%
Energy efficienct fittings	-	-	0.0%	0.0%
[insert rows where applicable]			0.0%	0.0%
Service Equipment	18,506.00	18,506.00	0.0%	0.5%
Common area cooling	-	134,154.07	-100.0%	3.3%
Common area cooling (Applicable only for Retail Int Corridors and Retail Atrium)	-	-	0.0%	0.0%
BASE BUILDING	***5494390.72***	***4082793.57***		

PROPOSED IMPROVEMENT OVER REFERENCE BUILDING (kWh/yr)	*1411597.15*
% IMPROVEMENT OVER REFERENCE BUILDING	*26%*
POINTS SCORED FOR 2.02(a)	

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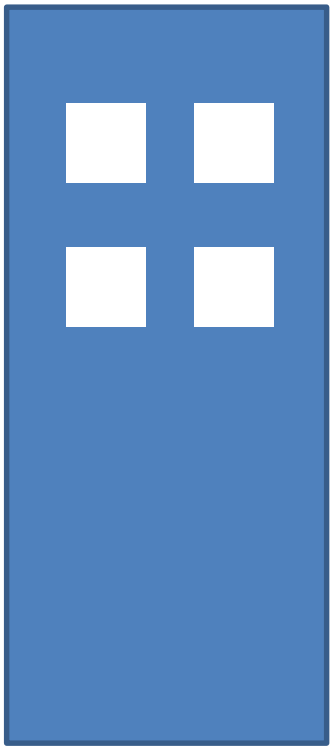
2.02 Energy Effectiveness

Energy Performance Points Calculator	Energy Modelling
Intent • Quick gauge on indicative energy performance and energy effectiveness • Points scoring • Complements energy modelling	Intent: • Detailed design analysis and optimization • Quantifying of building energy savings
Notional Reference Model with normalised fixed assumptions • Common areas assumed as non AC (energy penalty) • Fixed cooling W/m2	Code Reference Model
Static	Dynamic
Excludes carpark consumption, receptacle consumption, renewable energy generation	Includes carpark consumption, receptacle consumption, renewable energy generation
• Does not take into account heat ingress through façade (ETTV)	Takes into account heat ingress through façade (ETTV)

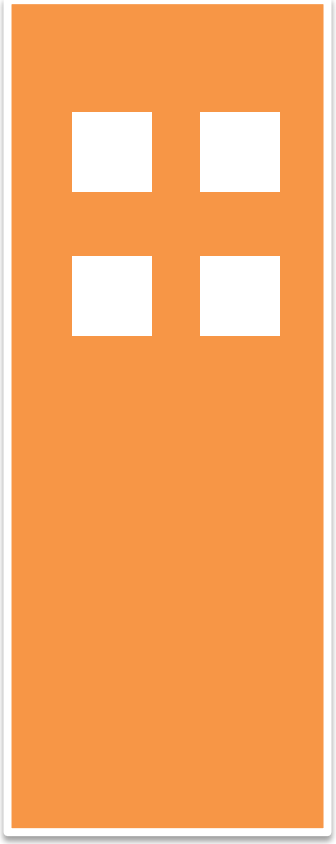
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Energy Performance Points Calculator

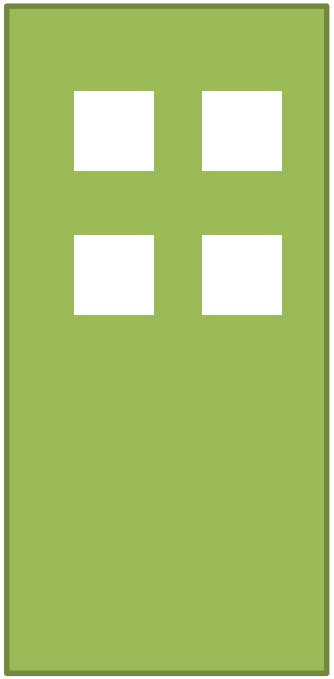
Notional Building



EM Baseline



Proposed Building



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Section 3.Resource Stewardship

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Resource Stewardship



Water
(8 points)



Materials
(18 points)



Waste
(4 points)

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3.02c Sustainable Products

(ii) Singular Sustainable Products outside of Functional Systems

Certified by approved local certification body	Points per product (≥ 80% of the applicable use)
Sustainable Hardscape	0.25 (capped at 2 points)
Building Services	
M&E Products	

Advanced Green Efforts (Enhanced Performance)

SGBP Rating	Points per product (Functional system – 90% use)
Very Good (2-ticks)	0.25
Excellent (3-ticks)	0.5
Leader (4-ticks)	1.0

Up to 2 points

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Section 4. Smart and Healthy Building

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P.12 Refrigerants

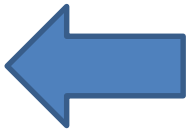
ODP = 0

GWP < 100

Air conditioning systems shall use refrigerants with ozone depleting potential (ODP) of zero or global warming potential (GWP) of less than 100.

A refrigerant leak detection system shall also be installed in critical areas of plant rooms containing chillers and/ or other equipment using refrigerants.

Use of refrigerants with both 0 ODP AND GWP < 100 can be awarded points under Advanced Green Efforts (for 4.01c Indoor Contaminants)



Criteria	GM NRB:2015	GM ENRB:2017 (upcoming)
ODP = 0 & GWP<700/750	0.5	1
ODP = 0 & GWP<10	1	1.5

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Singapore Green Building Week 2016

*Held on **5 - 11 September 2016***
at Marina Bay Sands Singapore

Highlights of IGBC 2016 Conference



Opening ceremony and gaining insights form renowned speakers



Engaging discussions with thought leaders and industry speakers



Exclusive Green Mark Tours

Networking opportunities with international and local firms

28,000 Delegates

50 Countries

80+ Speakers

22 Events

Singapore Green Building Week 2017

International Green Building Conference 2017 Singapore

IGBC - The Premier Green Building Event in Asia

12 – 14 September 2017
Marina Bay Sands, Singapore



*Themed "**Build Green: Be The Change**", IGBC 2017 seeks to catalyze behavioral change, at individual, interpersonal and community level.*

What to anticipate at IGBC 2017:

- Positive/Zero/Super Low Energy Buildings
- Changing Behaviour towards Sustainability
- Building Healthy Spaces
- Outstanding Green Projects
- A Bird's Eye View of the Sustainable Built Environment
- Green Mark Tours

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https://www.bca.gov.sg/events/sgbw/en.html

Registration Now Open!

Sign up by **30 July 2017** to enjoy Early Bird Rate!

- **Full 3-day Pass with Green Mark Tours S$900**

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