



**BCA Green Mark for
Non-Residential Existing Buildings
Version NREB 2.1**

Green Mark Assessment Criteria for Non-Residential Existing Building (Version 2.1)

To achieve GREEN MARK CERTIFIED

ENERGY EFFICIENCY

WHOLE BUILDING EFFICIENCY

Comply with any option below:

- | | |
|----------|--|
| Option A | Demonstrate 10% energy savings over the last three years (against own historical baseline) |
| Option B | Top 50th percentile in building energy performance i.e.
EEI of 215 kWh/m ² /year for office buildings
EEI of 420 kWh/m ² /year for hotel buildings
EEI of 479 kWh/m ² /year for retail malls |
| Option C | Committed energy savings over the next three years of 10% savings
(against own historical baseline) |

**Nb: The energy savings target under Option A & C will be raised to 15% within the next two years and the energy performance under Option B will be raised to 45th percentile to promote reduction of national energy consumption by the building sector.*

MINIMUM SYSTEMS' EFFICIENCY

- Aircon plant efficiency ≤ 0.9 kW/ton (measured)
- Unitary air-conditioners efficiency ≥ 2.4 COP
- Mechanical fan system ≤ 0.47 W per m³/h for constant air volume fan and ≤ 0.74 W per m³/h for variable air volume fan. Power budget of mechanical ventilation system to be calculated.
- Lighting Density: 5% better than lighting power budget in SS530

**Nb: The minimum systems' efficiency will be reviewed within the next two years.*

ENERGY POLICY & MANAGEMENT

- Energy policy & implementation measures for continual energy improvement
- Annual disclosure of building energy consumption data and EEI to BCA
(to comply with section 1-4)

WATER EFFICIENCY

To achieve PUB's Water Efficient Building Certification

SUSTAINABLE OPERATION & MANAGEMENT

Post Occupancy Evaluation - (to comply with section 3-2)

Waste Management - [to comply with section 3-3(a) to 3-3(c)]

INDOOR ENVIRONMENTAL QUALITY

To conduct an IAQ audit once in three years that complies with Guidelines for Good Indoor Air Quality in Office Premises and Singapore Standard Code of Practice for 'Indoor air quality for air-conditioned buildings' (to be published). [(to comply with section 4-1(a))]

To comply with outdoor air supply requirements for mechanical ventilation stipulated in CP13:1999 (applicable to non air-conditioned areas)

Illuminance (lux) level to comply with SS531/CP 38 for various uses & indoor thermal environment (Temperature and relative humidity) to comply with CP 13

*The BCA Green Mark Certified standards above that add up to 50 points will form the minimum pre-requisites for BCA Green Mark Gold ratings and above.

POINT ALLOCATION

ASSESSMENT CRITERIA		POINTS AVAILABLE	PREQUISITIES		
ENERGY EFFICIENCY (To achieve minimum 30 points)					
Maximum Cap of 50 points can be scored	Minimum 30 points to be scored	Part 1 – Energy Efficiency			
		1-1 Energy Efficiency	22	15	
		1-2 Systems Energy Efficiency	23	11	
		1-3 Energy Monitoring	4	-	
		1-4 Energy Policy & Management	4	4	
		1-5 Renewable Energy / Energy Efficient Features [BONUS]	10	-	
		SubTotal (Part 1)	63	30	
OTHER GREEN REQUIREMENTS (To achieve minimum 20 points)					
Maximum Cap of 50 points can be scored	Minimum 20 points to be scored	Part 2 - Water Efficiency			
		2-1 Water Monitoring	2	-	
		2-2 Water Efficient Fittings	12	6	
		2-3 Alternative Water Sources	2	-	
		2-4 Water Efficiency Improvement Plans	1	-	
		2-5 Cooling Towers	1	-	
		SubTotal (Part 2)	18	6	
		Part 3 - Sustainable Operation & Management			
		3-1 Building Operation & Maintenance	4	-	
		3-2 Post Occupancy Evaluation	2	2	
		3-3 Waste Management	8	6	
		3-4 Greenery	3	-	
		3-5 Public Transport Accessibility	2	-	
		SubTotal (Part 3)	19	8	
		Part 4 - Indoor Environmental Quality			
		4-1 Indoor Air Quality Performance	6	4	
		4-2 Environmental Protection	5	-	
		4-3 Lighting Quality	4	1	
		4-4 Thermal Comfort	2	1	
		4-5 Internal Noise Level	1	-	
SubTotal (Part 4)	18	6			
Part 5 – Other Green Features [BONUS]					
SubTotal (Part 5)	10	-			
GRAND TOTAL		128	50		

To achieve GREEN MARK GOLD & above

**Energy Related Requirements
(63 Points Available)**



**Other Green Requirements
(65 Points Available)**

Part 1 - Energy Efficiency (63 points)

1-1 Energy Efficiency (22 points)

Comply with any option below:

Option A

15 points for being the top 50th percentile

0.2 point for every subsequent percentile improvement from baseline of 50th percentile

(Applicable to Office & Hotel Buildings)

Option B

Energy Savings (ES) over last 3 years from own EEI/EUI Baseline

15 points for achieving 10% energy savings from own historical baseline

0.2 point for every subsequent percentage improvement from baseline of 10% energy savings

1-2 Systems Energy Efficiency (23 points)

Air conditioning system (13 points)
Mechanical ventilation system
Natural ventilation system

Lighting power density (8 points)
Mechanical ventilation system (2 points)

1-3 Energy Monitoring (4 points)

Building Automation System (BAS)
Sub-metering for building systems

1-4 Energy Policy & Management (4 points)

1-5 Renewable Energy / Energy Efficient Features (10 points)

Part 2 - Water Efficiency (18 points)

2-1 Water Monitoring (2 points)

Sub-metering for major water uses

2-2 Water Efficient Fittings (12 points)

(PUB WELS)

2-3 Alternative Water Sources (2 points)

(for irrigation, cooling tower consumption etc)

2-4 Water Efficiency Improvement Plans (1 point)

2-5 Cooling Towers (1 point)

Part 3 – Sustainable Operation & Management (19 points)

- 3-1 Building Operation & Maintenance (4 points)**
- 3-2 Post Occupancy Evaluation (2 points)**
- 3-3 Waste Management (8 points)**
- 3-4 Greenery (3 points)**
- 3-5 Public Transport Accessibility (2 points)**

Part 4 - Indoor Environmental Quality (18 points)

- 4-1 Indoor Air Quality Performance (6 points)**
- 4-2 Environmental Protection (5 points)**
- 4-3 Lighting Quality (4 points)**
- 4-4 Thermal Comfort (2 points)**
- 4-5 Internal Noise Level (1 point)**

Part 5 – Other Green Features (10 points)

Green Mark Award Rating

Green Mark Points	Green Mark Rating
90 and above	Green Mark Platinum
85 to <90	Green Mark Gold ^{Plus}
75 to <85	Green Mark Gold
50 to <75	Green Mark Certified

To achieve the Green Mark Gold, Gold^{Plus} and Platinum rating, the project has to meet the following pre-requisite requirements:

For Green Mark **Gold** Rating

- Offices, Hotels and Retail Malls - To achieve the following Energy Efficiency Index (EEI) i.e.
 - EEI of 205 kWh/m²/year for office buildings
 - EEI of 404 kWh/m²/year for hotel buildings
 - EEI of 459 kWh/m²/year for retail malls
- Other Building Types - Demonstrate 15% energy savings over last three years

For Green Mark **Gold^{Plus}** Rating

- Offices, Hotels and Retail Malls - To achieve the following Energy Efficiency Index (EEI) i.e.
 - EEI of 177 kWh/m²/yr for office buildings
 - EEI of 368 kWh/m²/yr for hotels
 - EEI of 421 kWh/m²/yr for retail malls
- Air-conditioning system efficiency is ≤ 0.75 kW/RT.
- Other Building Types - Demonstrate 30% energy savings over last three years
- At least 10 points under Water Efficiency (Part 2)

For Green Mark **Platinum** Rating

- Offices, Hotels and Retail Malls - To achieve the following Energy Efficiency Index (EEI) i.e.
 - EEI of 154 kWh/m²/yr for office buildings
 - EEI of 333 kWh/m²/yr for hotels
 - EEI of 384 kWh/m²/yr for retail malls
- Air-conditioning system efficiency is ≤ 0.7 kW/RT.
- Other Building Types - Demonstrate 35% energy savings over last three years
- At least 12 points under Water Efficiency (Part 2)

Nb: Recertification projects previously certified under Green Mark for Existing Buildings criteria (version 1) will have 18 months to meet its equivalent Green Mark standards under Green Mark for Existing Buildings criteria (version 2) from the launch date i.e. 29 April 2009.

Energy Related Requirements

Part 1 - Energy Efficiency (Total Points: 63)	Green Mark Points
<p>1-1 Energy Efficiency (22 points)</p> <p>To achieve increased building energy efficiency against similar building types to promote efficient use of energy.</p> <p><u>Option A</u></p> <p>Option A is applicable for buildings where energy benchmarks are not available. Energy savings over its own historical baseline over the last three years must be demonstrated.</p> <p><u>Option B</u></p> <p>Option B is applicable to retail malls, offices & hotel buildings based on the following energy benchmarks:-</p> <ul style="list-style-type: none"> - EEI of 215 kWh/m²/yr for offices - EEI of 420 kWh/m²/yr for hotels - EEI of 475 kWh/m²/yr for retail malls 	<p><u>Option A</u></p> <p>15 points for achieving 10% energy savings from own historical baseline.</p> <p>0.2 point for every subsequent percentage improvement from baseline of 10% energy savings</p> <p><u>Option B</u></p> <p>15 points for achieving the stated energy benchmarks.</p> <p>0.2 point for every subsequent percentile improvement from baseline of the stated energy benchmarks.</p>
<p>1-2 Systems Energy Efficiency (23 points)</p> <p><u>Air-conditioning/Mechanical/Natural Ventilation System</u> (13 points)</p> <p>The systems to be considered are as follows –</p> <p>(a) Air-Conditioned Plant :</p> <ul style="list-style-type: none"> ▪ Chiller ▪ Chilled-water pump ▪ Condenser water pump ▪ Cooling tower <p>Note: For buildings using district cooling system, points will be awarded based on plant efficiency.</p> <p>District cooling system:</p> <ul style="list-style-type: none"> ▪ Chiller ▪ Chilled-water pumps (plant and building) ▪ Condenser water pump ▪ Cooling tower ▪ Losses during transportation of chilled water <p><i>*Nb: DCS system provided by external suppliers will be evaluated on a case-by-case basis.</i></p>	<p>7 points for achieving Efficiency of 0.9 kW/ton</p> <p>1.0 point for every subsequent 0.05 kW/ton improvement from 0.9 kW/ton (cap at 13 points)</p>

<p>OR</p> <p>(b) Unitary Air-Conditioners/Condensing Units :</p> <ul style="list-style-type: none"> ▪ Single-Split Unit ▪ Multi-Split Unit ▪ Variable Refrigerant Volume (VRV) System 	<p>OR</p> <p>7 points for achieving Efficiency of 2.4 COP</p> <p>0.6 point for every subsequent 0.15 COP improvement from 2.4 COP (cap at 13 points).</p>
<p>OR</p> <p>(c) Mechanical fan system</p> <p>Power budget (W/m²) for the mechanical ventilation system should be calculated.</p>	<p>OR</p> <p>7 points for achieving Efficiency of 0.47 W per m³/h for constant air volume fan and 0.74 W per m³/h for variable air volume fan</p> <p>0.15 point for every subsequent 1% improvement from 0.47 W per m³/h or 0.74 W per m³/h (cap at 13 points)</p>
<p>OR</p> <p>(d) Natural ventilation</p> <p>Note: Where there is a combination of (a), (b), (c), (d), the computation of the points awarded will be based on the pro-ration of points based on floor area (other than common areas such as carparks, toilets, staircases)</p> <p><u>Lighting System (8 points)</u></p> <p>To encourage optimization of lighting system efficiency</p>	<p>OR</p> <p>Full 13 points will be awarded for the use of 100% natural ventilation</p>
<p><u>Mechanical Ventilation System (2 points)</u></p> <p>Power budget (W/m²) for the mechanical ventilation system should be calculated for carparks, toilets, staircases and kitchens.</p>	<p>2 points for achieving lighting density of 5% better than lighting power budget in SS530</p> <p>0.5 point for every subsequent percentage improvement from baseline lighting density of 5% better than lighting power budget in SS530</p> <p>Points awarded = 0.5 x (% improvement 5% better than lighting power budget in SS530)</p> <p>(Including tenant lighting provision) (Up to 8 points)</p> <p>(Excluding tenant lighting provision) (Up to 4 points)</p> <p>2 points</p>

<p>1-3 Energy Monitoring (4 points)</p> <p>(a) Building Automation System (BAS) to facilitate monitoring and trend logging of building system performance, for e.g. airconditioning plant efficiency, COP of air-conditioner plant, parameters for chiller sequencing and air-side temperature.</p> <p>(b) Sub-metering for building systems to track energy consumption of major building uses and other end use applications e.g. by building systems or floors</p>	<p>2 points</p> <p>2 points</p>
<p>1-4 Energy Policy and Management (4 points)</p> <p>(a) Energy policy, energy targets and regular review with top management's commitment as part of an environmental strategy</p> <p>(b) To show intent, measures and implementation strategies of energy efficiency improvement plans to achieve energy target set over the next three years. Committed energy savings accrued from proposed measures should be quantified.</p> <p>(c) Annual disclosure of building energy consumption data to BCA. Monthly energy bills and summary of energy bills should be provided. The Energy Efficiency Index (EEI) and/or Energy Use Intensity (EUI) of the building should be computed and submitted.</p>	<p>1 point</p> <p>2 points</p> <p>1 point</p>
<p>1-5 Renewable Energy / Energy Efficient Features (10 Bonus Points)</p> <p>Encourage the application of renewable energy. Sources or energy efficient features in buildings.</p> <ul style="list-style-type: none"> ▪ Solar energy ▪ Wind Turbines ▪ Biomass ▪ Other renewable energy sources ▪ Natural ventilation beyond the design norm ▪ Motion sensors ▪ Photo sensors ▪ Sun pipes ▪ Heat recovery system ▪ Other energy efficient features 	<p>1 point for every 0.2% replacement of electricity by renewable / clean energy</p> <p>(Up to 10 Bonus Points)</p>

Other Green Requirements

Part 2 - Water Efficiency (Total Points: 18)	Green Mark Points
<p>2-1 Water Monitoring (2 points)</p> <p>Provide the use of private water meters and leak detection system for better monitoring and control at major water usage area (e.g. cooling tower, water features, irrigation, swimming pools, tenants' usage)</p>	<p>2 points</p>
<p>2-2 Water Efficient Fittings (12 points)</p> <p>Encourage the use of water efficient fittings under Water Efficiency Labelling Scheme (WELS) or adopt equivalent water efficient flow-rate/flush volumes for water fittings:-</p> <ul style="list-style-type: none"> ▪ Basin taps and mixers ▪ Showers ▪ Sink/Bib taps and mixers ▪ Urinals <p><i>*A PUB Water-Efficient Building would be entitled to 6 points.</i></p> <p>Use of dual flushing low capacity flushing systems under the Water Efficiency Labeling Scheme (WELS) or adopt equivalent water efficient flush volumes.</p>	<p><u>Rating based on Water Efficiency Labelling Scheme (WELS)</u> Very Good – 6 points Excellent – 9 points</p> <p>Points awarded based on the number and water efficiency rating of the fitting type used</p> <p>(Up to 9 points)</p> <p><u>Rating based on Water Efficiency Labeling Scheme (WELS)</u> Good – 1 point Very Good – 2 points Excellent – 3 points</p> <p>(Up to 3 points)</p>
<p>2-3 Alternative Water Sources (2 points)</p> <p>Use of suitable systems that utilize alternative water sources for non-potable uses: irrigation, washing, water features, cooling tower make-up water to reduce use of potable water. Alternative sources can include rainwater, greywater, NEWater, AHU condensate and recycled water from approved sources.</p>	<p>Points awarded based on % reduction in potable water usage of the applicable uses</p> <p>> 50 % - 2 points < 10 % to 50 % - 1 point < 10 % - 0.5 point</p> <p>(Up to 2 points)</p>
<p>2-4 Water Efficiency Improvement Plans (1 point)</p> <p>Targets to improve building water performance against own building water performance baseline should be set. To show intent, measures and implementation strategies of water efficiency improvement plans over the next three years. Committed water savings accrued from proposed measures should be quantified.</p>	<p>1 point</p>
<p>2-5 Cooling Towers (1 point)</p> <p>Use of cooling tower water treatment system which can achieve 7 or better cycles of concentration at acceptable water quality.</p>	<p>1 point</p>

Part 3 - Sustainable Operation & Management (Total Points: 19)	Green Mark Points
<p>3-1 Building Operation & Maintenance (4 points)</p> <p>(a) Building management plan or strategy that reflects the sustainability goals set for the building and its systems must be in place. It should adequately address all the Green Mark criteria and any other relevant aspects of building sustainability. The plan must be actively implemented and regularly reviewed. (The environmental policy, cleaning schedule, SOPs for SARs prevention should be included in the O & M guide).</p> <p>(b) A green guide for the occupants or visitors should be disseminated through various channels. Best practices to reduce energy use, water use and maintain a good indoor environment should be documented in this green guide. To demonstrate evidences of occupant involvement in environmental sustainability.</p> <p>(c) In-house building management team comprises one Certified Green Mark Manager (GMM) and/or Singapore Certified Energy Manager (SCEM).</p> <p>(d) The environmental management system of the building is ISO14000 certified.</p>	<p>1 point</p> <p>1 point</p> <p>1 point</p> <p>1 point</p>
<p>3-2 Post Occupancy Evaluation (2 points)</p> <p>(a) Conduct post occupancy evaluation annually that should include technical performance, energy and environmental performance, cost effectiveness and occupant's satisfaction.</p> <p>The minimum number of people surveyed should be around 10% of total occupancy or 30 whichever is the maximum.</p> <p><i>*Note that the POE sample templates will be provided in technical guide.</i></p> <p>(b) List of corrective actions taken following the post occupancy evaluation, if any.</p>	<p>1 point</p> <p>1 point</p>

<p>3-3 Waste Management (8 points)</p> <p>(a) Provision of recycling facilities /infrastructure for sorting and separate collection of recyclable waste for recycling (e.g consumables - glass, paper, metal, equipment, addition & alterations)</p> <p>(b) Promote and encourage waste minimization and recycling among occupants, tenants and visitors through various avenues</p> <p>(c) Promote waste sorting, collecting, quantifying, monitoring and recycling of a large range of waste generated in-house. Types of waste recycled:</p> <ul style="list-style-type: none"> • Glass waste • Paper waste • Metal waste (including drink cans) • Plastic waste • Other wastes – e.g. Printer cartridges, used electronic equipment, food waste <p>(d) Achieve reduction in total waste output over occupancy against historical baseline, through waste minimisation and recycling. A decrease in the amount of waste disposed of (excluding the amount of waste recycled) over the building’s own historical baseline must be demonstrated.</p>	<p style="text-align: right;">1 point</p> <p style="text-align: right;">1 point</p> <p style="text-align: right;">4 points</p> <p>0.5 point for achieving the 0.5% reduction in the total amount of waste disposed of by weight, from own historical baseline (average over the last three years).</p> <p style="text-align: right;">(Up to 2 points)</p>
<p>3-4 Greenery (3 points)</p> <p>(a) Greenery Provision (GnP) is calculated by considering the 3D volume covered by plants using the following Green Area Index (GAI) : Grass GAI = 1 ; Shrubs GAI = 3; Palms Trees GAI = 4; Trees GAI = 6</p> <p>(b) Use of compost recycled from horticulture waste.</p>	<p>GnP = 0.5 to < 1.0 - 0.5 point GnP = 1.0 to < 1.5 - 1 point GnP = 1.5 to < 3.0 - 1.5 points GnP ≥ 3.0 - 2 points</p> <p style="text-align: right;">(Up to 2 points)</p> <p style="text-align: right;">1 point</p>
<p>3-5 Public Transport Accessibility (2 points)</p> <p>Promote the use of public transport or bicycles to reduce pollution from individual car use with the following provision:</p> <p>(a) Good access to nearest MRT/LRT or bus stops.</p> <p>(b) Adequate bicycles parking lots.</p>	<p style="text-align: right;">1 point</p> <p style="text-align: right;">1 point</p>

Part 4 – Indoor Environmental Quality (Total Points: 18)	Green Mark Points
<p>4-1 Indoor Air Quality Performance (6 points) To promote a healthy indoor environment.</p> <p>(a) To conduct with IAQ audit once in three years that complies with Guidelines for Good Indoor Air Quality in Office Premises and Singapore Standard Code of Practice for 'Indoor air quality for air-conditioned buildings' (to be published)</p> <p>(b) Carbon dioxide monitoring to ensure delivery of sufficient / minimum outside air requirements.</p> <p>(c) Carbon monoxide monitoring in carpark areas.</p>	<p style="text-align: center;">4 points</p> <p style="text-align: right;">1 point</p> <p style="text-align: right;">1 point</p>
<p>4-2 Environmental Protection (5 points) Minimise airborne contaminants, mainly from inside sources to promote a healthy indoor environment.</p> <p>(a) Use of sustainable and environmental-friendly products with at least 30% recycled content by weight or volume OR use of products that are certified under the Singapore Green Label Scheme (SGLS)</p> <p>(b) Green procurement policy – Adoption of sustainable and environmental-friendly procurement and purchasing policy in the operation and maintenance of the building.</p> <p>(c) Reduce the potential damage to the ozone layer and the increase in global warming through the release of ozone depleting substances and greenhouse gases.</p> <ul style="list-style-type: none"> • Refrigerants with ozone depletion potential (ODP) of zero or with global warming potential (GWP) of less than 100. • Use of refrigerant leak detection system at critical areas of plant rooms containing chillers and other equipments with refrigerants. 	<p style="text-align: center;">1 point for high impact item 0.5 point for low impact item (Up to 2 points)</p> <p style="text-align: right;">1 point</p> <p style="text-align: right;">1 point</p> <p style="text-align: right;">1 point</p>

<p>4-3 Lighting Quality (4 points)</p> <p>To encourage good workplace lighting quality to promote productivity and occupant comfort</p> <p>(a) Lighting level to comply with SS531/CP38 for various uses.</p> <p>(b) Controllability of lighting system</p> <p>(c) High frequency ballast</p>	<p>1 point</p> <p>At least 90% of occupants are able to adjust lighting control to suit their task needs and preference</p> <p>Controlled by light switches - 0.5 point Controlled by task lights - 1 point</p> <p>(Up to 1 point)</p> <p>All applicable areas in the entire building that are served by fluorescent luminaries</p> <p>20% to < 40% - 0.5 point 40% to < 60% - 1 point 60% to < 80% - 1.5 points 80% and above - 2 points</p> <p>(Up to 2 points)</p>
<p>4-4 Thermal Comfort (2 points)</p> <p>(a) Comfort Level to comply with CP 13 (Temperature and relative humidity)</p> <p>(b) Controllability of temperature</p>	<p>1 point</p> <p>1 point</p>
<p>4-5 Internal Noise Level (1 point)</p> <p>Ensure internal noise level are maintained at an appropriate levels and to comply with CP 13</p>	<p>1 point</p>

Part 5 – Other Green Features (Total Points: 10)	Green Mark Points
<p>5-1 Green Features and Innovations</p> <p>To encourage the use of other green features which are innovative or/and have positive environmental impact.</p> <p>Examples :</p> <ul style="list-style-type: none"> • Use of self cleaning façade system • Use of grey water recycling system • Recycling of AHU condensate • Green roof and roof top garden • Vertical greening • Use of non-chemical termite treatment system such as termite baiting system, anti-termite mesh • Titanium Dioxide solutions to remove odour in toilets • Use of pneumatic waste collection system • Use of double refuse chutes for separating recyclable from non-recyclable waste • Ultraviolet light-C band (UV) emitters in all air handling units (AHUs) to improve indoor air quality • Provision of carpark guidance system • Life cycle analysis • Green Lease 	<p>2 points for high impact item</p> <p>1 point for medium impact item</p> <p>0.5 point for low impact item</p> <p>(Up to 10 Bonus Points)</p>