

Our Ref: BCA ID 89.11.2 Vol 1

Date: 18 Mar 2010

Technology Development Division
Tel : 6325 5921
Fax: 6325 4800
Email: tan_tian_chong@bca.gov.sg

CIRCULAR TO PROFESSIONAL INSTITUTES / ASSOCIATIONS

CALL FOR INDUSTRY COMMENTS ON REVISED BCA GREEN MARK CRITERIA FOR NEW BUILDINGS

Objective

1 This circular is to invite industry comments on the revised BCA Green Mark Criteria for New Buildings before implementation.

Background

2. BCA launched the BCA Green Mark Scheme in Jan 2005 to encourage and promote the development of environmentally sustainable buildings. It is a green building rating system to evaluate a building for its environmental impact and performance. Over last few years, the scheme has been well recognised and received by the industry. It is now widely used as the standard and basis for determining the eligibility and grant quantum under the various green building related incentive programmes. Its criteria framework was also largely adopted as the compliance method under the current regulatory requirement on environmental sustainability for buildings.

3. In line with government's continual commitment to reduce the carbon emission and energy intensity for building sector, BCA has recently reviewed and fine-tuned the BCA Green Mark Criteria for New Buildings to achieve greater energy and resource efficiency in building developments. The proposed revision would raise the energy efficiency standard by 10% from current standard. Correspondingly, the energy efficiency standards for other Green Mark levels, i.e. Gold, GoldPlus, and Platinum will also be raised. Other aspects of environmental sustainability in building developments such as water efficiency and efficient use of construction materials will be given greater emphasis to encourage better resource-efficient design and practices.

4. BCA has earlier sought feedback from key stakeholders and has incorporated their contributions to the revised draft criteria. Similarly, we would like to seek you and your members' feedback to further improve on the requirement before finalising the criteria for implementation.

Details of the Revision & Closing Date for Comments

5. The full details of the draft criteria and changes are enclosed in Annex A for your reference. Interested parties are invited to submit their comments using the template in Annex B by email to greenmark@bca.gov.sg. The closing date for comments is 20 Apr 2010.

Clarification

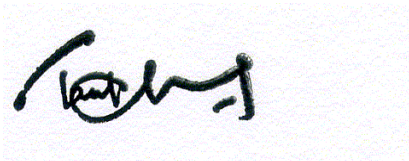
6. If you or your members have any queries, please do not hesitate to contact the following officers :

Name	Email	Contact No.
Lim Chan Boon	lim_chan_boon@bca.gov.sg	63255089
Lee Sui Fung	lee_sui_fung@bca.gov.sg	63255016
Grace Cheok	grace_cheok-chan@bca.gov.sg	63257588
Jeffery Neng	jeffery_neng@bca.gov.sg	63255914

Informing members

7. I would appreciate it if you could convey the contents of this circular to members of your organisation.

Thank you.



Tan Tian Chong
Director, Technology Development Division
for CHIEF EXECUTIVE OFFICER
BUILDING AND CONSTRUCTION AUTHORITY

DISTRIBUTION (via e-mail only):

President
Singapore Institute of Architects
79 Neil Road
Singapore 088904
Email: info@sia.org.sg

President
Institution of Engineers, Singapore
70 Bukit Tinggi Road
Singapore 289758
Email: iesnet@singnet.com.sg

President
Association of Consulting Engineers, Singapore
70 Palmer Road #04-06
Singapore 079427
Fax: 63242581
Email: acesing@starhub.net.sg

President
Real Estate Developers Association of Singapore
190 Clemenceau Avenue
#07-01 Singapore Shopping Centre
Singapore 239924
Fax: 63372217
Email: enquiry@redas.com

President
Singapore Contractors Association Limited
Construction House
1 Bukit Merah Lane 2
Singapore 159760
Email: enquiry@scal.com.sg

Registrar
Professional Engineers Board, Singapore
5 Maxwell Road
1st Storey Tower Block MND Complex
Singapore 069110
Email: registrar@peb.gov.sg

Registrar
Board of Architects, Singapore
5 Maxwell Road
1st Storey Tower Block MND Complex
Singapore 069110
Email : boarch@singnet.com.sg

President
Society of Project Managers (SPM)
Macpherson Road P.O.Box 1083
Singapore 913412
Email: sprojm@yahoo.com

President
Singapore Institute of Building Limited (SIBL)
70 Palmer Road,
#03-09C Palmer House
Singapore 079427
josephine@sib.com.sg

President
Singapore Institute of Surveyors & Valuers (SISV)
20 Maxwell Road #10-09B
Maxwell House Singapore 069113
sisv.info@sisv.org.sg

President
International Facility Management Association (IFMA) (Singapore)
c/o Hong Kong Land (Singapore)
1 Raffles Link # 02-01, North Lobby
Singapore 039393
E-mail: ifma@ifmasingapore.org.sg

President
Association of Property and Facility Managers (APFM)
20 Maxwell Road
#10-09B Maxwell House
Singapore 069113
Email: apfm@pacific.net.sg

President
Institution of Facilities Management (IFM)
Kent Ridge Post Office
Yusof Ishak House (NUS)
Kent Ridge PO Box 1058
Singapore 119260
Email: bekkh@singnet.com.sg

All CORENET e-Info subscribers



BCA Green Mark Criteria for New Buildings

Summary of Main Changes

The BCA Green Mark Criteria for New Buildings (Non-Residential and Residential) Version 3.0 will be revised to achieve greater energy and resource efficiency in building developments. The proposed changes include the following :

1. Maximum Cap of 50 points no longer applicable

The cap of 50 points for both Energy Related Requirement and other Green Requirement will be removed to encourage design team to explore more energy or resource efficient design options.

2. Pre-requisite Requirement to attain Green Mark Certification

Non-Residential Buildings (NRB)

- Minimum Air-Conditioned System Efficiency of 0.7 kW/ton for cooling load of more than 500 tons
- Minimum Air-Conditioned System Efficiency of 0.9 kW/ton for cooling load of 500 tons or less
- Instrumentation for Monitoring of Chilled Water Plant Efficiency

3. Additional Pre-requisite Requirement to attain Green Mark Gold^{Plus} and Platinum rating

Non-Residential Buildings (NRB) – For Green Mark Gold^{Plus} Rating

- Building Envelope Design with Envelope Thermal Transfer Value (ETTV) of 42 W/m² for GoldPlus Rating
- Testing and Commissioning of the chilled water plant is to be witnessed by Professional Engineer (Mechanical). Verification of the plant's performance are to be carried out 12 months upon issuance of TOP
- Minimum 3 points to be scored under NRB 3-1 Sustainable Construction

Non-Residential Buildings (NRB) – For Green Mark Platinum Rating

- Building Envelope Design with Envelope Thermal Transfer Value (ETTV) of 40 W/m² for Platinum Rating
- Minimum Air-Conditioned System Efficiency of 0.65 kW/ton for cooling load of more than 500 tons
- Testing and Commissioning process of the chilled water plant to be witnessed by Professional Engineer (Mechanical). Verification of the plant's performance are to be carried out 12 months upon issuance of TOP
- Minimum of 5 points to be scored under NRB 3-1 Sustainable Construction

Residential Buildings (RB) – For Green Mark Gold^{Plus} Rating

- Building Envelope Design with Residential Envelope Transmittance Value (RETV) of 22 W/m²
- If air-conditioners are provided, they must be energy efficient air-conditioners that are certified with 4 ticks under the Singapore Energy Labelling Scheme or equivalent for all dwelling units
- Minimum 3 points to be scored under RB 3-1 Sustainable Construction

Residential Buildings (RB) – For Green Mark Platinum Rating

- Building Envelope Design with Residential Envelope Transmittance Value (RETV) of 20 W/m²
- If air-conditioners are provided, they must be energy efficient air-conditioners that are certified with 4 ticks under the Singapore Energy Labelling Scheme or equivalent for all dwelling units
- Minimum 5 points to be scored under RB 3-1 Sustainable Construction
- Ventilation simulation study to identify the most effective building design and layout is required and 80% of typical units are designed with good natural ventilation.
- All staircases and common lobbies (exclude basement areas) are designed to be natural ventilated

4. Enhance the scoring and weightage of the following criteria

- Greater emphasis on the use of passive design strategies and more natural ventilated space. Refer NRB 1-3 & NRB 1-4 and RB 1-2 & RB 4-4.
- More weightage on Sustainable Construction to encourage recycling and the adoption of more concrete efficient design. Refer NRB3-1 and RB 3-1.
- Better water efficient fittings. Refer to NRB 2-1 and RB 2-1
- Better scoring for projects with extensive greenery provision. Refer to NRB 3-3 and RB 3-3

5. Reduce the scoring of the criteria that are now regulated or becoming a standard practice with due consideration of the technology advancement

- Artificial lighting
- Lift and Escalators
- Ventilation in Carparks
- Thermal Comfort
- Noise Level

6. New Inclusion

- Mechanical Ventilated Areas
- Daylighting Provision
- Stormwater Management
- Water Efficient Plants
- Daylight Glare Control
- Commissioning, Operation and Maintenance for Indoor Air Quality
- Effective drift eliminator
- Variable Speed Control for chiller plant equipment

7. Specific Details

The specific details of the criteria and changes are listed as follows :

Document Ref	Description
Annex A-1	BCA Green Mark Criteria for New Non-Residential Buildings (Draft Version 4.0 for comment only)
Annex A-2	Comparsion between Current BCA Green Mark Criteria (Ver 3.0) and the Revised Draft Criteria (Version 4.0) - Non-Residential Buildings
Annex A-3	BCA Green Mark Criteria for New Residential Buildings (Draft Version 4.0 for comment only)
Annex A-4	Comparsion between Current BCA Green Mark Criteria (Ver 3.0) and the Revised Draft Criteria (Version 4.0) - Residential Buildings

You may refer to http://bca.gov.sg/GreenMark/green_mark_criteria.html to download the the current BCA Green Mark Criteria for New Non-Residential and Residential Buildings (Version 3.0).

Annex A - 1

DRAFT

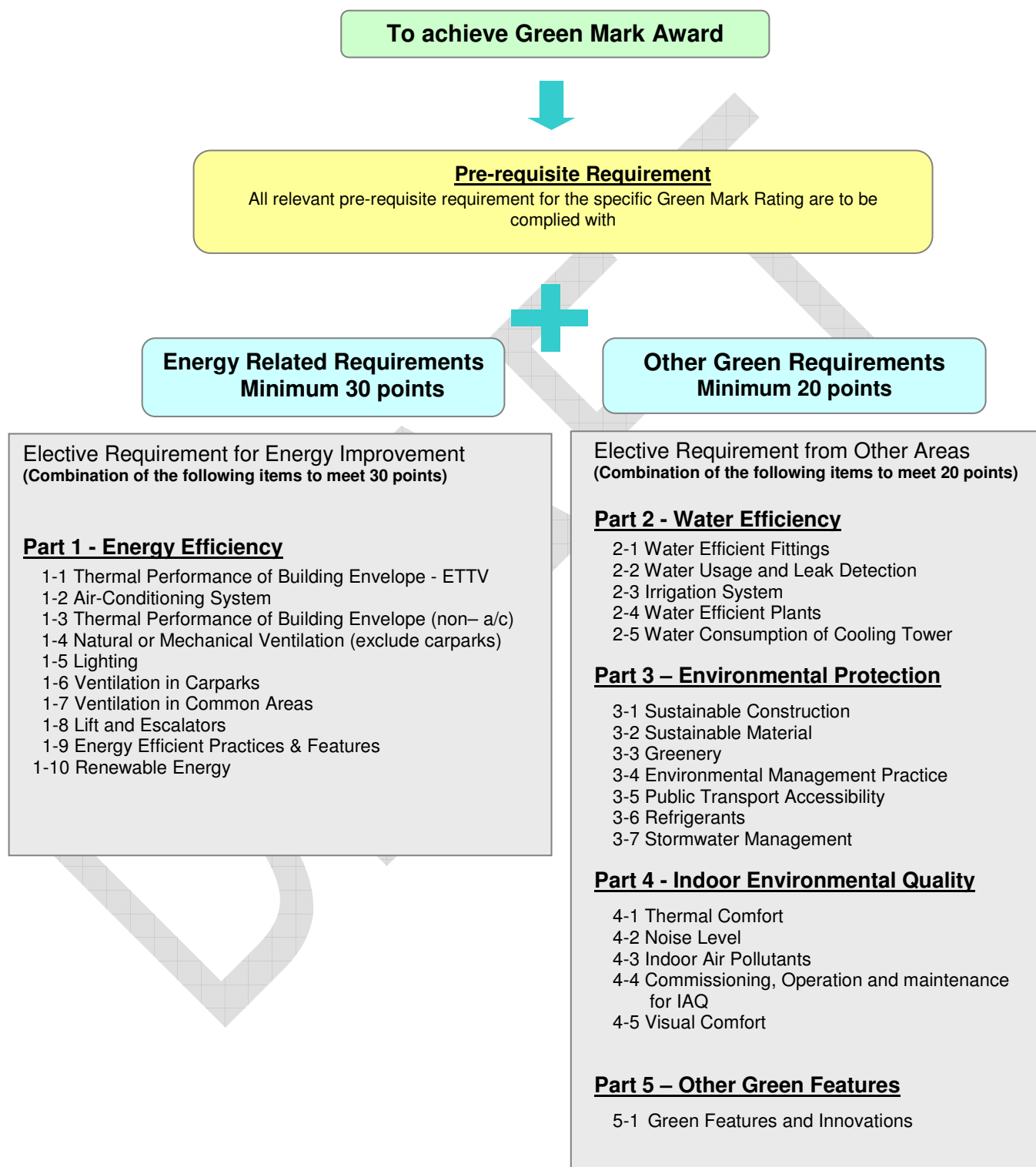


BCA Green Mark for New Non-Residential Buildings Version NRB/4.0

DRAFT for Comments

March 2010

Framework - BCA Green Mark for New Non-Residential Buildings (Version NRB/4.0)



Point Allocations - BCA Green Mark for New Non-Residential Buildings (Version NRB/4.0)

Category			Point Allocations
(I) Energy Related Requirements			
Minimum 30 points	Part 1 : Energy Efficiency		
	1-1 Thermal Performance of Building Envelope - ETTV	Section (A) Applicable to air-con areas	12
	1-2 Air-Conditioning System		33
	Sub-Total (A) - Item 1-1 to 1-2		45
	1-3 Thermal Performance of Building Envelope (non a /c)	Section (B) Applicable to non air-con areas	35
	1-4 Natural Ventilation and/or Mechanical Ventilation (exclude carparks)		20
	Sub-Total (B) - Item 1-3 and 1-4		55
	1-5 Lighting	Section (C) Generally applicable to all areas	16
	1-6 Ventilation in Carparks		4
	1-7 Ventilation in Common Areas		5
	1-8 Lift and Escalators		2
1-9 Energy Efficient Practices & Features	12		
1-10 Renewable Energy	20		
Sub-Total (C) - Item 1-5 to 1-10		59	
Category Score for Part 1 – Energy Efficiency		104 - 114	
Prorate Subtotal (A) + Prorate Subtotal (B) + Prorate Subtotal (C)			
(II) Other Green Requirements			
Minimum 20 points	Part 2 : Water Efficiency		
	2-1 Water Efficient Fittings		10
	2-2 Water Usage and Leak Detection		2
	2-3 Irrigation System		2
	2-4 Water Efficient Plants		1
	2-5 Water Consumption of Cooling Tower		2
	Category Score for Part 2 – Water Efficiency		17
	Part 3 : Environmental Protection		
	3-1 Sustainable Construction		10
	3-2 Sustainable Materials		8
	3-3 Greenery		8
	3-4 Environmental Management Practice		7
	3-5 Public Transport Accessibility		2
	3-6 Refrigerants		2
	3-7 Stormwater Management		3
	Category Score for Part 3 – Environmental Protection		40
	Part 4 : Indoor Environmental Quality		
	4-1 Thermal Comfort		1
	4-2 Noise Level		1
	4-3 Indoor Air Pollutants		2
4-4 Commissioning, Operation and maintenance for IAQ		2	
4-5 Visual Comfort		2	
Category Score for Part 4 – Indoor Environmental Quality		8	
Part 5 : Other Green Features			
5-1 Green Features & Innovations		7	
Category Score for Part 5 – Other Green Features		7	
Total Points Allocated :			176 - 186

BCA Green Mark Award Rating

Green Mark Score	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

Pre-requisite Requirements

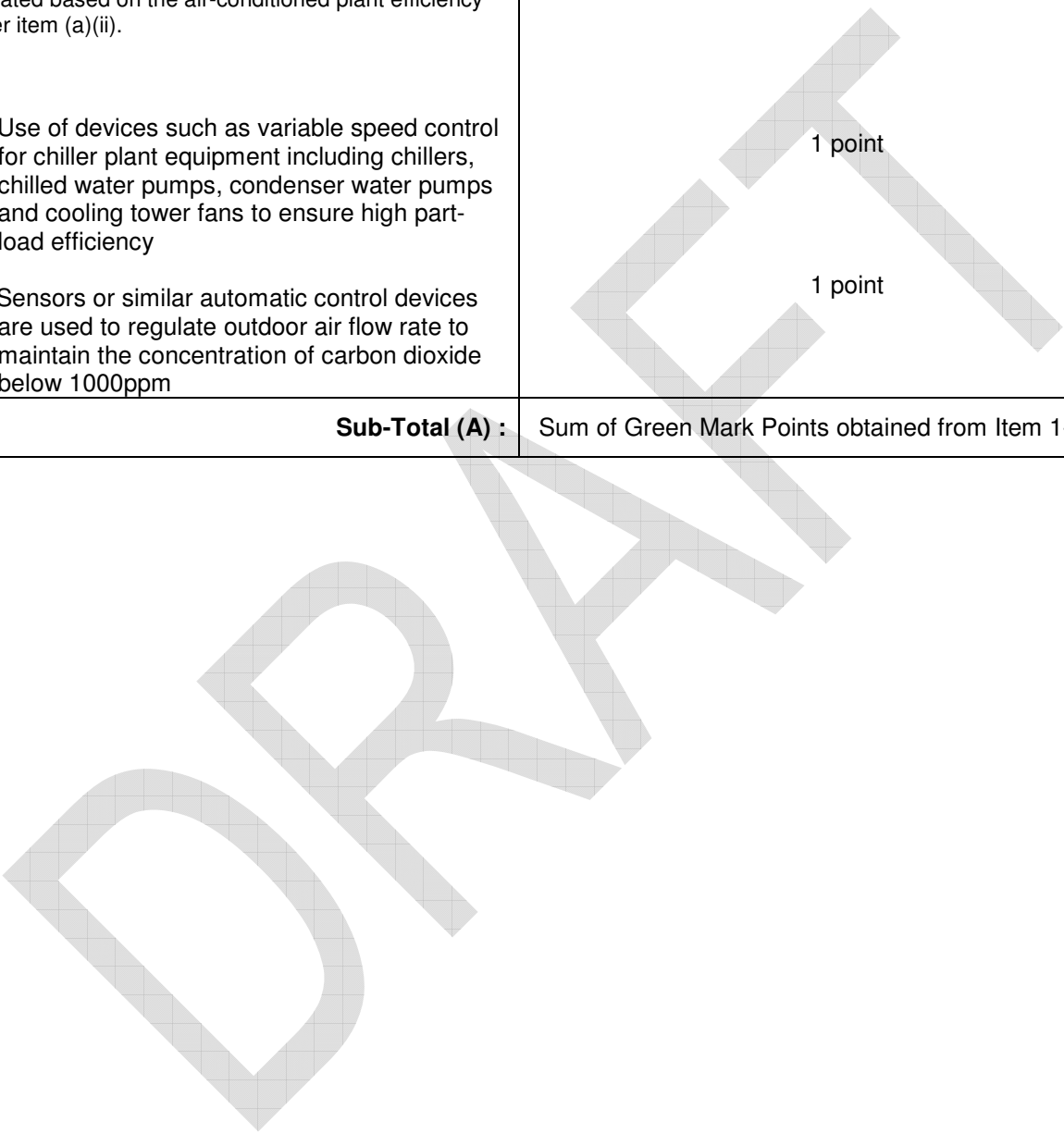
Green Mark Certified or Higher Rating	
Pre-requisite	Requirements
<u>Part 1 – Energy Efficiency: Air-Conditioning System</u> Design and adopt better energy efficient air-conditioned system.	<u>Certified to Gold^{plus} Rating</u> Air-conditioned System Efficiency ≤ 0.70 kW/ton for total building cooling loads ≥ 500 tons Air-conditioned System Efficiency ≤ 0.9 kW/ton for total cooling load ≤ 500 ton <u>Platinum Rating</u> Operating Chiller Plant Efficiency ≤ 0.65 kW/ton Applicable during *normal building operation *Monday to Friday: 8 am to 7 pm; Saturday: 8 am to 12 pm
<u>Part 1 Energy Efficiency: NRB 1-9 Energy Efficient Practice – Instrumentation for Monitoring Central Chilled-Water Plant Efficiency</u> Design and implement instrumentation for the measurement of determinant variables directly correlated to the chiller plant efficiency and verification through data acquisition via BMS.	Measuring and verification instrumentation implemented shall design to meet ASHRAE Guideline 22 or ARI Standard 550. The installed instrumentation must be capable of calculating chiller plant efficiency within 5% of the true value. Periodic calibration checks and re-calibration shall be carried out to ensure the accuracy of the data acquired via BMS.
Green Mark Gold ^{plus} or Platinum Rating	
Pre-requisite	Requirements
<u>Part 3 – Environmental Protection: NRB 3-1 Sustainable Construction</u> Encourage the adoption of building designs, construction practices and materials that are environmentally friendly and sustainable.	Gold ^{plus} Rating: Achieve ≥ 3 points Platinum Rating: Achieve ≥ 5 points
Air-conditioned Buildings	
<u>Part 1 - Energy Efficiency: Energy Modeling</u> To demonstrate the stipulated energy savings over its reference model using Energy Modelling Guidelines issued by BCA.	Gold ^{plus} Rating: $\geq 25\%$ Energy Savings Platinum Rating: $\geq 30\%$ Energy Savings
<u>Part 1 - Energy Efficiency: NRB 1-1 Building Envelope</u> Enhance overall thermal performance of building envelope to minimise heat gain.	Gold ^{plus} Rating: $ETTV \leq 42\text{W/m}^2$ Platinum Rating: $ETTV \leq 40\text{W/m}^2$

<u>Part 1 - Energy Efficiency: Central Chilled Water Plant Testing & Commissioning and Performance Verification</u> To verify that the chiller plant is calibrated to perform according to specifications requirements and basis of design.	Testing & commissioning of the chiller plant shall be witnessed and endorsed by the project PE (Mechanical) and verify the plant's performance 12 months upon TOP
Non Air-conditioned Buildings	
<u>Part 1 - Energy Efficiency: NRB 1-4 Natural Ventilation</u> Enhance building design to achieve good natural ventilation.	Use of ventilation simulation software or wind tunnel testing to identify the most effective building design and layout

BCA Green Mark for Non-Residential Buildings (Version NRB/4.0)

Elective Requirements

Part 1 – Energy Efficiency	Green Mark Points						
(A) Applicable to Air-Conditioned Building Areas (with an aggregate air-conditioned areas > 500 m²)							
<u>1-1 Thermal Performance of Building Envelope – Envelope Thermal Transfer Value</u> Enhance the overall thermal performance of building envelope to minimise heat gain thus reducing the overall cooling load requirement. <u>Baseline</u> : Maximum Permissible ETTV = 50 W/m ²	1.2 point for every reduction of 1 W/m ² in ETTV from the baseline Points awarded = $1.2 \times (50 - \text{ETTV})$ where $\text{ETTV} \leq 50 \text{ W/m}^2$ (Up to 12 points)						
<u>1-2 Air-Conditioning System</u> Encourage the use of better efficient air-conditioned equipment to minimise energy consumption. The systems to be considered are as follows - (a)(i) Air-Conditioned Plant : • Chiller • Chilled-water pump • Condenser water pump • Cooling tower (a)(ii) Unitary Air-Conditioners/Condensing Units : • Single-Split Unit • Multi-Split Unit • Variable Refrigerant Volume (VRV) system <u>Baseline</u> : (i) For total building cooling load of more than 500 tons, the minimum air-conditioned system efficiency should be 0.7 kW/ton or less; and (ii) For total building cooling load not more than 500 tons the minimum air-conditioned system efficiency should be 0.9 kW/ton or less. (a)(iii) Air Distribution System : • Air Handling Units (AHUs) • Fan Coil Units (FCUs) <u>Baseline</u> : (iii) SS553:2009 Table 2 – Fan power limitation in air-conditioning systems	<u>(a)(i) Air-Conditioned Plant & (a)(ii) Unitary Air-Conditioners/Condensing Units</u> For total building cooling load > 500 tons: 10 points for meeting the prescribed air-conditioned system efficiency of 0.7 kW/ton 0.9 points for every percentage improvement in the air-conditioned system efficiency over the baseline Points awarded = $0.9 \times (\% \text{ improvement})$ For total building cooling load ≤ 500 tons: 10 points for meeting the prescribed air-conditioned system efficiency of 0.9 kW/ton 0.9 points for every percentage improvement in the air-conditioned system efficiency over the baseline Points awarded = $0.9 \times (\% \text{ improvement})$ (Up to 25 points) <u>(a)(iii) Air Distribution System</u> 0.2 point for every percentage improvement in the air distribution system efficiency over baseline standard. Points awarded = $0.2 \times (\% \text{ improvement})$ (Up to 6 points)						
<table border="1"> <tr> <th colspan="2">Allowable nameplate motor power</th></tr> <tr> <th>Constant volume</th><th>Variable volume</th></tr> <tr> <td>1.7 kW/m³/s</td><td>2.4 kW/m³/s</td></tr> </table>	Allowable nameplate motor power		Constant volume	Variable volume	1.7 kW/m ³ /s	2.4 kW/m ³ /s	
Allowable nameplate motor power							
Constant volume	Variable volume						
1.7 kW/m ³ /s	2.4 kW/m ³ /s						

Note (1) : For buildings using district cooling system, there is no need to compute the plant efficiency under item (a)(i). The points obtained will be pro-rated based on the air distribution system efficiency under item (a)(iii). Note (2) : For building using unitary air conditioning system, there is no need to compute the air distribution system under item (a)(iii). The points obtained will be pro-rated based on the air-conditioned plant efficiency under item (a)(ii). (b) Use of devices such as variable speed control for chiller plant equipment including chillers, chilled water pumps, condenser water pumps and cooling tower fans to ensure high part-load efficiency (c) Sensors or similar automatic control devices are used to regulate outdoor air flow rate to maintain the concentration of carbon dioxide below 1000ppm	 1 point 1 point
Sub-Total (A) :	Sum of Green Mark Points obtained from Item 1-1 to 1-2

Part 1 – Energy Efficiency	Green Mark Points
(B) Applicable to Non Air-Conditioned Building Areas (with an aggregate non air-conditioned areas > 10 % of total floor area excluding carparks and common areas)	
<u>1-3 Building Envelope – Design / Thermal Parameters</u> Enhance the overall thermal performance of building envelope to minimise heat gain which would improve indoor thermal comfort and encourage natural ventilation or mechanical ventilation. (a) Minimum direct west facing façade through building design orientation. Note (3) : Orientation of façade that falls within the range of 22.5° N of W and 22.5° S of W will be defined as west facing facade. Core walls for lifts or staircases and toilets that are located within this range are exempted in computation. (b)(i) Minimum west facing window openings. (b)(ii) Effective sunshading provision for windows on the west façade with minimum shading of 30%. (c) Better thermal transmittance (U-value) of external west facing walls. The U-value of external west facing walls should be equal or less than 2 W/m²K.	Points awarded = $15 - 0.3 \times (\% \text{ of west facing facade areas over total facade areas})$ (Up to 15 points) Where there is no west facing façade, the total points awarded for this item will be <u>30 points</u>; the items 1-3 b(i), b(ii) and (c) as listed below will not be applicable. Points awarded = $10 - 0.1 \times (\% \text{ of west facing window areas over total west facing facade areas})$ Points awarded = $0.1 \times (\% \text{ of west facing window areas with sunshading devices over total west facing facade areas})$ (Up to 10 points for item b(i) & b(ii)) Points awarded = $0.05 \times (\% \text{ of the external west facing walls areas with U value of } 2 \text{ W/m}^2\text{K or less over total west facing facades areas})$ (up to 5 points)

Part 1 – Energy Efficiency	Green Mark Points												
(B) Applicable to Non Air-Conditioned Building Areas (with an aggregate non air-conditioned areas > 10 % of total floor area excluding carparks and common areas)													
(d) Better thermal transmittance (U-value) of roof. <u>Baseline:</u> U-value for roof stated below depending on the weight range of roof structure: <table><tr><th>Weight Group</th><th>Weight range (kg/m²)</th><th>Maximum Thermal Transmittance (W/m²K)</th></tr><tr><td>Light</td><td>Under 50</td><td>0.8</td></tr><tr><td>Medium</td><td>50 to 230</td><td>1.1</td></tr><tr><td>Heavy</td><td>Over 230</td><td>1.5</td></tr></table>	Weight Group	Weight range (kg/m²)	Maximum Thermal Transmittance (W/m²K)	Light	Under 50	0.8	Medium	50 to 230	1.1	Heavy	Over 230	1.5	2 points for every 0.1 W/m²K reduction (Up to 5 points)
Weight Group	Weight range (kg/m²)	Maximum Thermal Transmittance (W/m²K)											
Light	Under 50	0.8											
Medium	50 to 230	1.1											
Heavy	Over 230	1.5											
<u>1-4 Natural Ventilation and/or Mechanical Ventilation (exclude carparks)</u> <u>Natural Ventilation</u> Enhance building design to achieve good natural ventilation. (a) Proper design of building layout that utilizes prevailing wind conditions to achieve adequate cross ventilation. (b) Use of ventilation simulation software or wind tunnel testing to identify the most effective building design and layout to achieve good natural ventilation. AND/OR <u>Mechanical Ventilation</u> Encourage energy efficient mechanical ventilation system design as the preferred ventilation mode to air conditioning in buildings. <u>Baseline:</u> SS553:2009 Table 8 – Fan power limitation in mechanical ventilation systems <table><tr><th colspan="2">Allowable nameplate motor power</th></tr><tr><th>Constant volume</th><th>Variable volume</th></tr><tr><td>1.7 kW/m³/s</td><td>2.4 kW/m³/s</td></tr></table> Note (3) : Where there is a combination of natural ventilated and mechanical ventilated spaces, the points under NRB 1-4 will be prorated according to their respective areas	Allowable nameplate motor power		Constant volume	Variable volume	1.7 kW/m³/s	2.4 kW/m³/s	<u>Natural Ventilation</u> 1 point for every 10% of units/rooms with window openings facing north and south directions Points awarded = 1 x (% of units/10) (Up to 10 points) Identification of most effective building design and layout through ventilation simulations (5 points) The recommendations from ventilation simulations implemented in design optimisation (5 points) AND/OR <u>Mechanical Ventilation System</u> 0.6 point for every percentage improvement in the air distribution system efficiency. Points awarded = 0.6 x (% improvement) (Up to 15 points)						
Allowable nameplate motor power													
Constant volume	Variable volume												
1.7 kW/m³/s	2.4 kW/m³/s												

<i>Exception : For existing buildings, Item 1.3(a) may be excluded in computation, the total Green Mark Points for Sub-Total (B) under Part 1 will be prorated accordingly.</i>	
Sub-Total (B) :	Sum of Green Mark Points obtained from Item 1-3 and 1-4

Part 1 - Energy Efficiency	Green Mark Points														
(C) General															
1-5 Lighting a) Artificial Lighting Encourage the use of better efficient lighting to minimise energy consumption from lighting usage while maintaining proper lighting level. Baseline = Maximum lighting power budget stated in SS 530 b) Use of the Daylighting i) Daylighting for at least of 75% of all regularly occupied areas, excluding common areas. ii) Daylighting for at least 80% of each of the following common areas: a) Toilets b) Staircases c) Corridors d) Lift Lobbies e) Atriums f) Car Park	a) 0.3 point for every percentage improvement in lighting power budget Points awarded = $0.3 \times (\% \text{ improvement})$ (Including tenant lighting provision) (Up to 12 points) (Excluding tenant lighting provision) (Up to 5 points) 1 point Extent of Coverage : At least 90 % of each applicable area <table border="1"> <thead> <tr> <th>Common areas</th><th>Point</th></tr> </thead> <tbody> <tr> <td>Toilets</td><td>0.5</td></tr> <tr> <td>Staircases</td><td>0.5</td></tr> <tr> <td>Corridors</td><td>0.5</td></tr> <tr> <td>Lift Lobbies</td><td>0.5</td></tr> <tr> <td>Atriums</td><td>0.5</td></tr> <tr> <td>Car Park</td><td>0.5</td></tr> </tbody> </table>	Common areas	Point	Toilets	0.5	Staircases	0.5	Corridors	0.5	Lift Lobbies	0.5	Atriums	0.5	Car Park	0.5
Common areas	Point														
Toilets	0.5														
Staircases	0.5														
Corridors	0.5														
Lift Lobbies	0.5														
Atriums	0.5														
Car Park	0.5														
1-6 Ventilation in Carparks Encourage the use of energy efficient design and control of ventilation systems in carparks. (a) Carparks designed with natural ventilation. (b) CO sensors are used to regulate the demand for mechanical ventilation (MV). Note (4) : Where there is a combination of different ventilation mode adopted for carpark design, the points obtained under this item will be prorated accordingly.	Naturally ventilated carparks – 4 points Points awarded based on the mode of mechanical ventilation provided Fume extract – 2.5 points MV with or without supply - 2 points (Up to 4 points)														

Part 1 – Energy Efficiency	Green Mark Points
(D) General	
<u>1-7 Ventilation in Common Areas</u> Encourage the use of energy efficient design and control of ventilation systems in the following common areas : (a) Toilets (b) Staircases (c) Corridors (d) Lift lobbies (e) Atrium	Extent of Coverage : At least 90 % of each applicable area Points awarded based on the mode of ventilation provided in the applicable areas Natural ventilation – 1.5 points for each area Mechanical ventilation – 0.5 point for each area (Up to 5 points)
<u>1-8 Lifts and Escalators</u> Encourage the use of efficient lifts and escalators. (a) Lifts and/or escalator with AC variable voltage and variable frequency (VVVF) motor drive and sleep mode features.	Extent of Coverage : All lifts and/or escalators Lifts – 1 point Escalators – 1 point
<u>1-9 Energy Efficient Practices & Features</u> Encourage the use of energy efficient practices and features which are innovative and/or have positive environmental impact. (a) Computation of energy consumption based on design load in the form of energy efficiency index (EEI). (b) Use of vertical greenery system on west and east façade to reduce the heat gain through the building envelope (c) Energy consumption monitoring for key M&E Building Services via BMS or online web-based system. (d) Use of energy efficient features : Examples: ■ Heat recovery system ■ Motion sensors for staircase half landing ■ Sun pipes ■ Lifts with gearless drive ■ Re-regenerative lift ■ Light shelves ■ Photocell sensor to maximize the use of daylighting ■ Heat pumps ■ Solar thermal heaters ■ Gas heaters ■ Low loss service transformer i.e. < 2.5% of rated load etc	1 point 1 point for high impact 0.5 point for low impact 2 points 3 points for every 1% energy saving over the total building energy consumption (Up to 8 points)

Part 1 – Energy Efficiency	Green Mark Points
<u>1-10 Renewable Energy</u> Encourage the application of renewable energy sources in buildings.	5 points for every 1% replacement of electricity (based on the total electricity consumption including tenant's usage) by renewable energy OR 3 points for every 1% replacement of electricity (based on the total electricity consumption excluding tenant's usage) by renewable energy (Up to 20 points)
Sub-Total (C) :	Sum of Green Mark Points obtained from Item 1-5 to 1-10
PART 1 – ENERGY EFFICIENCY CATEGORY SCORE :	$\text{Sub-Total (A)} \times \frac{\text{Air-Conditioned Building Floor Area}}{\text{Total Floor Area}} + \text{Sub-Total (B)} \times \frac{\text{Non Air-Conditioned Building Floor Area}}{\text{Total Floor Area}} + \text{Sub-Total (C)}$ where Sub-Total (A) = Sum of Green Mark Points obtained under Section (A) that is Item 1-1 to 1-2 Sub-Total (B) = Sum of Green Mark Points obtained under Section (B) that is item 1-3 and 1-4 Sub-Total (C) = Sum of Green Mark Points obtained under Section (C) that is item 1-5 to 1-10 If either Section (A) or Section (B) is not applicable, no pro-rating of areas is required for the score computation.

Part 2 – Water Efficiency	Green Mark Points		
<u>2-1 Water Efficient Fittings</u> Encourage the use of water efficient fittings covered under the Water Efficiency Labelling Scheme (WELS). (a) Basin taps and mixers (b) Flushing cistern (c) Showerheads, taps and mixers (d) Sink/Bib taps and mixers (e) All other water fittings	Rating based on Water Efficiency Labelling Scheme (WELS)		Points awarded based on the number and water efficiency rating of the fitting type used (Up to 10 points)
	Very good	Excellent	
	Weightage		
	6	10	
<u>2-2 Water Usage and Leak Detection</u> Promote the use of sub-metering and leak detection system for better control and monitoring.			

(a) Provision of sub-meters for major water uses which includes irrigation, cooling tower and tenants' usage.	1 point
(b) Linking all sub-meters to the Building Management System (BMS) for leak detection.	1 point
<u>2-3 Irrigation System</u> Provision of suitable systems that utilise rainwater or recycled water for landscape irrigation to reduce potable water consumption.	1 point
(a) Use of non potable water including rainwater for landscape irrigation.	
(b) Use of automatic water efficient irrigation system with rain sensor.	Extent of Coverage : At least 50% of the landscape areas are served by the system 1 point
<u>2-4 Water Efficient Plants</u> Use of drought resistant plants or plants that require minimal irrigation	Extent of Coverage : At least 80% of the landscape areas 1 point
<u>2-5 Water Consumption of Cooling Tower</u> Reduce potable water use for cooling purpose.	
(a) Use of cooling tower water treatment system which can achieve 7 or better cycles of concentration at acceptable water quality.	0.5 point
(b) Use of NEWater or on-site and recycled water from approved sources.	0.5 point
(c) Use of effective drift eliminator to reduce drift loss to a maximum of 0.005% of the total water delivered to the cooling tower at design condition.	1 point
PART 2 – WATER EFFICIENCY CATEGORY SCORE :	Sum of Green Mark Points obtained from Item 2-1 to 2-5

Part 3 – Environmental Protection	Green Mark Points
<u>3-1 Sustainable Construction</u> Encourage recycling and the adoption of building designs, construction practices and materials that are environmentally friendly and sustainable (a) Use of Sustainable and Recycled Materials (i) Green Cements with approved industrial by-product (such as Ground Granulated Blastfurnance Slag (GGBS), silica fume, fly ash) to replace Ordinary Portland Cement (OPC) by at least 10% by mass for either substructure or superstructure applications. (ii) Recycled Concrete Aggregates (RCA) and Washed Copper Slag (WCS) from approved sources to replace coarse and fine aggregates for concrete production of main building elements. Note : For structural building elements, the use of RCA and WCS shall be limited to maximum 10% replacement by mass of coarse/fine aggregates respectively or as approved by the relevant authorities.	1 point Extent of Coverage : The total quantity used (in tonnage) for replacement of the coarse or fine aggregates must not be less than the minimum usage requirement that is $[0.03 \times \text{Gross Floor Area (GFA in m}^2\text{)}]$ 2 points for the use of RCA to replace coarse aggregates 2 points for the use of WCS to replace fine aggregates Where the total quantity used (in tonnage) for replacement of coarse or fine aggregates is at least two times (2x) that of the minimum usage requirement. 4 points for the use of RCA 4 points for the use of WCS (up to 5 points)

Part 3 – Environmental Protection	Green Mark Points												
(ii) Concrete Usage Index (CUI) Encourage designs with efficient use of concrete for building components	<table border="1"> <thead> <tr> <th>Project CUI (m³/m²)</th><th>Points Allocation</th></tr> </thead> <tbody> <tr> <td>≤ 0.70</td><td>1 point</td></tr> <tr> <td>≤ 0.60</td><td>2 points</td></tr> <tr> <td>≤ 0.50</td><td>3 points</td></tr> <tr> <td>≤ 0.40</td><td>4 points</td></tr> <tr> <td>≤ 0.35</td><td>5 pointts</td></tr> </tbody> </table>	Project CUI (m ³ /m ²)	Points Allocation	≤ 0.70	1 point	≤ 0.60	2 points	≤ 0.50	3 points	≤ 0.40	4 points	≤ 0.35	5 pointts
Project CUI (m ³ /m ²)	Points Allocation												
≤ 0.70	1 point												
≤ 0.60	2 points												
≤ 0.50	3 points												
≤ 0.40	4 points												
≤ 0.35	5 pointts												
<u>3-2 Sustainable Products</u> Use of sustainable products for non-structural building components and construction such as : (a) Environmentally friendly products that are certified by approved local or overseas certification body; or (b) Products with at least 30% recycled content by weight or volume; or (c) Products that made of rapidly renewable materials..	1 point for high impact item 0.5 point for low impact item (Up to 8 points)												

Part 3 – Environmental Protection	Green Mark Points								
3-3 Greenery Encourage greater use of greenery, restoration of trees to reduce heat island effect. (a) Green Plot Ratio (GnPR) is calculated by considering the 3D volume covered by plants using the prescribed Leaf Area Index (LAI) (Reference : http://floraweb.nparks.gov.sg/) (b) Restoration of trees on site, conserving or relocating of existing trees on site. (c) Use of compost recycled from horticulture waste.	<table border="1"> <thead> <tr> <th>GnPR</th><th>Points Allocation</th></tr> </thead> <tbody> <tr> <td>0.5 to < 1.0</td><td>1</td></tr> <tr> <td>1.0 to < 1.5</td><td>2</td></tr> <tr> <td>1.5 to < 3.0</td><td>3</td></tr> </tbody> </table>	GnPR	Points Allocation	0.5 to < 1.0	1	1.0 to < 1.5	2	1.5 to < 3.0	3
GnPR	Points Allocation								
0.5 to < 1.0	1								
1.0 to < 1.5	2								
1.5 to < 3.0	3								
3-4 Environmental Management Practice Encourage the adoption of environmental friendly practices during construction and building operation. (a) Implement effective environmental friendly programmes including monitoring and setting targets to minimise energy use, water use and construction waste. (b) Main builder that has good track records in the adoption of sustainable, environmentally friendly and considerate practices during the construction such as the Green and Gracious Builder Award. (c) Building quality assessed under the Construction Quality Assessment System (CONQUAS). (d) Developer, main builder, M & E consultant and architect that are ISO 14000 certified. (e) Project team comprises Certified Green Mark Manager (GMM), Green Mark Facilities Manager (GMFM) or Green Mark Professional (GMP). (f) Provision of building users' guide including details of the environmental friendly facilities and features within the building and their uses in achieving the intended environmental performance during building operation.	1 point 1 point 1 point 0.25 point for each firm (Up to 1 point) 0.5 point for certified GMM 0.5 point for certified GMFM 1 point for certified GMP (Up to 1 point) 1 point								

(g) Provision of facilities or recycling bins at each block of development for collection and storage of different recyclable waste such as paper, glass, plastic food waste etc	1 point
--	---------

Part 3 – Environmental Protection	Green Mark Points
<u>3-5 Public Transport Accessibility</u> Promote the use of public transport or bicycles to reduce pollution from individual car use with the following provision : (a) Good access to nearest MRT/LRT or bus stops. (b) Provision of sheltered bicycles parking lots and shower or changing facilities	1 point Extent of coverage : At least for ≥ 5% of building users 1 point
<u>3-6 Refrigerants</u> Reduce the potential damage to the ozone layer and the increase in global warming through the release of ozone depleting substances and greenhouse gases. (a) Refrigerants with ozone depletion potential (ODP) of zero or with global warming potential (GWP) of less than 100. (b) Use of refrigerant leak detection system at critical areas of plant rooms containing chillers and other equipments with refrigerants.	1 point 1 point
<u>3-7 Stormwater Management</u> Encourage the treatment of stormwater runoff before discharging to the public drain. Provisions of the following waters design features based on PUB's ABC Water Design Guidelines • Bioretention swales / other Bioretention systems • Rain Gardens • Constructed wetlands • Cleansing biotopes	Points awarded based on the the extent of the stormwater treatment. 3 points – 100% runoff 2 points – 50% run off 1 point – 25% run off (Up to 3 points)
PART 3 – ENVIRONMENTAL PROTECTION CATEGORY SCORE :	Sum of Green Mark Points obtained from Item 3-1 to 3-7

Part 4 – Indoor Environmental Quality	Green Mark Points
<u>4-1 Thermal Comfort</u> Air-conditioning system is designed to allow for cooling load variation due to fluctuations in ambient air temperature to ensure consistent indoor conditions for thermal comfort. Indoor operative temperature between 24 to 26 °C Relative Humidity < 65%	1 point
<u>4-2 Noise Level</u> Occupied spaces in buildings are designed with good ambient sound levels as recommended in SS 553 Table 8 – Recommended ambient sound level.	1 points
<u>4-3 Indoor Air Pollutants</u> Minimise airborne contaminants, mainly from inside sources to promote a healthy indoor environment. (a) Use of low volatile organic compounds (VOC) paints certified by approved local or overseas certification body. (b) Use of adhesives recognized by for composite wood products.	Extent of Coverage : At least 90% of the total internal wall areas 1 point 1 point
<u>4-4 Commissioning, Operation and Maintenance for IAQ</u> Before a new or retrofitted building is commissioned or put in service, ACMV system shall be designed, installed and capable of functioning to achieve acceptable IAQ. The building ventilation and air conditioning components shall be maintained in accordance with the guidelines given in SS554 Annex F.	2 points
<u>4-5 Visual Comfort</u> <u>High Frequency Ballasts</u> <i>Applicable to offices, classrooms and the like</i> Improve workplace lighting quality by avoiding low frequency flicker associated with fluorescent lighting with the use of high frequency ballasts in the fluorescent luminaries. <u>Daylight Glare Control</u> Encourage proper daylighting design in occupied space with the implementation of glare control measures. Provide sunlight redirection and/or glare control devices to ensure daylight effectiveness.	Extent of Coverage : At least 90% of all applicable areas that are served by fluorescent luminaries 1 points 1 point

PART 4 – INDOOR ENVIRONMENTAL QUALITY CATEGORY SCORE :	Sum of Green Mark Points obtained from Item 4-1 to 4-5
---	---

Part 5 – Other Green Features	Green Mark Points
<u>5-1 Green Features and Innovations</u> Encourage the use of other green features which are innovative and/or have positive environmental impact. Examples : ▪ Pneumatic waste collection system ▪ Rainwater harvesting ▪ Dual chute system ▪ Self cleaning façade system ▪ Infiltration trenches ▪ Integrated storm water retention/treatment into landscaping ▪ Provision of vertical greenery system only to enhance aesthetics of buildings and their surroundings ▪ Provision of covered walkway to facilitate connectivity and use of public transport ▪ Recycling of organic food waste e.g. for biogas production, compost ▪ Electric vehicle charging station and preferred parking lots ▪ Calculate the carbon footprint of development ▪ etc	2 points for high impact item 1 point for medium impact item 0.5 point for low impact item (Up to 7 points)
PART 5 – OTHER GREEN FEATURES CATEGORY SCORE :	Sum of Green Mark Points obtained from Item 5-1

Green Mark Score

$$\text{Green Mark Score} = \sum \text{Category Score [(Part 1 – Energy Efficiency) + (Part 2 – Water Efficiency) + (Part 3 – Environmental Protection) + (Part 4 – Indoor Environmental Quality) + (Part 5 – Other Green Features)]}$$

where Category Score for Part 1 $\geq$ 30 Green Mark points and

$\sum$ Category Score for Part 2, 3, 4 & 5 $\geq$ 20 Green Mark points

Annex A - 2

Non-Residential Building Criteria

Pre-requisite Requirements – Non-Residential Buildings

Pre-requisite	Details
Green Mark Certified or Higher Rating	
<u>Part 1 – Energy Efficiency: Air-Conditioning System</u> Design and adopt better energy efficient air-conditioned system	<u>Certified to Gold^{plus} Rating</u> Air-conditioned System Efficiency ≤ 0.7 kW/ton for total cooling load > 500 tons Air-conditioned System Efficiency ≤ 0.9 kW/ton for total cooling load ≤ 500 tons <u>Platinum Rating</u> Operating Chiller Plant Efficiency ≤ 0.65 kW/ton Applicable during *normal building operation *Monday to Friday: 8 am to 7 pm; Saturday: 8 am to 12 pm
<u>Part 1 Energy Efficiency: NRB 1-9 Energy Efficient Practice – Instrumentation for Monitoring Central Chilled-Water Plant Efficiency</u>	Measuring and verification instrumentation implemented shall design to meet ASHRAE Guideline 22 or ARI Standard 550. The installed instrumentation must be capable of calculating chiller plant efficiency within 5% of the true value. Periodic calibration checks and re-calibration shall be carried out to ensure the accuracy of the data acquired via BMS.
Green Mark Gold^{plus} or Platinum Rating	
<u>Part 3 – Environmental Protection: NRB 3-1 Sustainable Construction</u>	Gold ^{plus} Rating: Achieve ≥ 3 points Platinum Rating: Achieve ≥ 5 points
Air-conditioned Buildings	
<u>Part 1 - Energy Efficiency: NRB 1-1 Building Envelope</u>	Gold ^{plus} Rating: ETTV $\leq 42\text{W/m}^2$ Platinum Rating: ETTV $\leq 40\text{W/m}^2$
<u>Part 1 - Energy Efficiency: Central Chilled Water Plant Testing & Commissioning and Performance Verification</u>	Testing & commissioning of the chiller plant shall be witnessed and endorsed by PE (Mechanical). Verification of the plant's performance to be carried 12 months upon the issuance of TOP

Non-Residential Building Criteria

Part 1 – Energy Efficiency

Criteria	Version 3 *(Max 50 points)	Version 4 *(Scores not capped at 50 points)
<u>1-1 ETTV</u>	2 points for every reduction of 1 W/m² in ETTV from the baseline 42.5 W/m² to achieve max 15 points	1.2 points for every reduction of 1 W/m² in ETTV from the baseline 40 W/m² to achieve max 12 points
<u>1-2 Air-Conditioning System</u>	(a) <u>Air- Conditioned Plant</u> 1.45 points for every % improvement in chiller plant (exclude cooling towers) 0.05 point for every % improvement in cooling towers efficiency - Max 20 points (b) Air distribution system 0.5 point for every % improvement 10% improvement to achieve max 5 points OR (c) Unitary Air-con 1.5 points for every % improvement - Max 25 points	(a)(i) Air-Conditioned Plant & a(ii) Unitary Air-Conditioners/Condensing Units <u>Building Cooling Load > 500tons</u> - Min Air-Conditioned System Efficiency ≤ 0.7 kW/ton (Exclude after office hours operation) 10 points for meeting the prescribed air-conditioned system efficiency 0.9 point for every percentage improvement in the air-conditioned system efficiency over the baseline <u>Building Cooling Load ≤ 500tons</u> - Min Air Conditioned System Efficiency of 0.9 kW/ton 10 points for meeting the prescribed air-conditioned system efficiency 0.9 point for every percentage improvement in the air-conditioned system efficiency over the baseline (a) (iii) Air distribution system 0.2 point for every % improvement 30% improvement to achieve max 6 points - More stringent requirement for VAV base line in SS553 of 0.66 W/CMH; CP 13 – 0.74 W/CMH <u>Additional Criterion</u> - variable speed control for chiller plant equipment – 1 points

Non-Residential Building Criteria

1-3 Building Envelope – Design / Thermal Parameters	• 24 points for no west facing façade -	• 30 points for no west facing façade
1-4 Natural Ventilation (exclude carparks)	• Max 8 points for 100% of the buildings achieving good natural ventilation • 5 points for ventilation simulation & implementation of identified effective building design • Max 13 points	• Max 10 points for 100% of the buildings achieving good natural ventilation • 5 points for ventilation simulation & • 5 points for implementation of identified effective building design • Max 20 points Additional Criterion: Mechanical Ventilation • 15 points for 25% improvement in mechanical ventilation system efficiency from the stipulated SS553 baseline
1-5 Lighting	• Max 12 points for 24% improvement in lighting power budget – Including tenant • Max 5 points for 10% improvement in lighting power budget – Excluding tenant -	• Max 14 points for 40% improvement in lighting power budget – Including tenant • Max 7 points for 20% improvement in lighting power budget – Excluding tenant Additional Criterion: Daylighting • 1 point for occupied space; up to 3 point for common areas
1-6 Ventilation in Carparks	• 5 points for naturally ventilated carparks • 4 points for Fume extract • 3 points MV with or without supply	• 4 points for naturally ventilated • 2.5 points for Fume extract • 2 points MV with or without supply

Non-Residential Building Criteria

Criteria	Version 3 *(Max 50 points)	Version 4 *(Scores not capped at 50 points)
<u>1-8 Lifts and Escalators</u>	• 1 point for lifts with the AC variable voltage and variable frequency (VVVF) motor drive and • 1 point for sleep mode • 1 point for escalators with energy efficient features such as motion sensors	Both sleep mode and VVVF motor drive implemented: • All lifts and escalators - 2 point • All lifts or escalators - 1 point
<u>1-9 Energy Efficient Practices & Features</u>	• 3 points for every 1% energy saving over the total building energy consumption	• 2 points for every 1% energy saving over the total building energy consumption <u>Additional Criteria</u> • 1 point for the use of vertical greenery system on west and east façade • 2 points for monitoring energy consumption for major M&E Services via BMS or web-based system • Lifts with gearless drive • Re-generative lifts • Low loss service transformer

Non-Residential Building Criteria

Part 2 – Water Efficiency

Criteria	Version 3	Version 4
<u>2-1 Water Efficient Fittings</u>	• 4 points for “Good” rating fittings • 6 points for “Very Good” rating fittings • 8 points for “Excellent” rating fittings • Max 8 points	• No point for “Good” rating fittings -MWEL • 5 points for “Very Good” rating fittings • 10 points for “Excellent” rating fittings • Max 10 Points
<u>2-4 Water Efficient Plant</u>	-	<u>Additional Criterion</u> • 1 point for use of drought resistant plants or plants that require minimal irrigation for ≥ 80% of the landscape areas
<u>2-5 Water Consumption of Cooling Tower</u>	• Cooling tower water treatment system which can achieve 6 or better cycles of concentration	• Cooling tower water treatment system which can achieve <u>7</u> or better cycles of concentration <u>Additional Criterion</u> • 1 point - use of effective drift eliminator to reduce drift loss to a maximum of 0.002% of the total water delivered

Non-Residential Building Criteria

Part 3 - Environmental Protection

Criteria	Version 3	Version 4													
<u>3-1 Sustainable Construction</u>	-	• 1 point for the use of Green Cements at least 10% by mass for either substructure or superstructure applications. • 2 points for the use of RCA <u>or</u> WCS above or equal to the minimum usage requirement • 4 points for the use of RCA <u>and</u> WCS above or equal to the minimum usage requirement													
<u>3-1 Sustainable Construction – Concrete Usage Index</u>	• 0.1 point for every percentage reduction in the prescribed CUI limit (Up to 4 points)	<table><tr><th>Project CUI (m3/m2)</th><th>Points</th></tr><tr><td>≤ 0.70</td><td>1</td></tr><tr><td>≤ 0.60</td><td>2</td></tr><tr><td>≤ 0.50</td><td>3</td></tr><tr><td>≤ 0.40</td><td>4</td></tr><tr><td>≤ 0.35</td><td>5</td></tr></table>	Project CUI (m3/m2)	Points	≤ 0.70	1	≤ 0.60	2	≤ 0.50	3	≤ 0.40	4	≤ 0.35	5	
Project CUI (m3/m2)	Points														
≤ 0.70	1														
≤ 0.60	2														
≤ 0.50	3														
≤ 0.40	4														
≤ 0.35	5														
<u>3-2 Sustainable Products</u>	• SGLS Products - 1 point for high impact item; 0.5 point for low impact item (Cap at 4 points) • Products with at least 30% recycled content by weight or volume - 1 point for high impact item; 0.5 point for low impact item (Cap at 4 points)	• 1 point for high impact item; 0.5 point for low impact item (up to 8 Points) • Items include: (a) Environmentally friendly products that are certified by approved local or overseas certification body (b) Products with at least 30% recycled content by weight or volume. (c) Products that made of rapidly renewable materials													

Non-Residential Building Criteria

Criteria	Version 3	Version 4																								
<u>3-3 Greenery</u>	<table><thead><tr><th>GnPR</th><th>Points</th></tr></thead><tbody><tr><td>0.5 to < 1.0</td><td>1</td></tr><tr><td>1.0 to < 1.5</td><td>2</td></tr><tr><td>1.5 to < 3.0</td><td>3</td></tr><tr><td>3.0 to < 3.5</td><td>4</td></tr></tbody></table> Using the Green Area Index (GAI) for computation of Greenery Provision.	GnPR	Points	0.5 to < 1.0	1	1.0 to < 1.5	2	1.5 to < 3.0	3	3.0 to < 3.5	4	<table><thead><tr><th>GnPR</th><th>Points</th></tr></thead><tbody><tr><td>0.5 to < 1.0</td><td>1</td></tr><tr><td>1.0 to < 1.5</td><td>2</td></tr><tr><td>1.5 to < 3.0</td><td>3</td></tr><tr><td>3.0 to < 3.5</td><td>4</td></tr><tr><td>3.5 to < 4.0</td><td>5</td></tr><tr><td>≥ 4.0</td><td>6</td></tr></tbody></table> Using the Leaf Area Index (LAI) for computation of Green Plot Ratio.	GnPR	Points	0.5 to < 1.0	1	1.0 to < 1.5	2	1.5 to < 3.0	3	3.0 to < 3.5	4	3.5 to < 4.0	5	≥ 4.0	6
GnPR	Points																									
0.5 to < 1.0	1																									
1.0 to < 1.5	2																									
1.5 to < 3.0	3																									
3.0 to < 3.5	4																									
GnPR	Points																									
0.5 to < 1.0	1																									
1.0 to < 1.5	2																									
1.5 to < 3.0	3																									
3.0 to < 3.5	4																									
3.5 to < 4.0	5																									
≥ 4.0	6																									
<u>3-4 Environmental Management Practice</u>	1 point for project team comprises certified GMM 2 point for project team comprises certified GMP (Up to 3 points)	0.5 point for project team comprises certifiedGMM 0.5 point for project team comprises certified GMFM 1 point for project team comprises certified GMP (Up to 1 points) 1 point for provision of recycling bins at each block of development for collection and storage of different recyclable waste such as paper, glass, plastics etc 1 point for main contractor with good track records in sustainable practices (new criteria)																								
<u>3-4 Public Transport Accessibility</u>	1 point - Adequate bicycle parking lots	1 point - Covered/sheltered bicycles parking lots for ≥ 5% of building users and adequate shower/changing facilities																								
<u>3-7 Stormwater Management</u>	-	Additional Criteria Points awarded based on the the extent of the stormwater treatment. 3 points – 100% runoff 2 points – 50% run off 1 point – 25% run off (Up to 3 points)																								

Non-Residential Building Criteria

Part 4 – Indoor Environmental Quality

Criteria	Version 3	Version 4
<u>4-1 Thermal Comfort</u>	2 points - indoor temperature between 22.5 and 25.5; RH < 70%	1 point - indoor operative temperature between 24 to 26 °C; Relative Humidity < 65%
<u>4-2 Noise Level</u>	2 points for good ambient sound levels as recommended in SS 553	1 point for good ambient sound levels as recommended in SS 553
<u>4-4 Commissioning, Operation and Maintenance for IAQ</u>	-	<u>Additional Criterion</u> 2 points for ACMV system installed capable of functioning to achieve acceptable IAQ stated in SS554.
<u>4-5 Visual Comfort</u>	-	<u>Additional Criterion</u> <u>Daylight Glare Control</u> 1 points for glare control devices to ensure daylight effectiveness.
<u>Part 5- Other Green Features</u>		
<u>5-1 Green Features and Innovations</u>		<u>New inclusion</u> - Recycling of organic food waste - Electric vehicle charging station - Carbon footprint calculation - Provision of covered walkway to facilitate connectivity and use of public transport

Annex A - 3

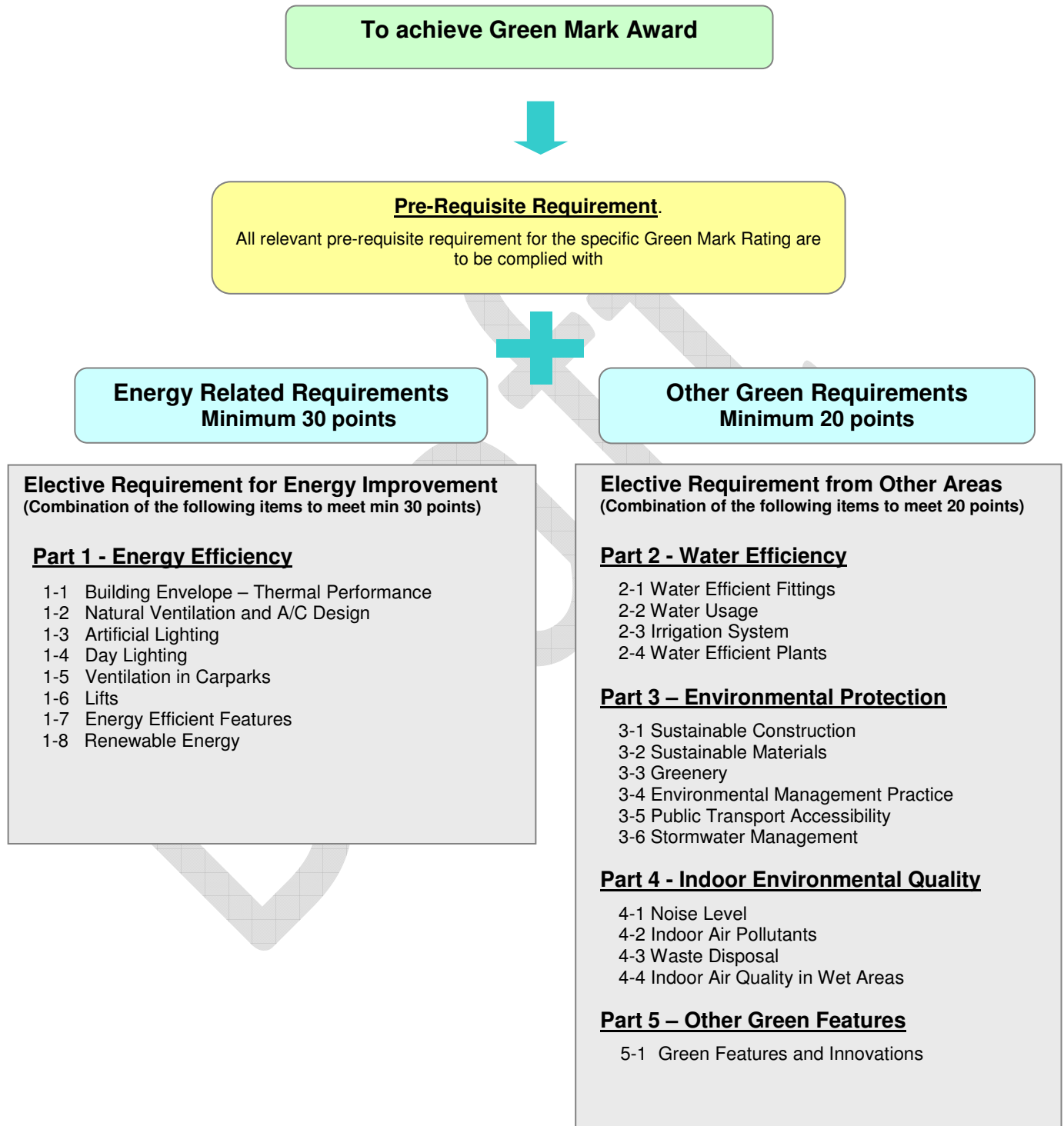


BCA Green Mark for New Residential Buildings **Version RB/4.0**

Draft for Comments

March 2010

Framework - BCA Green Mark for Residential Buildings (Version RB/4.0)



Point Allocations - BCA Green Mark for Residential Buildings (Version RB/4.0)

Category		Point Allocations
(I) Energy Related Requirements		
Minimum 30 points	Part 1 : Energy Efficiency	
	1-1 Building Envelope – Thermal Performance	15
	1-2 Natural Ventilation and A/C Design	22
	1-3 Artificial Lighting	10
	1-4 Daylighting	4
	1-5 Ventilation in Carpark	6
	1-6 Lifts	1
	1-7 Energy Efficient Features	7
	1-8 Renewable Energy	20
Category Score for Part 1 – Energy Efficiency (Exclude Bonus Points)		81 - 85
(II) Other Green Requirements		
Minimum 20 points	Part 2 : Water Efficiency	
	2-1 Water Efficient Fittings	10
	2-2 Water Usage	1
	2-3 Irrigation System	2
	2-4 Water Efficient Plants	1
	Category Score for Part 2 – Water Efficiency	
	14	
	Part 3 : Environmental Protection	
	3-1 Sustainable Construction	10
	3-2 Sustainable Materials	8
	3-3 Greenery	8
	3-4 Environmental Management Practice	8
	3-5 Public Transport Accessibility	2
	3-6 Stormwater Management	3
	Category Score for Part 3 – Environmental Protection	
	39	
	Part 4 : Indoor Environmental Quality	
	4-1 Noise Level	1
	4-2 Indoor Air Pollutants	2
	4-3 Waste Disposal	1
	4-4 Indoor Air Quality in Wet Areas	2
	Category Score for Part 4 – Indoor Environmental Quality	
	6	
	Part 5 : Other Green Features	
	5-1 Green Features & Innovations	6
	Category Score for Part 5 – Other Green Features	
	6	
Total Point Allocated:		146 - 150

BCA Green Mark Award Rating

Green Mark Score	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

Pre-requisite Requirements

Green Mark Gold ^{Plus} or Platinum Rating	
Pre-requisite	Requirements
<u>Part 1 - Energy Efficiency: RB 1-1 Building Envelope</u> Enhance overall thermal performance of building envelope to minimise heat gain.	Gold ^{Plus} Rating: $RETV \leq 22W/m^2$ Platinum Rating: $RETV \leq 20W/m^2$
<u>Part 1 - Energy Efficiency: RB1-2: Natural Ventilation</u> Use of ventilation simulation software or wind tunnel testing to identify the most effective building design and layout	Platinum Rating: $\geq 80\%$ of the typical units have good natural ventilation
<u>Part 1 - Energy Efficiency: RB1-2: Natural Ventilation</u> Staircases and common lobbies (exclude basements) are naturally ventilated	Platinum Rating: The staircases and common lobbies (exclude basements) shall comply with Building Regulation on natural ventilation
<u>Part 1 - Energy Efficiency: RB1-2: A/C Design</u> To ensure provision of energy efficient air-conditioners if air-conditioners are provided	For both Gold ^{Plus} and Platinum Rating Air-conditioners with 4-ticks or equivalent COP should be used in all dwelling units
<u>Part 3 – Environmental Protection: RB 3-1 Sustainable Construction</u> Encourage recycling and the adoption of building designs, construction practices and materials that are environmentally friendly and sustainable.	Gold ^{Plus} Rating: Achieve ≥ 3 points Platinum Rating: Achieve ≥ 5 points

Elective Requirements

Part 1 - Energy Efficiency	Green Mark Points
<u>1-1 Building Envelope – Thermal Performance</u> Enhance the overall thermal performance of building envelope to minimise heat gain thus reducing the overall cooling load when required. <u>Baseline</u> : Maximum Permissible RETV = 25 W/m²	3 points for every reduction of 1 W/m² in RETV from the baseline Points awarded = 75 – 3(RETV) where RETV ≤ 25 W/m² (Up to 15 points)
<u>1-2 Natural Ventilation and A/C Design</u> <u>a) Natural Ventilation and A/C Design in Dwelling units</u> Enhance dwelling unit indoor comfort through the provision of good natural ventilation design and energy efficient air-conditioners <u>Option 1 – Passive Design for Tropic</u> Use of ventilation simulation software or wind tunnel testing to identify the most effective building design and layout to achieve good natural ventilation¹. Notes 1: All types of typical units should be included in the ventilation simulation. Unit will consider achieve good natural ventilation if the ventilation simulation result of the unit achieve average wind velocity of 0.6m/s OR <u>Option 2 – Passive and/or A/C Design</u> (i) Passive design - without use of ventilation simulation software in the design of natural ventilation <u>Building layout design</u>: Proper design of building layout that utilizes prevailing wind conditions to achieve adequate cross ventilation. <u>Dwelling unit design</u>: Good ventilation in indoor units through sufficient openings.	0.2 point for every percentage of typical units with good natural ventilation Points awarded = 0.2 x (% of typical units with good natural ventilation) (up to 20 points) OR 0.05 point for every percentage of units with window openings facing north and south directions Points awarded = 0.05 x (% of units with window openings facing north and south directions) 0.05 point for every percentage of living rooms and bedrooms designed with true cross ventilation Points awarded = 0.05 x (% rooms with true cross ventilation) (Up to 8 points)

Part 1 - Energy Efficiency	Green Mark Points
(ii) A/C design - use of energy efficient air-conditioners that are certified under the Singapore Energy Labelling Scheme. Note: If development do not provide air-conditioners, points for A/C design will be pro-rated according to (i) on passive design b) Natural Ventilation in Common Areas Design for natural ventilation in following common areas : (i) Lift lobbies and corridors (ii) Staircases	Extent of Coverage : At least 80% of the air-conditioners used in all dwelling units Air-conditioners labelled with : Three Ticks – 4 points Four Ticks – 8 points Extent of Coverage : At least 80% of the applicable areas 1 point 1 point
<u>1-3 Artificial Lighting</u> Encourage the use of better efficient lighting in common areas to minimise energy consumption from lighting usage while maintaining proper lighting level. <u>Baseline</u> = Maximum lighting power budget stated in SS 530	0.25 point for every percentage improvement in the lighting power budget Points awarded = $0.25 \times (\% \text{ improvement})$ (Up to 10 points)
<u>1-4 Daylighting</u> Encourage the use of daylighting to minimise energy consumption from lighting usage (a) Daylighting for dwelling unit's living and dining areas (b) Daylighting in the following areas : (i) Lift lobbies and corridors (ii) Staircases (iii) Car parks	0.2 point for every 10% of unit's living and dining areas with daylighting (Up to 2 points) Extent of Coverage : At least 80% of the applicable areas 0.5 point 1 point 0.5 point

Part 1 - Energy Efficiency	Green Mark Points
<u>1-5 Ventilation in Car parks</u> Encourage the use of energy efficient design and control of ventilation systems in car parks. (a) Car parks designed with natural ventilation. (b) CO sensors are used to regulate the demand for mechanical ventilation (MV). Note (3): Where there is a combination of different ventilation mode adopted for car park design, the points obtained under this item will be prorated accordingly.	Naturally ventilated car parks – 6 points Points awarded based on the mode of mechanical ventilation provided Fume extract – 4 points MV with or without supply - 3 points (Up to 6 points)
<u>1-6 Lifts</u> Encourage the use of lifts with AC variable voltage and variable frequency (VVVF) motor drive or equivalent and energy efficient features such as sleep mode features or equivalent.	1 point
<u>1-7 Energy Efficient Features</u> Encourage the use of energy efficient features which are innovative and have positive environmental impact. Examples : ■ Provision of vertical greenery system at external walls outside living, dining and bedrooms ■ Use of lifts with gearless drive ■ Use of re-generative lifts ■ Heat recovery devices ■ Cool paints ■ Insulation paints ■ Motion sensors at staircase half landing ■ Provision of spaces and facilities to dry clothes ■ Gas heaters ■ Calculation of EEI ■ etc	2 points for high impact item 1 point for medium impact item 0.5 point for low impact item (Up to 7 points)

Part 1 - Energy Efficiency	Green Mark Points
<u>1-8 Renewable Energy</u> Encourage the application of renewable energy sources such as solar energy, etc in buildings.	3 points for every 1% replacement of electricity (exclude household's usage) by renewable energy (Up to 20 points)
PART 1 – ENERGY EFFICIENCY CATEGORY SCORE :	Sum of Green Mark Points obtained from Item 1-1 to 1-8

Part 2 – Water Efficiency	Green Mark Points	
<u>2-1 Water Efficient Fittings</u> Encourage the use of water efficient fittings that are certified under the Water Efficiency Labelling Scheme (WELS). (a) Basin taps and mixers (b) Flushing cistern (c) Showerheads, taps and mixers (d) Sink/Bib taps and mixers (e) All other water fittings	Rating based on Water Efficiency Labelling Scheme (WELS)	
	Very Good	Excellent
	Weightage	
	5	10
	Points awarded based on the number and water efficiency rating of the fitting type used (Up to 10 points)	
<u>2-2 Water Usage</u> Provision of sub-meters to monitor the major water usage such as irrigation, swimming pools and other water features.	1 point	
<u>2-3 Irrigation System</u> Provision of suitable systems that utilise rainwater or recycled water for landscape irrigation to reduce potable water consumption. (a) Use of non potable water including rainwater for landscape irrigation. (b) Use of automatic water efficient irrigation system with rain sensor.	1 point Extent of Coverage : At least 50% of the landscape areas are served by the system 1 point	

<u>2-4 Water Efficient Plants</u> Use of drought resistant plants or plants that require little or no watering	Extent of Coverage : At least 80% of the landscape areas 1 point
PART 2 – WATER EFFICIENCY CATEGORY SCORE :	Sum of Green Mark Points obtained from Item 2-1 to 2-4

Part 3 – Environmental Protection	Green Mark Points
<u>3-1 Sustainable Construction</u> Encourage recycling and the adoption of building designs, construction practices and materials that are environmentally friendly and sustainable (a) Use of Sustainable and Recycled Materials (i) Green Cements with approved industrial by-product (such as Ground Granulated Blastfurnance Slag (GGBS), silica fume, fly ash) to replace Ordinary Portland Cement (OPC) by at least 10% by mass for either substructure or superstructure applications. (ii) Recycled Concrete Aggregates (RCA) and Washed Copper Slag (WCS) from approved sources to replace coarse and fine aggregates for concrete production of main building elements. Note : For structural building elements, the use of RCA and WCS shall be limited to maximum 10% replacement by mass of coarse/fine aggregates respectively or as approved by the relevant authorities.	1 point Extent of Coverage : The total quantity used (in tonnage) for replacement of coarse or fine aggregates must not be less than the minimum usage requirement that is [0.03 x Gross Floor Area (GFA in m²)] 2 points for the use of RCA to replace coarse aggregates 2 points for the use of WCS to replace fine aggregates Where the total quantity used (in tonnage) for replacement of coarse or fine aggregates is at least two times (2x) that of the minimum usage requirement. 4 points for the use of RCA 4 points for the use of WCS (up to 5 points)

Part 3 – Environmental Protection	Green Mark Points												
b) Concrete Usage Index (CUI) Encourage designs with efficient use of concrete for building components.	<table> <tr> <th>Project CUI (m³/m²)</th><th>Points Allocation</th></tr> <tr> <td>≤ 0.70</td><td>1</td></tr> <tr> <td>≤ 0.60</td><td>2</td></tr> <tr> <td>≤ 0.50</td><td>3</td></tr> <tr> <td>≤ 0.40</td><td>4</td></tr> <tr> <td>≤ 0.35</td><td>5</td></tr> </table>	Project CUI (m ³ /m ²)	Points Allocation	≤ 0.70	1	≤ 0.60	2	≤ 0.50	3	≤ 0.40	4	≤ 0.35	5
Project CUI (m ³ /m ²)	Points Allocation												
≤ 0.70	1												
≤ 0.60	2												
≤ 0.50	3												
≤ 0.40	4												
≤ 0.35	5												
3-2 Sustainable Products Use of sustainable products for non-structural building components and construction such as : a) Environmentally friendly products that are certified by approved local or overseas certification body; or b) Products with at least 30% recycled content by weight or volume; or c) Products that made of rapidly renewable materials	1 point for high impact item 0.5 point for low impact item (Up to 8 points)												

Part 3 – Environmental Protection	Green Mark Points														
3-3 Greenery Encourage greater use of greenery, restoration of trees to reduce heat island effect. (a) Green Plot Ratio (GnPR) is calculated by considering the 3D volume covered by plants using the prescribed Leaf Area Index (LAI) (Reference : http://floraweb.nparks.gov.sg/) (b) Restoration of trees on site, conserving or relocating of existing trees on site. (c) Use of compost recycled from horticulture waste.	<table> <tr> <th>GnPR</th><th>Points Allocation</th></tr> <tr> <td>1.0 to < 2.0</td><td>1</td></tr> <tr> <td>2.0 to < 3.0</td><td>2</td></tr> <tr> <td>3.0 to < 4.0</td><td>3</td></tr> <tr> <td>4.0 to < 5.0</td><td>4</td></tr> <tr> <td>5.0 to < 6.0</td><td>5</td></tr> <tr> <td>≥ 6.0</td><td>6</td></tr> </table> 1 point 1 point	GnPR	Points Allocation	1.0 to < 2.0	1	2.0 to < 3.0	2	3.0 to < 4.0	3	4.0 to < 5.0	4	5.0 to < 6.0	5	≥ 6.0	6
GnPR	Points Allocation														
1.0 to < 2.0	1														
2.0 to < 3.0	2														
3.0 to < 4.0	3														
4.0 to < 5.0	4														
5.0 to < 6.0	5														
≥ 6.0	6														

<u>3-4 Environmental Management Practice</u> Encourage the adoption of environmental friendly practices during construction and building operation. (a) Implement effective environmental management programmes including monitoring and setting of targets to minimise energy use, water use and construction waste. (b) Main builder that has good track records in the adoption of sustainable, environmentally friendly and considerate practices during the construction such as the Green and Gracious Builder Award (c) Building quality assessed under the Construction Quality Assessment System (CONQUAS) and Quality Mark Scheme. (d) Developer, main builder, M & E consultant and architect that are ISO 14000 certified. (e) Project team comprises one Certified Green Mark Manager (GMM) or one Certified Green Mark Facilities Manager (GMFM) or one Certified Green Mark Professional (GMP). (f) Provision of building users' guide including details of the environmental friendly facilities and features within the building and their uses in achieving the intended environmental performance during building operation. (g) Provision of facilities or recycling bins at each blocks of development for collection and storage of different recyclable waste such as paper, glass, plastic etc	1 point 1 point 1 point each (Up to 2 points) 0.25 point for each firm (Up to 1 point) 0.5 point for GMM or GMFM / 1 point for GMP (Up to 1 point) 1 point 1 point
<u>3-5 Public Transport Accessibility</u> Promote the use of public transport or bicycles to reduce pollution from individual car use with the following provision : (a) Good access to nearest MRT/LRT stations or bus stops. (b) Covered/Sheltered bicycle parking lots	1 point Minimum parking lots 0.5 point - at least 5% of residential units 1 point - at least 10% of residential units (Up to 1 point)

<u>3-6 Stormwater Management</u> Encourage the treatment of stormwater runoff before discharge to the public drain. Provisions of the following waters design features based on PUB's ABC Water Design Guidelines • Bioretention swales / other Bioretention systems • Rain Gardens • Constructed wetlands • Cleansing biotopes	Points awarded based on the the extent of the stormwater treatment. 3 points – 100% runoff 2 points – 50% run off 1 point – 25% run off (Up to 3 points)
PART 3 – ENVIRONMENTAL PROTECTION CATEGORY SCORE :	Sum of Green Mark Points obtained from Item 3-1 to 3-6

Part 4 – Indoor Environmental Quality	Green Mark Points
<u>4-1 Noise Level</u> Building design to achieve ambient internal noise level as specified : 55 dB (6am-10pm) LeqA 45 dB (10pm-6 am) LeqA	1 point
<u>4.2 Indoor Air Pollutants</u> Minimise airborne contaminants, mainly from inside sources to promote a healthy indoor environment. (a) Use of low volatile organic compounds (VOC) paints certified by approved local or overseas certification body. (b) Use of environmentally friendly adhesives certified by local established certification body.	Extent of Coverage : At least 90% of the total internal wall areas 1 point 1 point
<u>4-3 Waste Disposal</u> Minimise airborne contaminants from waste by locating refuse chutes or waste disposal area at open ventilation areas such as service balconies or common corridors.	1 point
<u>4-4 Indoor Air Quality in Wet Areas</u> Provision of adequate natural ventilation and daylighting in wet areas such as kitchens, bathrooms and toilets.	Extent of Coverage : 50% to 90% of all applicable areas 1 point Extent of Coverage : More than 90% of all applicable areas 2 points (Up to 2 points)
PART 4 – INDOOR ENVIRONMENTAL QUALITY CATEGORY SCORE :	Sum of Green Mark Points obtained from Item 4-1 to 4-4

Part 5 – Other Green Features	Green Mark Points
<u>5-1 Green Features and Innovations</u> Encourage the use of other green features which are innovative and have positive environmental impact. Examples : ■ Provision of vertical greenery system outside service lobbies, staircases and other common areas ■ Calculate the carbon footprint of development ■ Provision of covered walkway to facilitate connectivity and use of public transport ■ Pneumatic waste collection system ■ Dual chute system ■ Self cleaning façade system ■ Conservation of existing building structure such as structural elements or building envelope ■ etc	2 point for high impact item 1 point for medium impact item 0.5 point for low impact item (Up to 7 points)
PART 5 – OTHER GREEN FEATURES CATEGORY SCORE :	Sum of Green Mark Points obtained from Item 5-1

Green Mark Score

Green Mark Score = $\sum$ Category Score [(Part 1 – Energy Efficiency) +
 (Part 2 – Water Efficiency) +
 (Part 3 – Environmental Protection) +
 (Part 4 – Indoor Environmental Quality) +
 (Part 5 – Other Green Features)]

where Category Score for Part 1 $\geq$ 30 Green Mark points and

$\sum$ Category Score for Part 2, 3, 4 & 5 $\geq$ 20 Green Mark points

Annex A - 4

Residential Building Criteria

Pre-requisite Requirements –Residential Buildings

Pre-requisite	Details
Green Mark Gold^{plus} or Platinum Rating	
<u>Part 1 - Energy Efficiency: RB 1-1 Building Envelope</u> Enhance overall thermal performance of building envelope to minimise heat gain	Gold ^{plus} Rating: $RETV \leq 22W/m^2$ Platinum Rating: $RETV \leq 20W/m^2$
<u>Part 1 - Energy Efficiency: RB 1-2 Natural Ventilation</u> Use of ventilation simulation software or wind tunnel testing to identify the most effective building design and layout	Platinum Rating: $\geq 80\%$ of the typical units have good natural ventilation
<u>Part 1 - Energy Efficiency: RB1-2: A/C Design</u> To ensure provision of energy efficient air-conditioners if air-conditioners are provided	For both Gold ^{plus} and Platinum Rating Air-conditioners with 4-ticks or equivalent COP should be used in all dwelling units
<u>Part 3 – Environmental Protection: NRB 3-1 Sustainable Construction</u> Staircases and common lobbies (exclude basements) are naturally ventilated	Platinum Rating: The staircases and common lobbies (exclude basements) shall comply with Building Regulation on natural ventilation
<u>Part 3 – Environmental Protection: NRB 3-1 Sustainable Construction</u> Encourage the adoption of building designs, construction practices and materials that are environmentally friendly and sustainable.	Gold ^{plus} Rating: Achieve ≥ 3 points Platinum Rating: Achieve ≥ 5 points

Residential Building Criteria

Criteria	Version 3 *(Max 50 points)	Version 4 *(Scores not capped at 50 points)
Part 1: Energy Efficiency		
1-1 Building Envelope – Thermal Performance		No changes
1-2 Natural Ventilation and A/C Design	<u>Dwelling Unit Indoor Comfort</u> (a) A/C or Natural Ventilation Design - Up to 12 points for A/C certified under Singapore Energy Labelling Scheme 2 points for A/C with 2-ticks 6 points for A/C with 3-ticks 12 points for A/C with 4-ticks OR - Up to 12 points for building layout and units designed for natural ventilation (application to development where A/C are not provided) (b) 4 points for using ventilation simulation to ensure good natural ventilation design <u>Natural Ventilation in Common Areas</u> 1 point for lift lobbies and corridors 1 point for staircases (extent of coverage: all applicable areas)	<u>Natural Ventilation and A/C Design in Dwelling Units</u> Option 1 – Passive Design for Tropic 0.2 point for every % of typical units with good natural ventilation - Up to 20 points Option 2 – Passive and/or A/C Design - Up to 8 points for building layout and units designed for natural ventilation - Up to 8 points for A/C certified under Singapore Energy Labelling Scheme 4 points for A/C with 3-ticks 8 points for A/C with 4-ticks <u>Natural Ventilation in Common Areas</u> 1 point for lift lobbies and corridors 1 point for staircases (extent of coverage: at least 80% of applicable areas)
1-3 Artificial Lighting	0.3 point for every % improvement in the lighting power budget - Up to 12 points	0.25 point for every % improvement in the lighting power budget - Up to 10 points
1-4 Daylighting	Daylighting in the following common areas 1 point for lift lobbies and corridors 1 point for staircases 1 point for carparks	0.15 point for every 10% of true daylighting for all living and dining areas - Up to 2 points - Daylighting in the following common areas

Residential Building Criteria

	(extent of coverage : all applicable areas)	0.5 point for lift lobbies and corridors 1 point for staircases 0.5 point for carparks (extent of coverage: at least 80% of the applicable areas)
1-5 Ventilation in Car parks	8 points for naturally ventilated carparks 6 points for using CO sensors to regulate MV carparks with fume extract design 4 points for using CO sensors to regulated MV carparks with or without supply	6 points for naturally ventilated carparks 4 points for using CO sensors to regulate MV carparks with fume extract design 3 points for using CO sensors to regulated MV carparks with or without supply
1-6 Lifts	1 point for lifts with AC VVVF motor drive or equivalent 1 point for lifts with sleep mode	1 point for lifts with AC VVVF motor drive or equivalent and sleep mode
1-7 Energy Efficient Features		New Inclusion - Provision of vertical greenery system at external walls outside living, dining and bedrooms - Lifts with gearless drive - Re-generative lifts
1-8 Renewable Energy	1 point for every 3 KWp of solar energy - Up to 20 points	3 points for every 1% replacement of electricity (exclude household's usage) by renewable energy - Up to 20 points
Part 2- Water Efficiency		
2-1 Water Efficient Fittings	- For each categories of water efficient fittings with Water Efficiency Labelling Scheme 0.5 points for good rating 1 point for very good rating 2 points for excellent rating (extent of coverage: at least 90% of the type of fittings used) - Up to 10 points	- No point for water efficient fitting with good rating 5 points for water efficient fittings with very good rating 10 points for water efficient fittings with excellent rating - Up to 10 points

Residential Building Criteria

2-2 Water Usage		No changes												
2-3 Irrigation System		No changes												
2-4 Water Efficient Plants		<u>Additional Criteria</u> 1 point for use of drought resistant plants or plants that require minimal irrigation (extent of coverage: at least 80% of the landscape areas)												
Part 3- Environmental Protection														
3-1 Sustainable Construction	1 point for every % reduction in the prescribed CUI (Up to 4 points) 2 points for conservation of existing building structure (extent of coverage: at least 50% of the existing structural elements or building envelope)	(a) Encourage recycling and use of Green Cements, Recycled Concrete Aggregates (RCA) and Washed Copper Slag (WCS) 1 point for the use of Green Cements at least 10% by mass for either substructure or superstructure applications. 2 points for the use of RCA <u>or</u> WCS above or equal to the minimum usage requirement 4 points for the use of RCA <u>and</u> WCS above or equal to the minimum usage requirement (Up to 5 points) (b) CUI <table><tr><th>Project CUI (m3/m2)</th><th>Points</th></tr><tr><td>≤ 0.70</td><td>1</td></tr><tr><td>≤ 0.60</td><td>2</td></tr><tr><td>≤ 0.50</td><td>3</td></tr><tr><td>≤ 0.40</td><td>4</td></tr><tr><td>≤ 0.35</td><td>5</td></tr></table>	Project CUI (m3/m2)	Points	≤ 0.70	1	≤ 0.60	2	≤ 0.50	3	≤ 0.40	4	≤ 0.35	5
Project CUI (m3/m2)	Points													
≤ 0.70	1													
≤ 0.60	2													
≤ 0.50	3													
≤ 0.40	4													
≤ 0.35	5													
3-2 Sustainable Products	- SGLS Products - 1 point for high impact item; 0.5 point for low impact item (Cap at 3 points) - Products with at least 30% recycled content by weight or volume - 1 point for high impact item; 0.5 point for low impact item (Cap at 3 points)	1 point for high impact item; 0.5 point for low impact item (up to 8 Points) - Items include: (a) Environmentally friendly products that are certified by local or overseas established certification body (b) Products with at least 30% recycled content by weight or volume. (c) Products that made of rapidly renewable materials												

Residential Building Criteria

3-3 Greenery	Using Green Area Index (GAI) for computation of Greenery Provision (GnP) <table><thead><tr><th>GnP</th><th>Points</th></tr></thead><tbody><tr><td>2 to < 3.0</td><td>1</td></tr><tr><td>3.0 to < 3.5</td><td>2</td></tr><tr><td>3.5 to < 4.0</td><td>3</td></tr><tr><td>≥4.0</td><td>4</td></tr></tbody></table>	GnP	Points	2 to < 3.0	1	3.0 to < 3.5	2	3.5 to < 4.0	3	≥4.0	4	Using Leaf Area Index (LAI) for computation of Green Plot Ratio (GnPR) <table><thead><tr><th>GnPR</th><th>Points</th></tr></thead><tbody><tr><td>1.0 to < 2.0</td><td>1</td></tr><tr><td>2.0 to < 3.0</td><td>2</td></tr><tr><td>3.0 to < 4.0</td><td>3</td></tr><tr><td>4.0 to < 5.0</td><td>4</td></tr><tr><td>5.0 to < 6.0</td><td>5</td></tr><tr><td>≥ 6.0</td><td>6</td></tr></tbody></table>	GnPR	Points	1.0 to < 2.0	1	2.0 to < 3.0	2	3.0 to < 4.0	3	4.0 to < 5.0	4	5.0 to < 6.0	5	≥ 6.0	6
GnP	Points																									
2 to < 3.0	1																									
3.0 to < 3.5	2																									
3.5 to < 4.0	3																									
≥4.0	4																									
GnPR	Points																									
1.0 to < 2.0	1																									
2.0 to < 3.0	2																									
3.0 to < 4.0	3																									
4.0 to < 5.0	4																									
5.0 to < 6.0	5																									
≥ 6.0	6																									
3-4 Environmental Management Practice	1 point for project team comprises of GMM 2 points for project team comprises of GMP (up to 3 points) 1 point for provision of facilities or recycling bins for collection and storage of different recyclable waste such as paper, glass, plastics etc	0.5 point for project team comprises of GMM or GMFM 1 point for project team comprises of GMP (up to 1 point) 1 point for provision of recycling bins at each block of development for collection and storage of different recyclable waste such as paper, glass, plastics etc 1 point for main contractor with good track records in sustainable practices (<i>new criteria</i>)																								
3-5 Public Transport Accessibility	1 point for provision of adequate bicycles parking lots	- Provision of covered/sheltered bicycles parking lots 0.5 point - at least 5% of residential units 1 point - at least 10% of residential units - Up to 1 point																								
3-6 Stormwater Management		<u>Additional Criteria</u> Points awarded based on the the extent of the stormwater treatment. 3 points – 100% runoff 2 points – 50% run off 1 point – 25% run off																								

Residential Building Criteria

		(Up to 3 points)
Part 4- Indoor Environmental Quality		
4-1 Noise Level		No changes
4-2 Indoor Air Pollutants	2 points for use of low-VOC paints certified under the Singapore Green Labelling Scheme (extent of coverage: at least 90% of the total internal wall areas)	1 point for use of low-VOC paints certified under approved local or overseas certification body (extent of coverage: at least 90% of the total internal wall areas)
4-3 Waste Disposal		No changes
4-4 Indoor Air Quality in Wet Areas	1 point for provision of natural ventilation and daylighting in wet areas such as kitchens, bathrooms and toilets (extent of coverage: at least 90% of all applicable areas)	Provision of natural ventilation and daylighting in wet areas such as kitchens, bathrooms and toilets 1 point for 50%-90% of all applicable areas 2 points for more than 90% of all applicable areas (up to 2 points)
Part 5- Other Green Features		
5-1 Green Features and Innovations		New inclusion - Carbon footprint calculation - Provision of covered walkway to facilitate connectivity and use of public transport

Annex B

INVITATION FOR INDUSTRY COMMENTS ON REVISED BCA GREEN MARK CRITERIA FOR NEW BUILDINGS (VERSION 4.0) - DRAFT	
SUBMITTED BY : Items marked with an * are compulsory	
EMAIL TO : greenmark@bca.gov.sg OR FAX TO : 63254800	
Full Name	
E-mail address *	
Designation	
Name of Company* (N.A if feedback is given in individual capacity)	
Address of Company	
Telephone No. *	
Fax No	
COMMENTS/RECOMMENDED CHANGES	
<i>1. General Comments</i>	

SPECIFIC COMMENTS ON REVISED BCA GREEN MARK CRITERIA FOR NEW NON RESIDENTIAL BUILDINGS (VERSION 4.0) - DRAFT			
Criteria		Comments / Feedback	Recommended Changes
Part 1: Energy Efficiency			
1-1	Building envelope- ETTV		
1-2	Air conditioning system		
1-3	Building Envelope - Design/Thermal Parameters		
1-4	Natural Ventilation and/ or Mechanical Ventilation (exclude carparks and common areas)		
1-5	Lighting		
1-6	Ventilation in Carparks		
1-7	Ventilation in Common Areas		
1-8	Lifts and Escalators		
1-9	Energy Efficient Practices & Features		
1-10	Renewable energy		
	Other suggestions		
Part 2: Water Efficiency			
2-1	Water Efficient Fittings		
2-2	Water Usage and Leak Detection		
2-3	Irrigation System		
2-4	Water Efficient plant		
2-5	Water Consumption of Cooling Tower		
	Other suggestions		

Part 3: Environmental Protection			
3-1	Sustainable Construction		
3-2	Sustainable Materials		
3-3	Greenery		
3-4	Environmental Management Practice		
3-5	Public Transport Accessibility		
3-6	Refrigerants		
3-7	Stormwater Management		
	Other suggestions		
Part 4: Indoor Environmental Quality			
4-1	Thermal Comfort		
4-2	Noise Level		
4-3	Commissioning, Operation and maintenance for IAQ		
4-4	Visual Comfort		
	Other suggestions		
Part 5: Other Green Features			
5-1	Green Features & Innovations		
	Other suggestions		

SPECIFIC COMMENTS ON REVISED BCA GREEN MARK CRITERIA FOR NEW RESIDENTIAL BUILDINGS (VERSION 4.0) - DRAFT			
Criteria		Comments/ Feedback	Recommended Changes
Part 1: Energy Efficiency			
1-1	Building envelope- Thermal Performance		
1-2	Natural Ventilation and A/C Design		
1-3	Artificial lighting		
1-4	Daylighting		
1-5	Ventilation in Carparks		
1-6	Lifts		
1-7	Energy Efficient Features		
1-8	Renewable energy		
	Other suggestions		
Part 2: Water Efficiency			
2-1	Water Efficient Fittings		
2-2	Water Usage		
2-3	Irrigation System		
2-4	Water Efficient Plants		
	Other suggestions		

Part 3: Environmental Protection			
3-1	Sustainable Construction		
3-2	Sustainable Materials		
3-3	Greenery		
3-4	Environmental Management Practice		
3-5	Public Transport Accessibility		
3-6	Stormwater Management		
	Other suggestions		
Part 4: Indoor Environmental Quality			
4-1	Noise Level		
4-2	Indoor Air Pollutants		
4-3	Waste Disposal		
4-4	Indoor Air Quality in Wet Areas		
	Other suggestions		
Part 5: Other Green Features			
5-1	Green Features & Innovations		
	Other suggestions		