Green Mark for Existing Non- Residential Buildings GM ENRB: 2017



14 Mar 2017

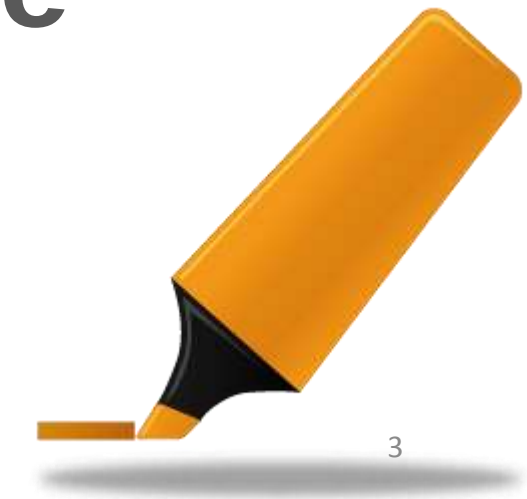
Green Mark Department (Existing Buildings)
Environmental Sustainability Group

Presentation Outline

1) Highlights of ENRB:2017 and implementation timeline
2) Pre-Requisite Requirements
3) Detailed view of Criteria
4) Re-certification Process
5) Q&A

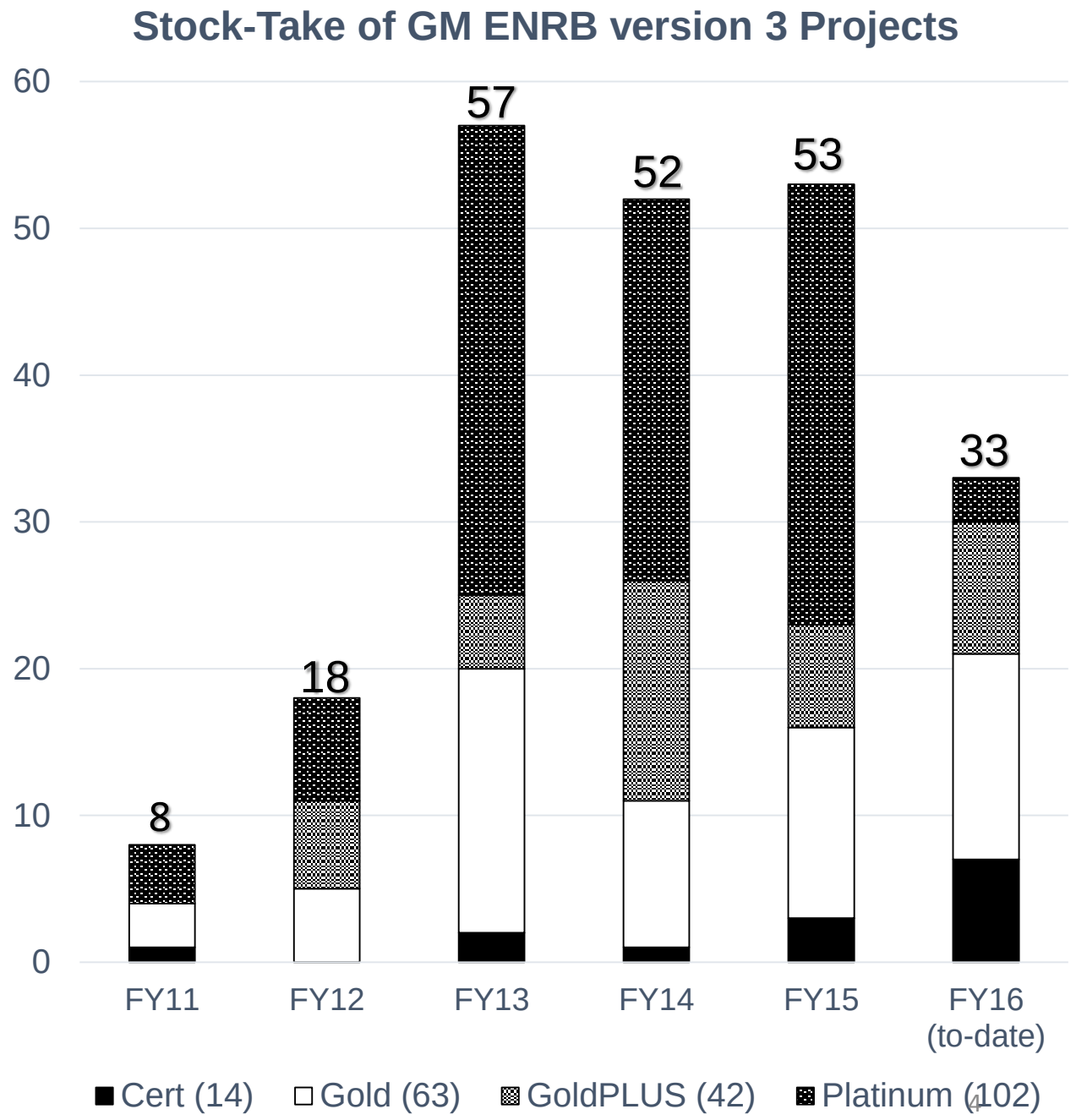
GM ENRB: 2017
Highlights of ENRB:2017 and Implementation Timeline

1



BCA GREEN MARK
ENRB v3

1. Energy Efficiency
2. Water Efficiency
3. Sustainable Operation & Management
4. Indoor Environment Quality
5. Other Green Features



Sustainable Management Taskforce
[Chaired by: Lim Tow Fok & Eng Shyan]

EEI/EUI Workgroup
[Lead: Thomas]

Greenery Workgroup
[Lead: Halim]

Transportation Workgroup
[Lead: Thomas]

Air conditioning Taskforce
[Chaired by: Prof Wong, Koh Kin Teng & Eng Shyan]



Hot Water System Taskforce
[Chaired by: Joseph Loh, Tay Cher Seng & Eng Shyan]

Solar PV Workgroup
[Lead: Thomas Pang]
Continue to engage GM2015 TF

Lighting Workgroup
[Lead: Francis]
Continue to engage GM2015 TF

Water Workgroup
[Lead: Tracy, Jocelyn]

Waste Workgroup
[Lead: Boon Wee]

Smart building Taskforce
[Chaired by: Alfred Lim, Tony Tay & Eng Shyan]

IEQ Taskforce
[Chaired by: Lim Fatt Seng & Eng Shyan]

Noise & Acoustics Workgroup
[Lead: Kai Siong & Lewis]
Continue to engage GM2015 TF

NV Workgroup
[Lead: Xijing]
Continue to engage GM2015 TF



14

Taskforces & Workgroups co-chaired by BCA and leading industry experts

Comprising

>70

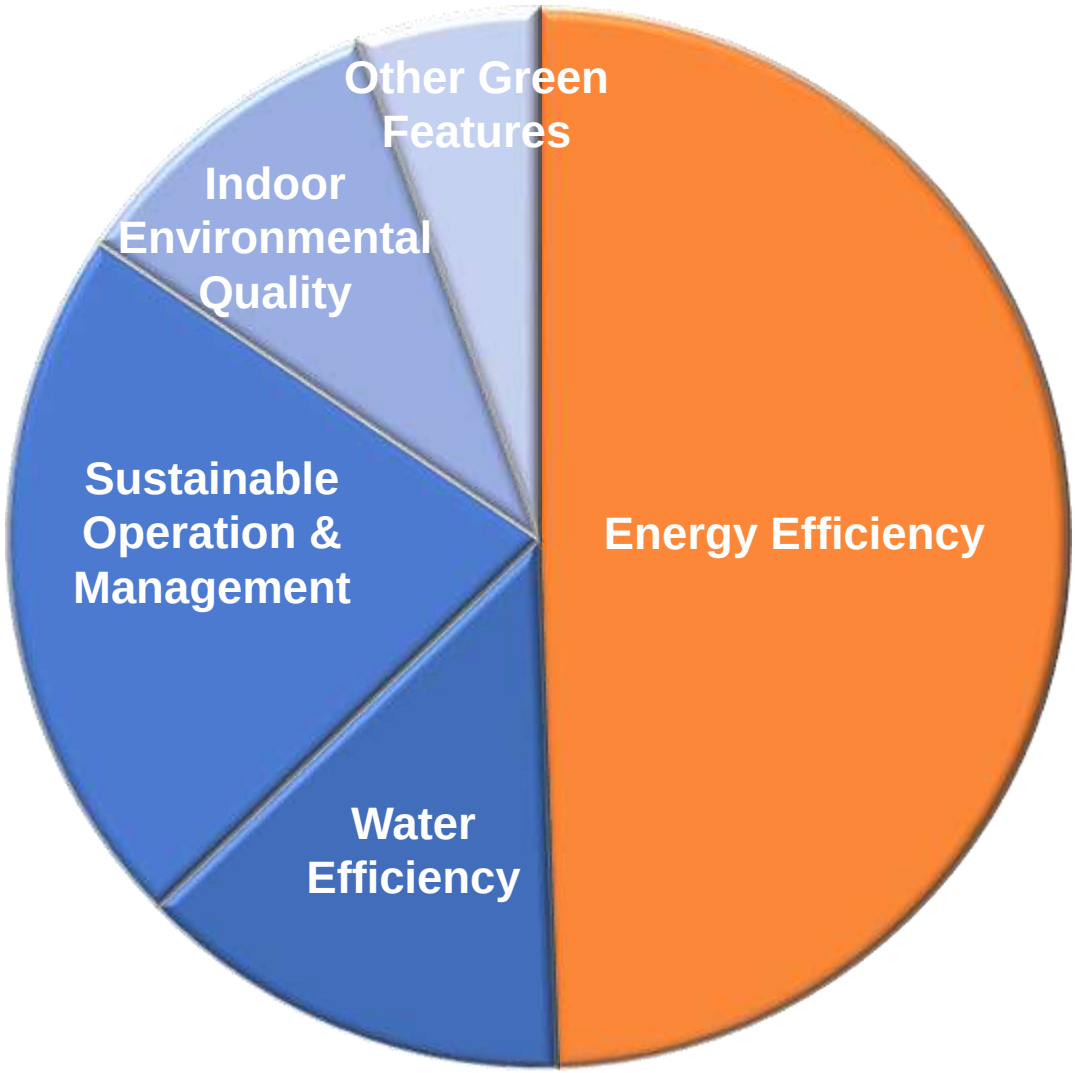


external industry experts from

>50 companies

Overview of Credit Scoring System

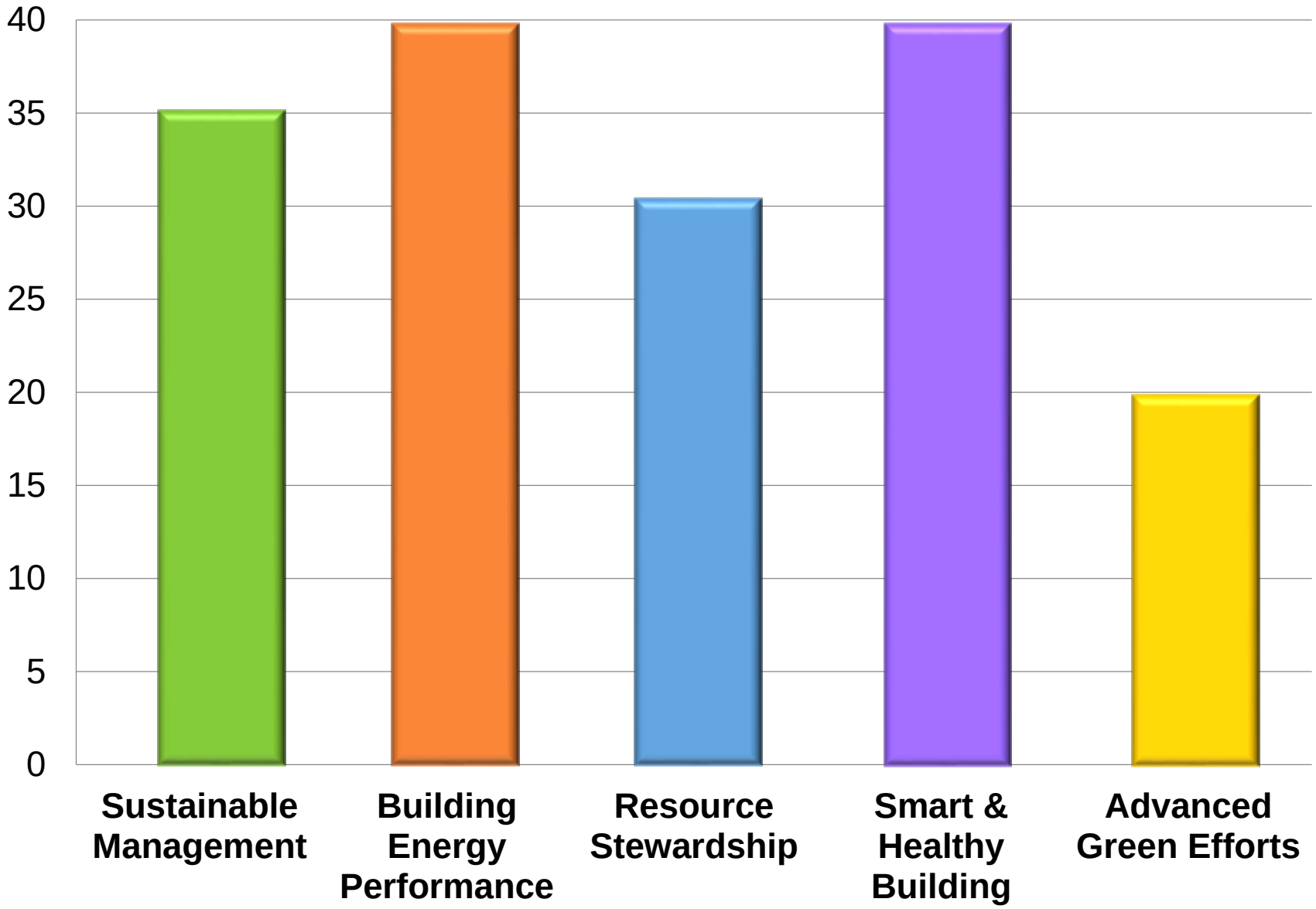
GM ENRB Version 3



GM ENRB: 2017



Overview of Credit Scoring System



5

Sections

10

Pre-requisite requirements

42

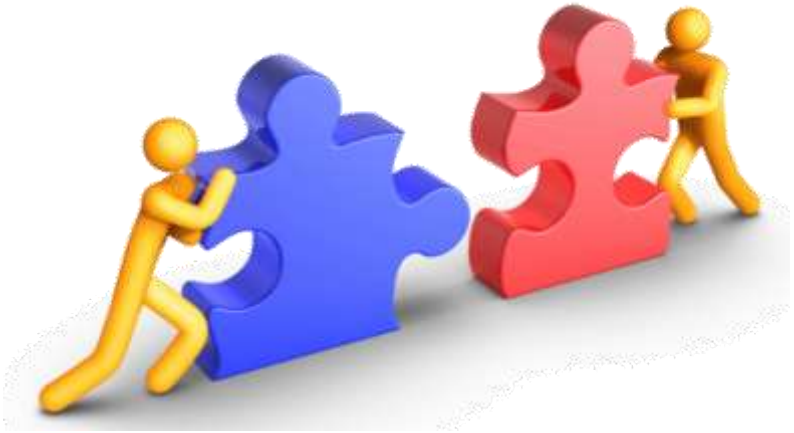
Criteria

Key Highlight
Section 1: Sustainable Management

Tenant/Occupant Engagement

To encourage building owners and tenants to set up Environmental or Green Committee to promote sustainability related initiatives within the building.

- Green Building Committee,
- Tenant engagement activities









Key Highlight

Section 1: Sustainable Management

Performance-based Procurement for Retrofits and Maintenance

Encourages Energy Performance Contracting

For EE Retrofits

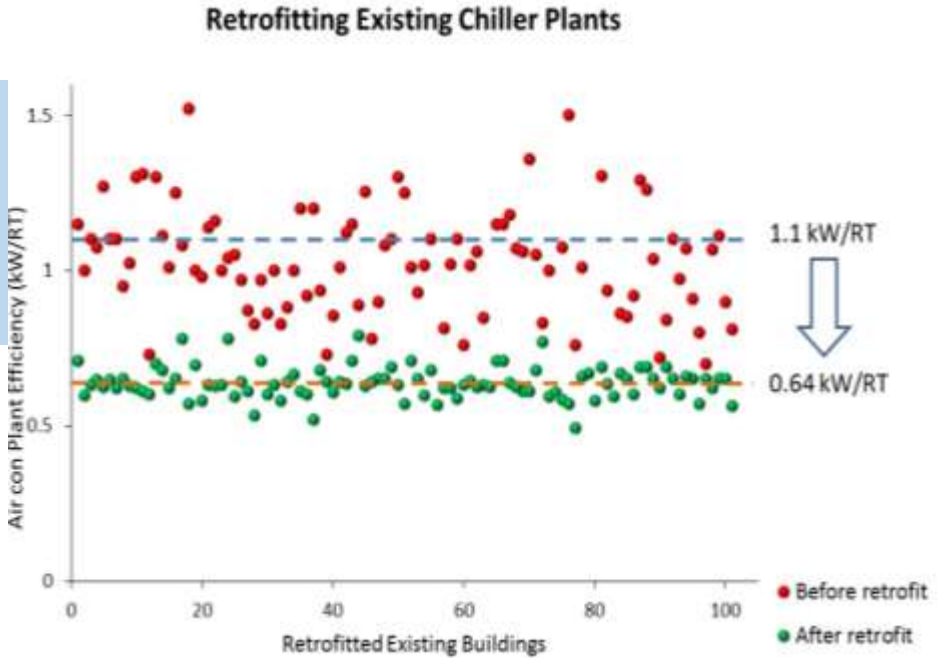
- Chilled water system
- Air distribution system

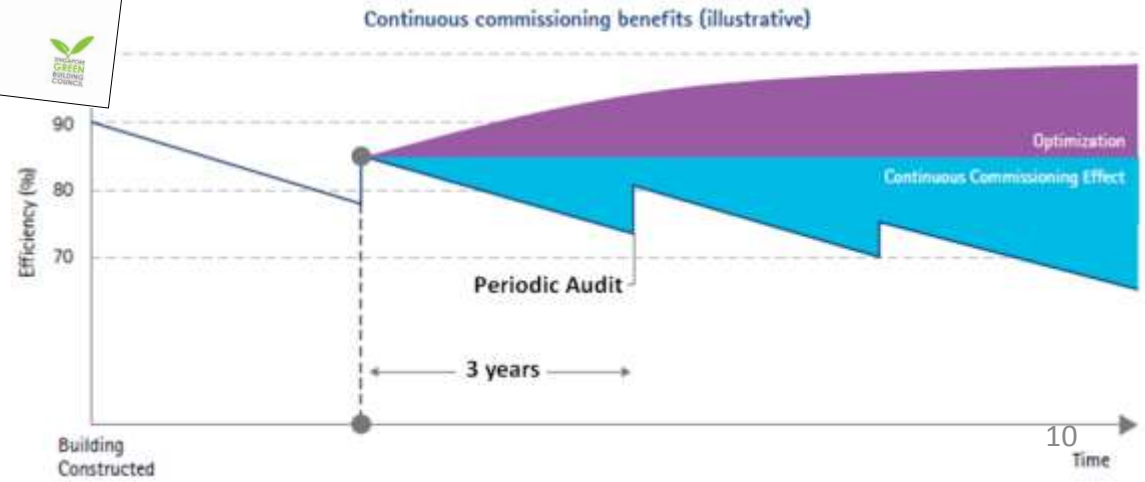
For Maintenance *(min. 3 years)*

- Chilled water system
- Air distribution system



SINGAPORE GREEN BUILDING SERVICES SGBC





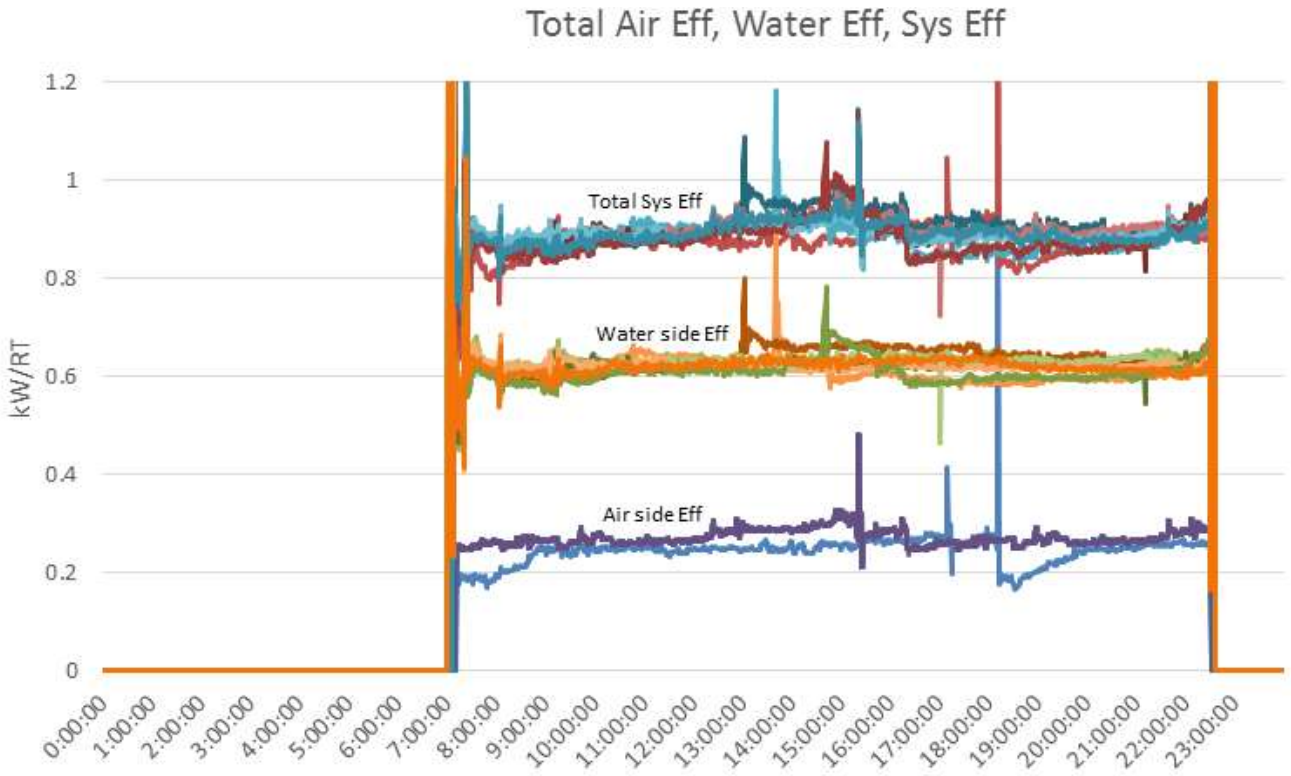
Key Highlight
Section 2: Building Energy Performance

Air-Conditioning System Efficiency
Encourages measurement of air distribution system efficiency

High potential savings in air distribution system

Green Mark Rating	Building Cooling Load (RT)	
	< 500	≥ 500
	Minimum Efficiency (kW/RT)	
Certified	0.85	0.75
Gold	0.80 (v3) → **0.75**	0.70
Gold^{Plus}	0.75 (v3) → **0.7**	0.68
Platinum	0.70 (v3) → **0.68**	0.65

Baseline for Air Distribution Efficiency (voluntary basis): 0.28 kW/RT



Total air con system score = score $_{water}$ + score $_{air}$

Key Highlight
Section 2: Building Energy Performance

Renewable Energy
Drives efforts towards net positive energy low-rise buildings, zero energy mid-rise buildings and low energy high-rise buildings



Solar Energy Feasibility Study
- Evaluation of building's potential for solar opportunities

Solar Ready Roof
- Structural readiness
- Electrical readiness
- Spatial readiness



Key Highlight
Section 4: Smart & Healthy Building

Indoor Air Quality (IAQ)
Drives indoor environment quality management and occupant health & well-being

Occupant Comfort

(iv) Post Occupancy Evaluation (POE)

– **Coming up with standardised POE survey form**

(v) IAQ Management Plan



Outdoor air & Filtration

(ii) Enhanced filtration media (MERV 14)

Additional points: Trend logging of IAQ parameters





Key Highlight
Section 4: Smart & Healthy Building

Smart Building Operations
Encourages adoption of smart control tools and strategies to future-proof buildings

Energy Monitoring

- BAS and Controller with Open Protocol
- Connection to BCA Smart Chiller Portal



Demand Control

Integration and Analytics





Implementation Timeline

Feb - Mar '17

1st Draft of GM ENRB: 2017

Apr - May '17

2nd Draft of GM ENRB: 2017

Sep '17

Launch pilot version of ENRB:2017

Industry Associations, Public Agencies

Singapore Green Building Council; The Institution of Engineers Singapore; Association of Consulting Engineers Singapore; IFMA Singapore Chapter; REDAS; Singapore Hotel Association; jtc Breaking New Ground; Housing & Development Board; National Environment Agency; PUB Water for All: Conserve, Value, Enjoy

ENRB: 2017 Taskforce members, BCA Energy Auditors, Building Owners/ MCSTs/ MAs

International Green Building Conference Singapore

INDUSTRY CONSULTATION & FEEDBACK

Criteria with basic points structure

PRELIMINARY TRIAL

COMMUNICATIONS

To ensure smooth pilot launch

GM ENRB: 2017
Pre-requisite Requirement

2







Pre-requisite Requirement

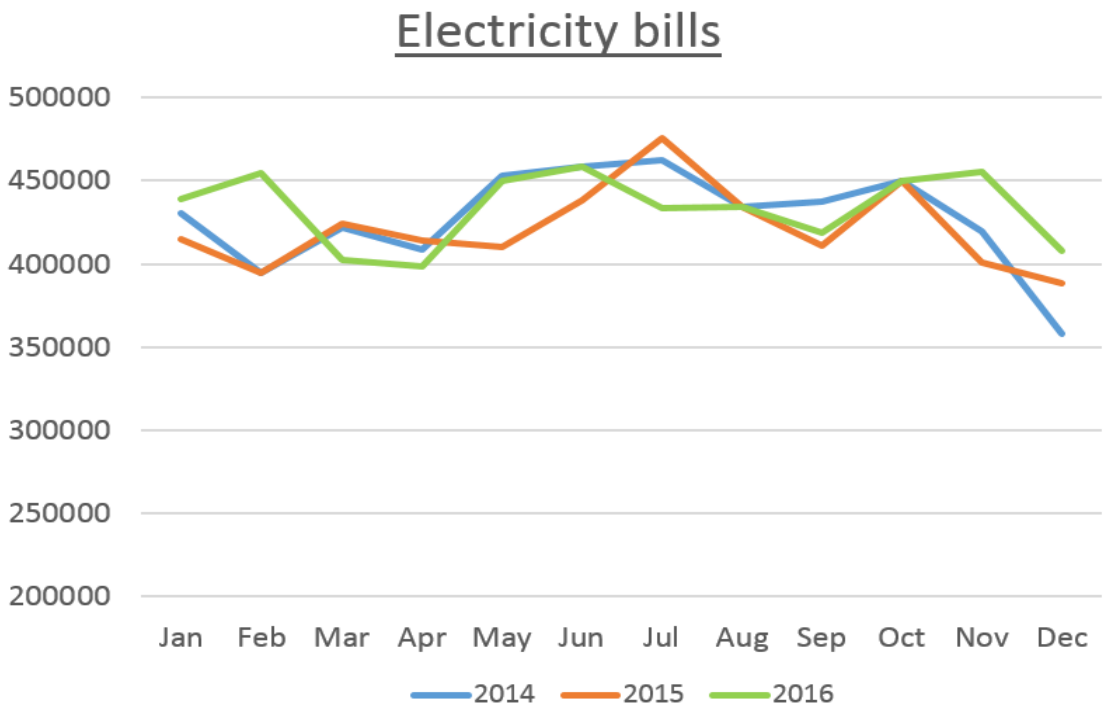
Pre-requisite Requirement	GM Rating
1. Energy Consumption of the Development	All rating
2. Minimum Systems' Efficiency	All rating
3. Energy Improvement on Lighting System (Common areas)	All rating
4. Water Consumption Monitoring	All rating
5. Chiller Plant M&V Instrumentation	All rating
6. Indoor Temperature	All rating
7. IAQ Surveillance Audit	All rating
8. Tenant / Occupant Engagement	Gold^{PLUS} and Platinum
9. Recycling Facilities	Gold^{PLUS} and Platinum
10. Post Occupancy Evaluation (POE)	Gold^{PLUS} and Platinum

Pre-requisite Requirement

ALL GM Rating

1. Energy consumption of the development

- To compute and monitor energy use intensity (EUI), for past 3 years
- To have energy efficiency improvement plan





Pre-requisite Requirement

ALL GM Rating

2. Minimum Systems' Efficiency

Water cooled chilled water system

Green Mark Rating	Building Cooling Load (RT)	
	<500 RT	≥500RT
	Minimum Efficiency (kW/RT)	
Certified	0.85	0.75
Gold	0.8 → 0.75	0.70
Gold^{PLUS}	0.75→ 0.7	0.68
Platinum	0.7 → 0.68	0.65

Air cooled chilled water system or Unitary Air-Conditioner

Green Mark Rating	Building Cooling Load (RT)	
	<500 RT	≥500RT
	Minimum Efficiency (kW/RT)	
Certified	1.1	1.0
Gold	1.0	*Case by case basis
Gold^{PLUS}	0.85	
Platinum	0.78	

Building Type	Operating Hours
Office Buildings	9 a.m. to 6 p.m. (Monday to Friday)
Retail Malls	10 a.m. to 10 p.m.
Hotels and Hospital	24 hours
Other Building Types	To be determined based on operating hours

New in ENRB:2017

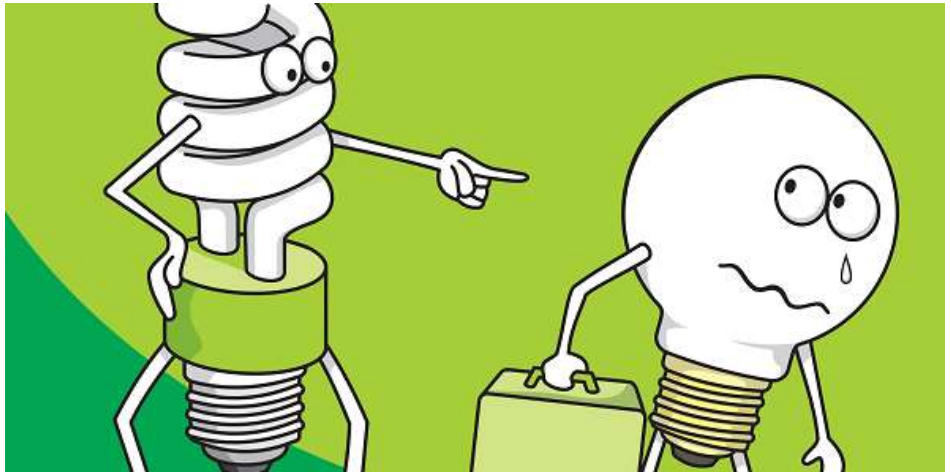
Enhanced from ENRB v3

Pre-requisite Requirement

ALL GM Rating

3. Energy Improvement on Lighting System (Common Areas)

★ To demonstrate **≥ 20%** Improvement in Lighting Power Budget in **COMMON AREAS**



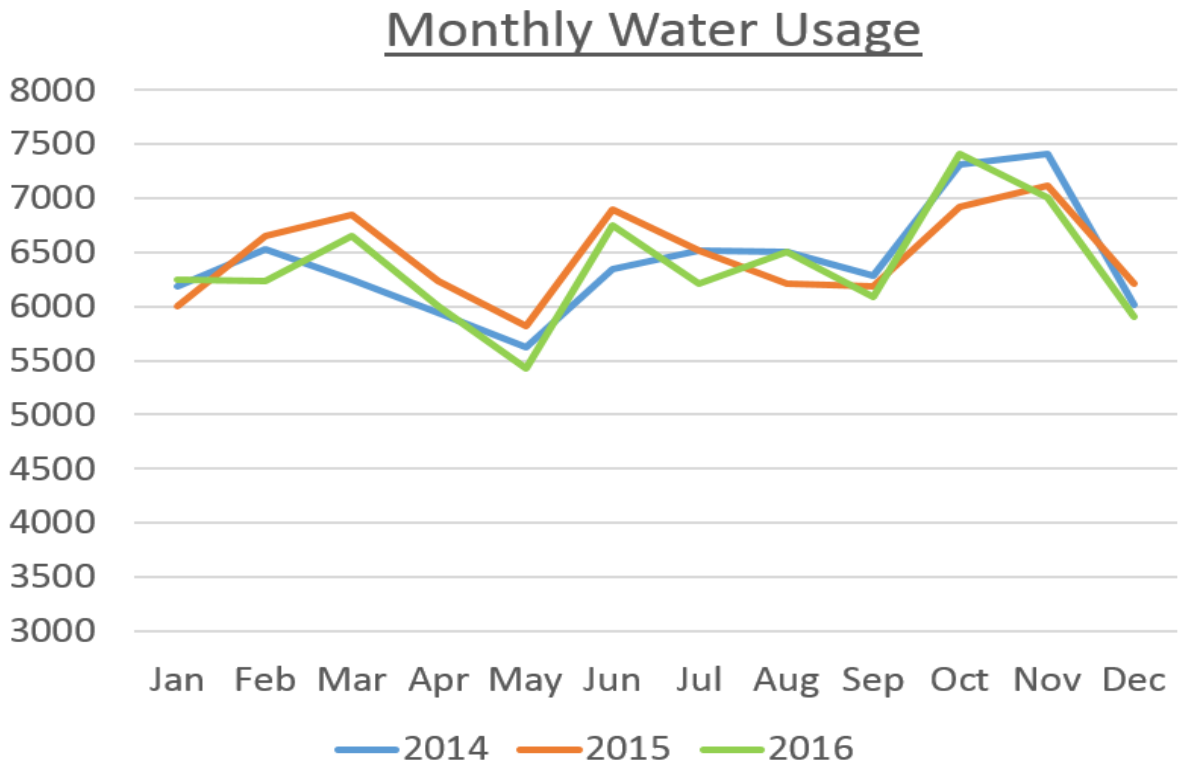
Type of usage	Maximum lighting power budget (W/m2)
Offices	15
Classrooms	15
Hotel guest room	15
Lecture theatres	15
Auditoriums / Concert halls	10
Shops / Supermarkets / Departmental stores (including general, accent & display lighting)	25
Restaurants	15
Lobbies / Atriums / Concourse	10
Stairs	6
Toilets	15
Corridors	10
Car parks	5
Electronic manufacturing and fine detail / Assembly industries	20
Medium and heavy industries	15
Warehouses / Storage areas	10

Pre-requisite Requirement

ALL GM Rating

4. Water Consumption Monitoring

- To compute and monitor yearly water consumption (m^3/m^2) for past 3 years
- To have water improvement plan





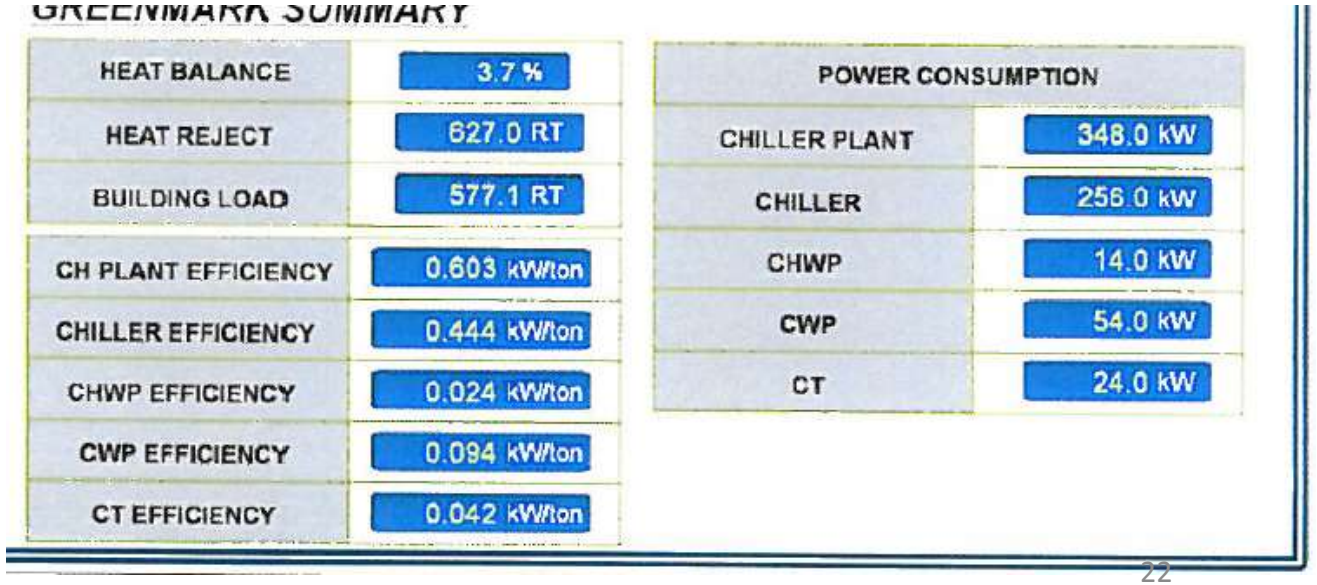
Pre-requisite Requirement

ALL GM Rating

5. Chiller Plant M&V Instrumentation

- Location and installation of measuring devices to meet manufacturer's recommendation
- All data: Trend 1 min interval and recorded to the 3rd decimal digit
- Compute and display of water side efficiency (kW/RT)

Date	Time	HRD_CHWS_T	HRD_CHWR_T	HRD_CWS_T	HRD_CWR_T
31/8/2016	11:24:52	6.813	14.028	28.07	33.108
31/8/2016	11:24:42	6.813	14.015	28.022	33.092
31/8/2016	11:24:32	6.809	14.045	27.975	33.074
31/8/2016	11:24:22	6.802	14.014	27.933	33.056
31/8/2016	11:24:12	6.799	13.994	27.894	33.043
31/8/2016	11:24:02	6.796	14.005	27.858	33.029
31/8/2016	11:23:52	6.796	13.982	27.818	33.009
31/8/2016	11:23:42	6.787	14.028	27.79	32.995
31/8/2016	11:23:32	6.782	14.002	27.764	32.977
31/8/2016	11:23:22	6.781	14.021	27.743	32.961
31/8/2016	11:23:12	6.781	14.036	27.724	32.949
31/8/2016	11:23:02	6.791	14.039	27.704	32.934



Pre-requisite Requirement

ALL GM Rating

5. Chiller Plant M&V Instrumentation

Flow Meter

- Full bore magnetic flow meter with 1% uncertainty
- Capable of electronic in-situ verification to within ±2% of its original factory calibration
- Where magnetic meter not possible, ultrasonic flow meter may be used

Temperature Sensor

- End-to end measurement not exceeding ±0.05°C over the entire measurement range
- Open-end thermo-wells
- Two spare thermo-wells

Power Meter & CT

- Class 1 or better
- provided for each of the groups of plant components

- Heat Balance accordance to AHRI 550/590

Pre-requisite Requirement

ALL GM Rating

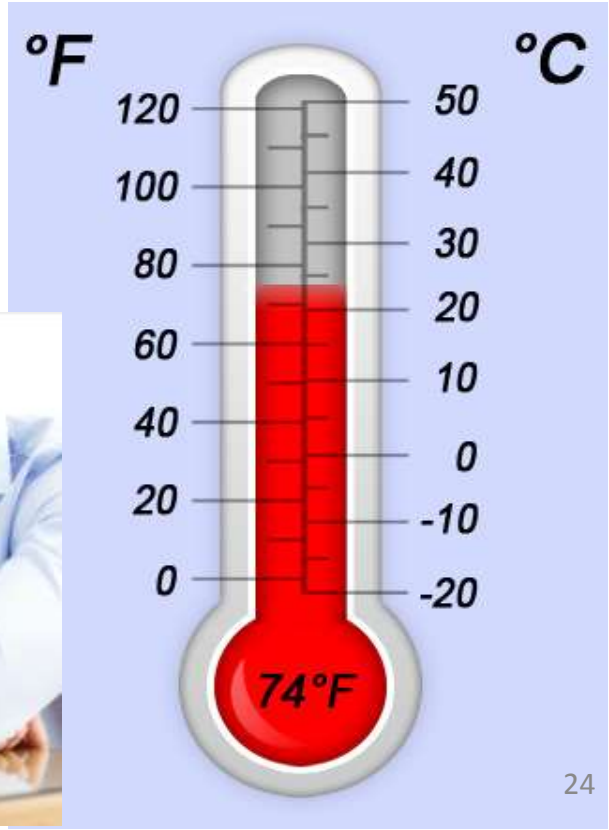
6. Indoor Temperature

- To maintain indoor dry bulb temperature of 23°C and above to prevent overcooling









Pre-requisite Requirement

ALL GM Rating

7. IAQ Surveillance Audit

- To conduct a 3 yearly IAQ audit
- According to NEA's Guideline for good Indoor Air Quality in Office Premises or SS554:2016
- By an accredited laboratory under Singapore Accreditation Council

TABLE 1: IAQ TEST RESULTS SUMMARY

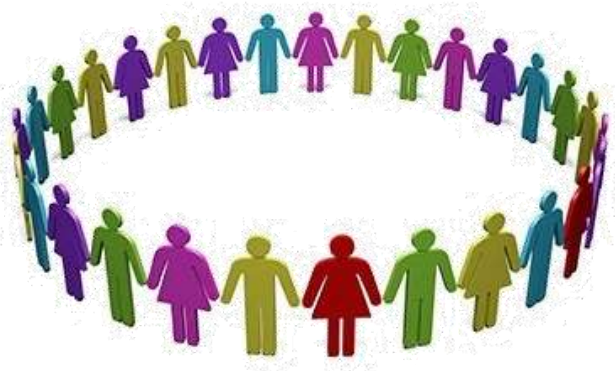
No	Floor Name	Sample Site	Date & Time of Sampling	CO_2 (ppm)	CO (ppm)	HCHO (ppm)	TVOC (ppb)	RSP ($\mu g/m^3$)	OT (°C)	RH (%)	AV (m/s)	TBC (Cfu/m^3)	TMC (Cfu/m^3)
*SSS554: 2009; Recommended Threshold limit				<1070	<9	<0.1	<3000	<50	24-26	<70	0.10-0.30	<500	<500
11	Level 15	Avenue Asia Meeting Room	14/10/2016 14:15 - 14:20	819	0	0.02	1100	3	24.3	58.3	0.24	110	<10
12	Level 16	AT Capital Office	14/10/2016 14:03 - 14:11	857	0	0.00	1400	8	24.8	55.3	0.10	280	10
13	Level 17	Yardi International Office	14/10/2016 13:53 - 14:00	804	0	0.00	1100	10	25.7	59.0	0.16	410	10
14	Level 19	Holman Fenwick Willan Meeting Room	14/10/2016 13:45 - 13:51	757	0	0.00	800	15	24.8	56.6	0.11	170	<10
15	Level 21	Samsung C&T Reception	14/10/2016 13:28 - 13:35	732	0	0.00	600	1	24.2	63.5	0.16	160	10
16	Level 22	Shagang Office	14/10/2016 11:43 - 11:50	798	0	0.00	600	13	24.8	58.8	0.12	390	<10
17	Level 22	Lift Lobby	14/10/2016 12:01 - 12:09	756	0	0.00	600	14	24.3	59.7	0.12	300	10
18	Level 23	Samsung Reinsurance Reception	14/10/2016 16:00 - 16:05	927	0	0.00	1000	5	24.0	61.5	0.23	260	10
19	Level 24	Rock Tree Meeting Room	14/10/2016 11:35 - 11:39	844	0	0.00	600	11	25.2	56.5	0.11	220	10
20	Level 25	Just Office (Pantry)	14/10/2016 11:23 - 11:30	827	0	0.00	500	19	24.1	58.2	0.14	290	<10

ACCREDITED LABORATORY SAC-SINGLAS

Pre-requisite Requirement

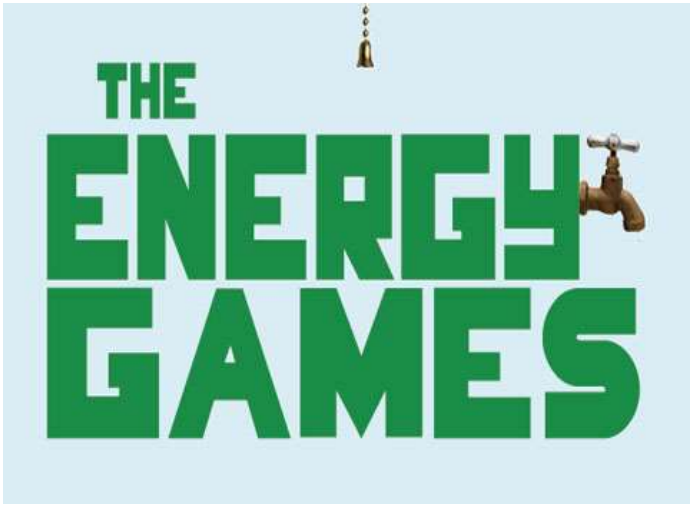
Gold^{PLUS} and Platinum

8. Tenant / Occupant Engagement



- At least 1 green related activities within a year







Pre-requisite Requirement

Gold^{PLUS} and Platinum

9. Recycling Facilities

- To provide recycling facilities for collection of common recyclables







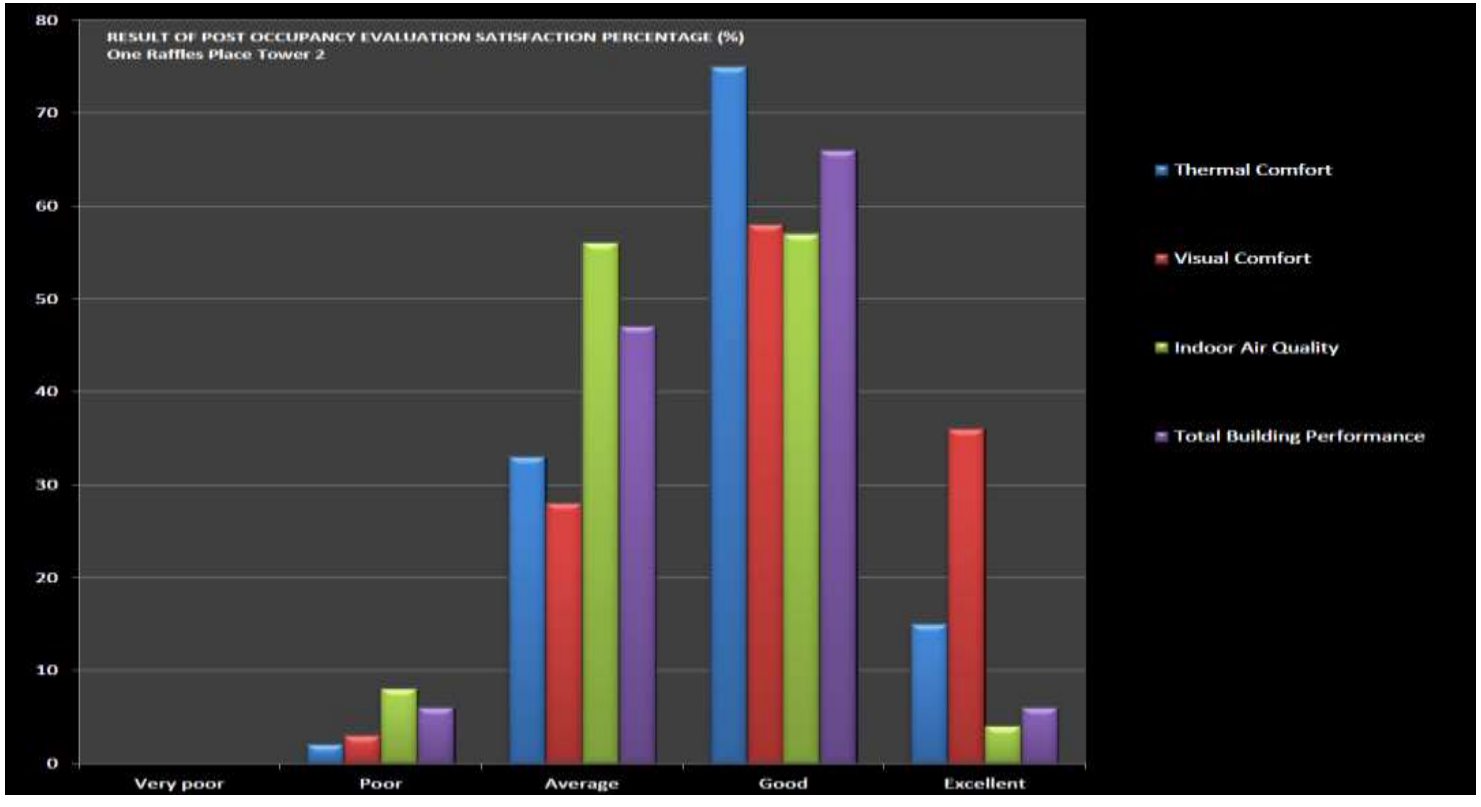


Pre-requisite Requirement

Gold^{PLUS} and Platinum

10. Post Occupancy Evaluation (POE)

- To conduct a POE
- To take corrective actions







Action Taken	Status
Re-adjusted VAV and thermostat setting. (Adjusted Temperature 24 degrees)	closed
We are using MERV 15 air filter which is a high efficency filter so we do not need to change the air filter on a quaterly basis.	closed
Re-adjusted VAV and thermostat setting. (Adjusted Temperature 23.5 degrees)	28closed

GM ENRB: 2017
Development Work & Criteria

3







GM ENRB 2017
Section 1 – SUSTAINABLE MANAGEMENT








Section 1: Sustainable Management

11 Criteria
35 Points

	GM Criteria	GM Points	
1.1	Environmental credentials of FM & Professionals	1	Leadership
1.2	Sustainable Policy and Action Plan	4	
1.3	Green Building Committee	2	
1.4	Green Education	2	User Engagement
1.5	Green fit-out guidelines	1	
1.6	Green Lease	2	
1.7	Green related activities for building occupants	3	
1.8	Greenery	6	
1.9	Refrigerant	4	
1.10	Green Transport	4	
1.11	Sustainable Operation	6	

Section 1

1.1 Environmental credentials of FM & Professionals
(up to 1 point)

To recognise facility managers, consultants and EPC firms with specialist green credentials who contribute towards sustainable management of the building. Applicable to in-house facility management team or external consultants with the following credentials:

- Certified GMFM (0.5 point)
- Certified GMFP (1 point)
- SCEM (1 point)

CERTIFIED GREEN MARK FACILITIES MANAGER

CERTIFIED GREEN MARK FACILITIES PROFESSIONAL

SINGAPORE CERTIFIED ENERGY MANAGER

★ *<u>Advanced Green Efforts (Section 5)</u>*

*Engagement of **GREEN** facility management (FM) companies accredited by Singapore Green Building Council (SGBC), in operation and maintenance of the building (1 point)*

Section 1

1.2 Sustainable Policy and Action Plan (4 points)

- ISO 14001 or ISO 50001 certifications *(1 point)*
- Energy Management Policy and Improvement Plan (1 point)
- Water Management Policy and Improvement Plan (1 point)
- Waste Management Policy and Recycling Plan (1 point)







1.3 Green Building Committee (2 points)

To encourage building owners to set up Green Committee and engage tenants to be part of this committee to promote sustainability related initiatives within the building.

- Set up Green Building Committee (1 point)
- Members of Committee includes tenants (1 point)

New in ENRB:2017

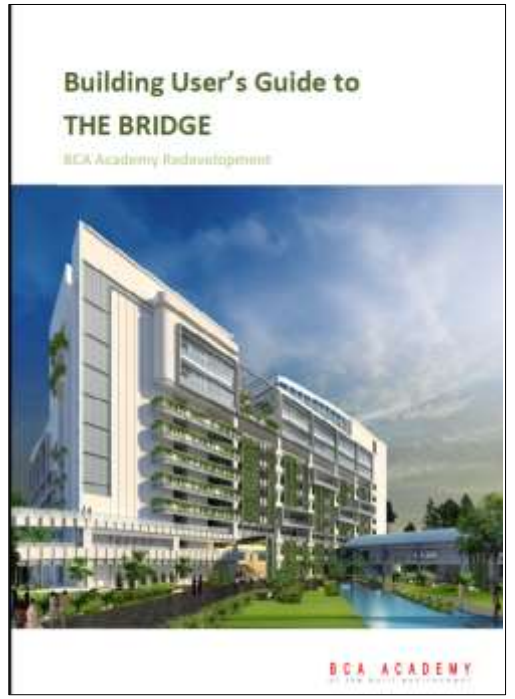
Enhanced from ENRB v3

Section 1

1.4 Green Education (2 points)

- Green Building User Guide (1 point)
- Green corner (1 point)





★ 1.5 Green Fit-out Guidelines (1 point)

Provision of Green Fit-out Guidelines for tenants with details recommending minimum environmental standards for their premises.





Section 1

1.6 Green Lease (up to 2 points)

Implementation of Green Lease. Points are given based on percentage of Net Lettable Area (NLA) having green lease.

- If tenants with Green Lease < 10% of NLA (0.5 point)
- If tenants with Green Lease ≥ 10% of NLA (1 point)
- If tenants with Green Lease ≥ 40% of NLA (2 points)

Go Green LEASING

Green Leases

1.7 Green Related activities for Building Occupants (up to 3 points)

Building owner to conduct green related activities for building occupants. Points are given based on the no. of green activities conducted in a year.

(1 point for each activity)





Section 1

1.8 Greenery (6 points)



a) Greenery Provision (GnP) *(Up to 2.5 points)*

Provision of greenery such as trees, palms and grass within the development. Point scored is based on the Greenery Provision (GnP) :

- GnP = 0.5 to < 1.0 (1 point)
- GnP = 1.0 to < 2.0 (1.5 point)
- GnP = 2.0 to < 3.0 (2 points)
- GnP ≥ 3.0 (2.5 points)



Section 1

1.8 Greenery (6 points)



1.8b Roof Top Greenery *(Up to 1 point)*

Provision of greenery on roof top. Points are given based on percentage of green area compared to useable roof area.

- Roof green area between ≥ 20% to < 50% (0.5 point)
- Roof green area between ≥ 50% (1 point)



1.8c Vertical Greenery *(Up to 1 point)*

Provision of vertical greenery. Points are given based on percentage of greenery area.

- Vertical green area between ≥ 10% to < 50% (0.5 point)
- Vertical green area between ≥ 50% (1 point)

Section 1

1.8 Greenery (6 points)

1.8d Sustainable Landscape Management *(Up to 1.5 points)*

- The landscape within the development has achieved Nparks Landscape Excellence Assessment Framework (LEAF) certification (1.5 points)

  OR

- Adoption of a proper landscape management plan that includes:-

  (a) the use of organic composts from horticultural wastes (0.5 point)

  (b) provision for onsite composting (0.5 point)

  (c) general landscape maintenance plan (0.5 point)









Section 1

1.9 Refrigerant (4 points)





a) Green Refrigerant *(Up to 1.5 points)*

- ODP = 0 **OR** GWP < 100 (0.5 points)
- ODP = 0 **AND** GWP < 750 (1 point)
- ODP = 0 **AND** GWP < 10 (1.5 points)





Refrigerant	Ozone Depletion Potential (ODP)	Global Warming Potential (GWP)
R123	0.012	77
R134a	0	1430
R410a	0	2088
R32	0	675
R513a	0	630
R1233zd	0	1
R1234ze	0	6

Enhanced from ENRB v3

Section 1

1.9 Refrigerant (Total 4 points)



b) Refrigerant Leak Detection System *(1 point)*

Provision of refrigerant leak detection system to prevent leaks into the atmosphere which can be hazardous to health and detrimental to the environment.

c) <u>Refrigerant Management System</u> *(1.5 points)*

To engage contractors to manage the refrigerant and ensure that the FM team is responsible to enforce the procedures on proper handling of refrigerant, maintaining the log sheets, tracking, proper safety procedures and preventing refrigerant leaks.

Simple Compliance Checklist

- ✓ Form a Refrigerant Compliance Management Team (Corporate and/or Site Level)
- ✓ Designate a Corporate Refrigerant Compliance Manager and site Refrigerant Compliance Managers
- ✓ Inventory all refrigerant containing equipment.
- ✓ Determine equipment total charge. (under 50 pounds, over 50-Comfort or Process)
- ✓ Develop written procedures and policies for refrigerants
- ✓ Standardize on an Refrigerant Management and Regulations record keeping system.
- ✓ Inventory all refrigerant containing equipment.
- ✓ Determine equipment total charge. (under 50 pounds, over 50-Comfort or Process)
- ✓ Implement all procedures and train all affected personnel.
- ✓ Follow-up with regularly scheduled audits/surveys.

Section 1

1.10 Green Transport (4 points)

a) Good access (< 500 m walking distance) to public transport networks such as MRT/LRT stations and bus stops. *(0.5 points)*

b) Provision of covered walkway to facilitate connectivity and use of public transport. *(0.5 points)*

c) Priority parking lots for hybrid / electric vehicles.

- Provision of 1 parking lot per 100 car parking lots or at least 10 lots. *(1 point)*
- Provision of at least 1 no. of electric vehicle charging points. *(0.5 point)*







Section 1

1.10 Green Transport (Total 4 points)

d) Sheltered bicycle parking lots with adequate shower and changing facilities.
(Up to 1.5 points)

- Provision of at least 1 bicycle lot per 1,500 m2 GFA *(0.5 point)*

OR

- Provision of at least 2 bicycle lots per 1,500 m2 GFA *(1 point)*

OR

- Provision of at least 3 bicycle lots per 1,500 m2 GFA *(1.5 points)*

OR

- Provision of at least 50 bicycle lots (*1.5 points)*





Enhanced from ENRB v3

Section 1

1.11 Sustainable Operation (Total 6 points)

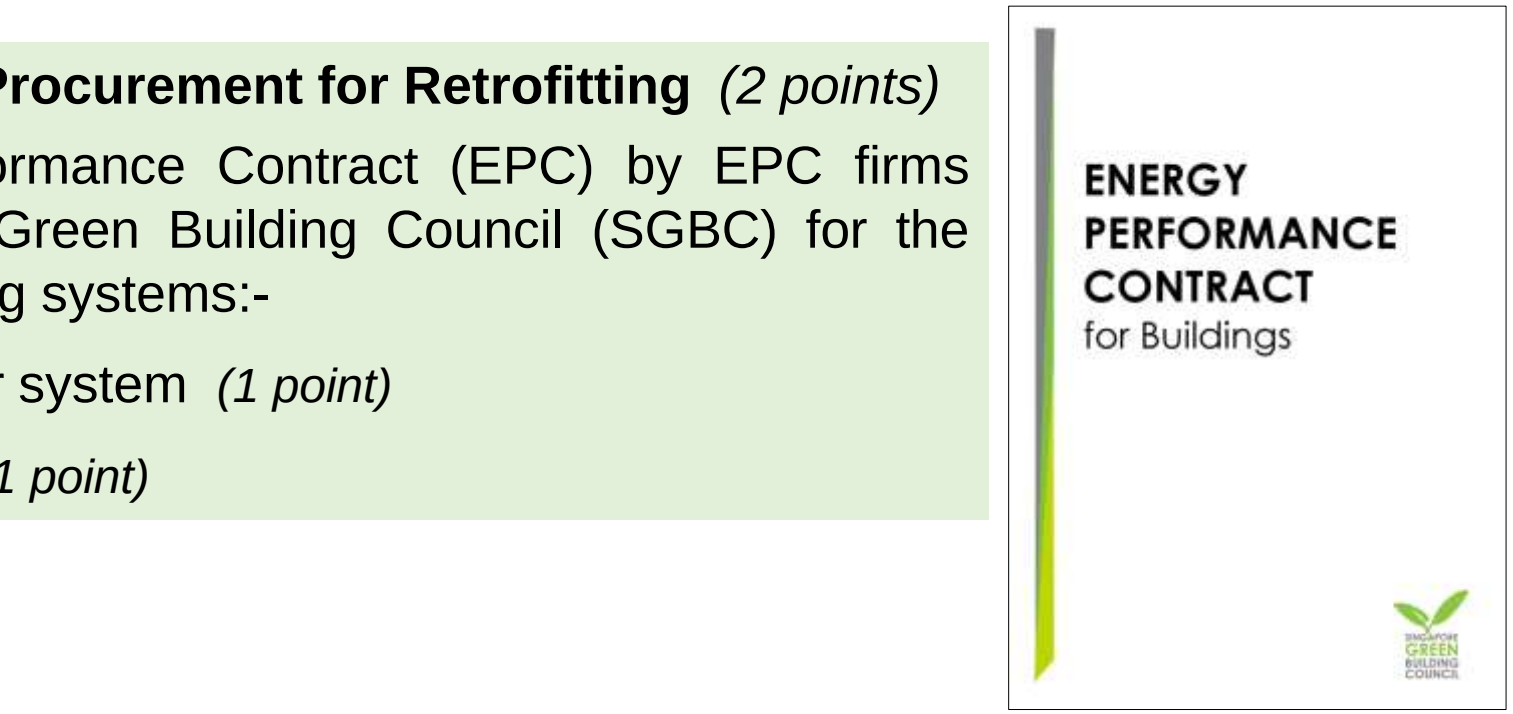
a) Green Procurement Policy *(1 point)*

Adoption of green procurement policy in the operation and maintenance of the building.

b) Performance Based Procurement for Retrofitting *(2 points)*

Adoption of Energy Performance Contract (EPC) by EPC firms accredited by Singapore Green Building Council (SGBC) for the replacement of the following systems:-

- Centralized chilled water system *(1 point)*
- Air distribution system *(1 point)*



Section 1

1.11 Sustainable Operation (6 points)



c) Performance Based Procurement for Maintenance *(2 points)*

Adoption of performance based maintenance contract for at least 3 years for the maintenance of the following systems:-

- Centralized chilled water system *(1 point)*
- Air distribution system *(1 point)*



d) System handover and Documents *(1 point)*

Maintain a proper and updated system handover documents for retrofitted building system (e.g. Air-conditioning system and Building Automation System).

Documents shall include description of systems operation and controls, testing and commissioning reports, as-built drawings, technical and training manuals and user guides.

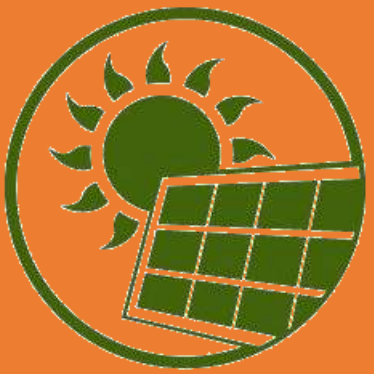












GM ENRB 2017

Section 2 – BUILDING ENERGY PERFORMANCE

Section 2: Building Energy Performance

9 Criteria
40 Points

	GM Criteria	GM Points
2.1	Façade performance	2
2.2	Air conditioning system efficiency	Up to 17
2.3	Natural / Mechanical ventilation	
2.4	Lighting efficiency	6
2.5	Transportation system	1.5
2.6	Ventilation in car park	2
2.7	Ventilation in common areas	3
2.8	Energy efficient practices and features	2
2.9	Renewable energy	6.5

Section 2

2.1 Façade Performance (2 points)

ETTV (W/m²)	Points
45 to <50	1
40 to <45	2

Advanced Green Efforts (Section 5)

Additional 1 point can be scored if ETTV < 40W/m²

ETTV

means

Envelope Thermal Transfer Value





Section 2

2.2 Air Conditioning System Efficiency (16 points)

a) Water-Cooled Chilled water system Efficiency (12 points)

	Building Cooling Load	
	< 500 RT	≥500 RT
Baseline	**0.85 kW/RT**	**0.75 kW/RT**

Point scored = 0.6 x (% improvement)

Full point for <500RT, efficiency ≤ 0.68kW/RT

Full point for ≥500RT, efficiency ≤ 0.60kW/RT

b) Air cooled chilled water plant /Unitary Air-con Efficiency (12 points)

	Building Cooling Load	
	< 500 RT	≥500 RT
Baseline	**1.1 kW/RT**	**1.0 kW/RT**

Point scored = 0.4 x (% improvement)

Full point for <500RT, efficiency ≤ 0.77kW/RT

Full point for ≥500RT, efficiency ≤ 0.70kW/RT



Note:

- *For building with different air-conditioning systems, the point scored will be pro-rated based on the cooling load of each system.*
- *For buildings using district cooling system, the points scored for chiller plant system will be based on the weighted percentage of the point scored in air distribution system efficiency.*



Section 2

2.2 Air Conditioning System Efficiency (16 points)

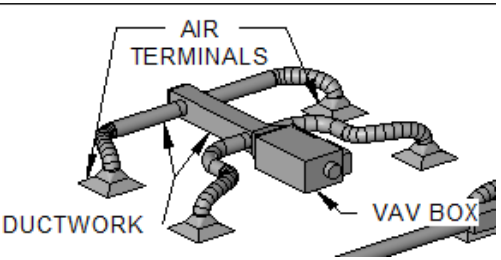
c) Air Distribution System (4 points)



	Air distribution Efficiency
Baseline	0.28 kW/RT

Point scored = 0.14 x (% improvement)

Full point if efficiency ≤ 0.2kW/RT



Note: For Building score for air distribution system, Building's air-con EUI shall be submitted.

The below Energy Use Intensity (EUI) of air-conditioning system for the past one year shall be calculated and submitted. It shall be calculated based on the following formulae:

(i) EUI_{AC} = Annual Building Energy Consumption of air-conditioning system (kWh) / GFA(m2).

(ii) $EUI_{AC\#}$= Annual Building Energy Consumption of air-conditioning system (kWh) within standard operating hour / GFA(m2).

Advanced Green Efforts (Section 5)

When Air side < 0.2kW/RT, additional 2 points can be scored

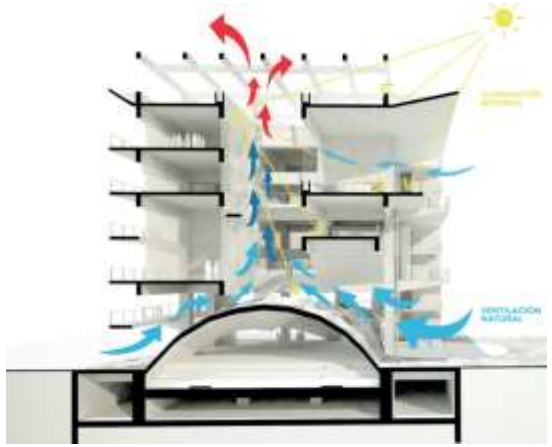
Section 2

2.3 Natural/Mechanical Ventilation (Up to 17 points)

***Note**: Applicable to Non Air-Conditioned Areas (with an aggregate non air-conditioned areas > **10%** of total floor area excluding car parks and common areas)*

a) Natural Ventilation (Up to 17 points)

1 points for every 10% of NV areas with window openings facing north and south directions and cross ventilation



b) Mechanical Ventilation (16 points)

Allowable nameplate motor power	
Constant volume	Variable volume
0.47 W/CMH	**0.74 W/CMH**

0.3 point for every percentage improvement from the baseline (Up to16 points)



*Note : Where there is a combination of naturally ventilated and mechanical ventilated spaces, the points scored will only be based on the predominant ventilation modes of **normally occupied spaces.***

Section 2

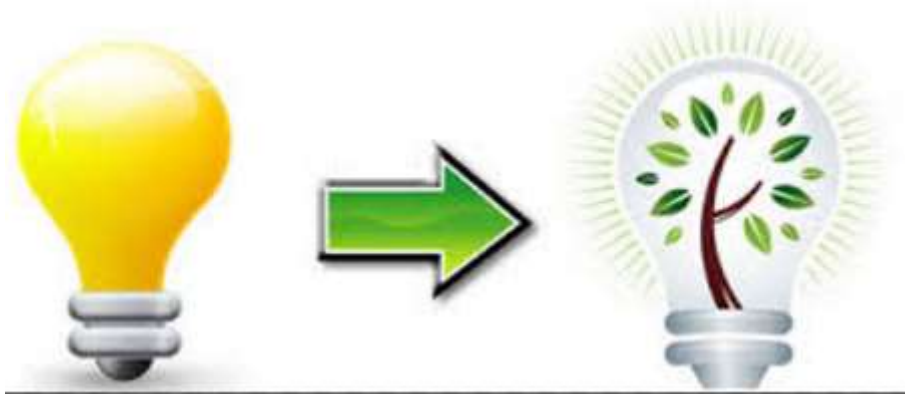
2.4 Lighting Efficiency (6 points)

Type of usage	Maximum lighting power budget (W/m2)
Offices	15
Classrooms	15
Hotel guest room	15
Lecture theatres	15
Auditoriums / Concert halls	10
Shops / Supermarkets / Departmental stores (including general, accent & display lighting)	25
Restaurants	15
Lobbies / Atriums / Concourse	10
Stairs	6
Toilets	15
Corridors	10
Car parks	5
Electronic manufacturing and fine detail / Assembly industries	20
Medium and heavy industries	15
Warehouses / Storage areas	10

Improvement of the building's lighting power density in comparison with the baseline

- Point scored = 0.12 x (% improvement)
  (Up to 6 points incl. tenant)
  To score full point ≥ 50% improvement

- Excluding tenant lighting provision (Up to 3 points)



Section 2

2.5 Vertical Transportation System (1.5 points)

***Note**: coverage at least 90% of applicable system*

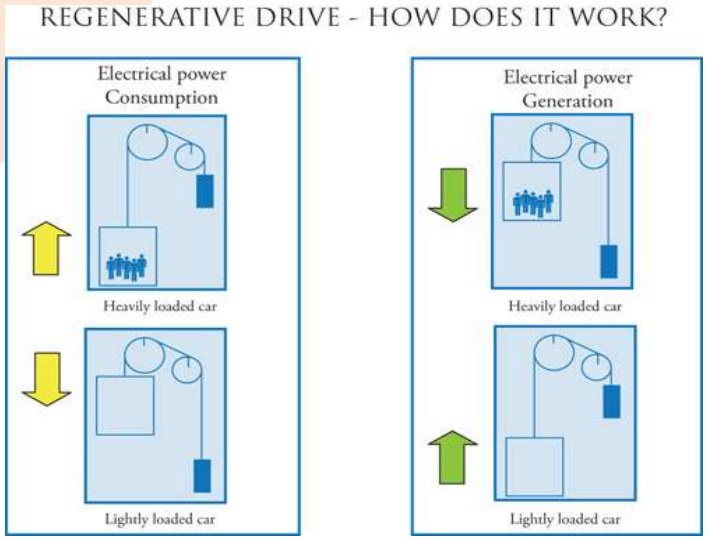
a) Lifts, escalators and travelators with AC variable voltage and variable frequency (VVVF) motor drive and sleep mode features. (1 point)

OR

b) Lift with sleep mode, VVVF motor and regenerative drive (1.5 point)







Section 2

2.6 Ventilation in Car Park (Up to 2 points)

***Note**: coverage at least 90% of applicable system*

a) Mechanically ventilated car park with CO sensor control (1.5 points)

b) Naturally ventilated car park (2 points)







Note: Where there is a combination of different ventilation mode adopted for carpark design, the points obtained will be prorated accordingly

Section 2

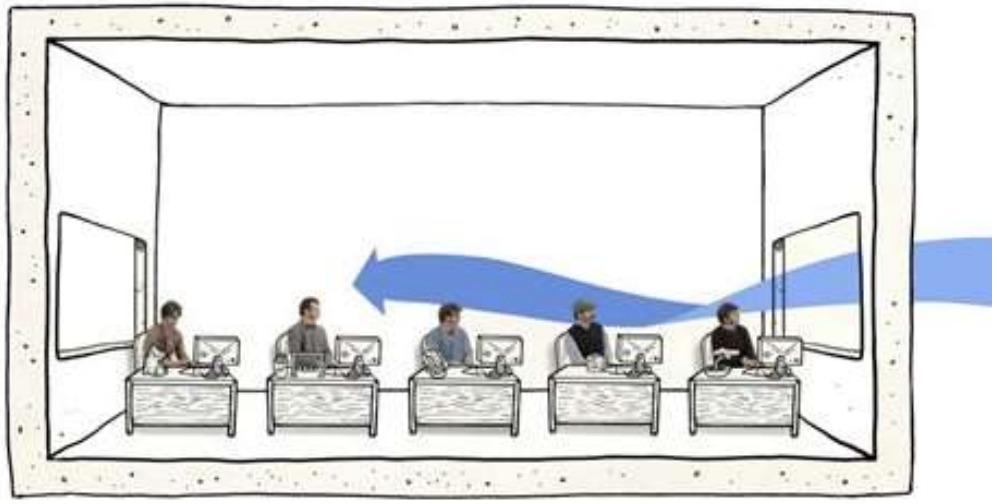
2.7 Ventilation in Common Areas (Up to 3 points)

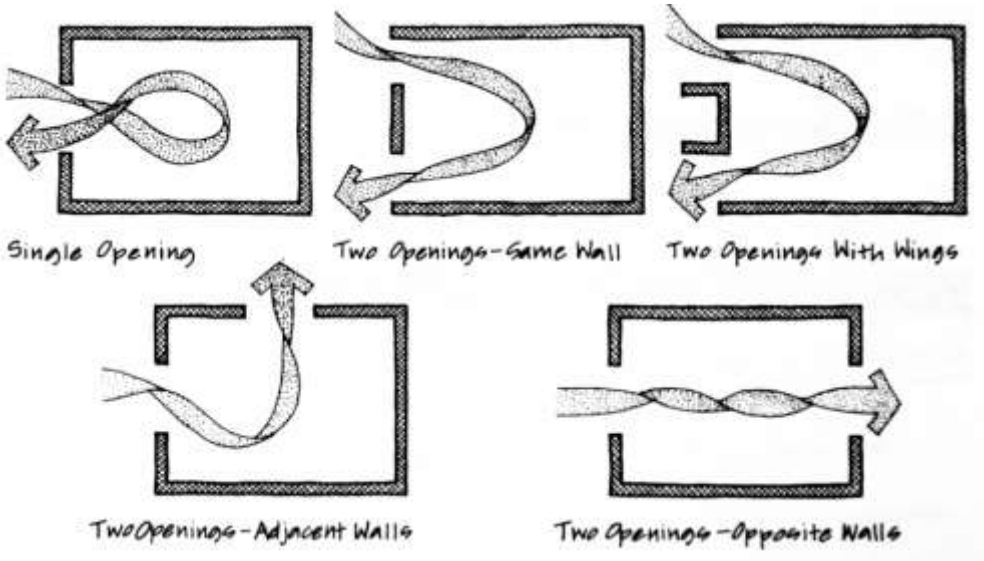
Use of energy efficient ventilation systems in the following common areas

- Toilets
- Staircases
- Corridors
- Lift lobbies
- Atrium

- Natural Ventilation – 1 point for each area
- Mechanical ventilated – 0.5 point for each area

  (Up to 3 points)





Section 2

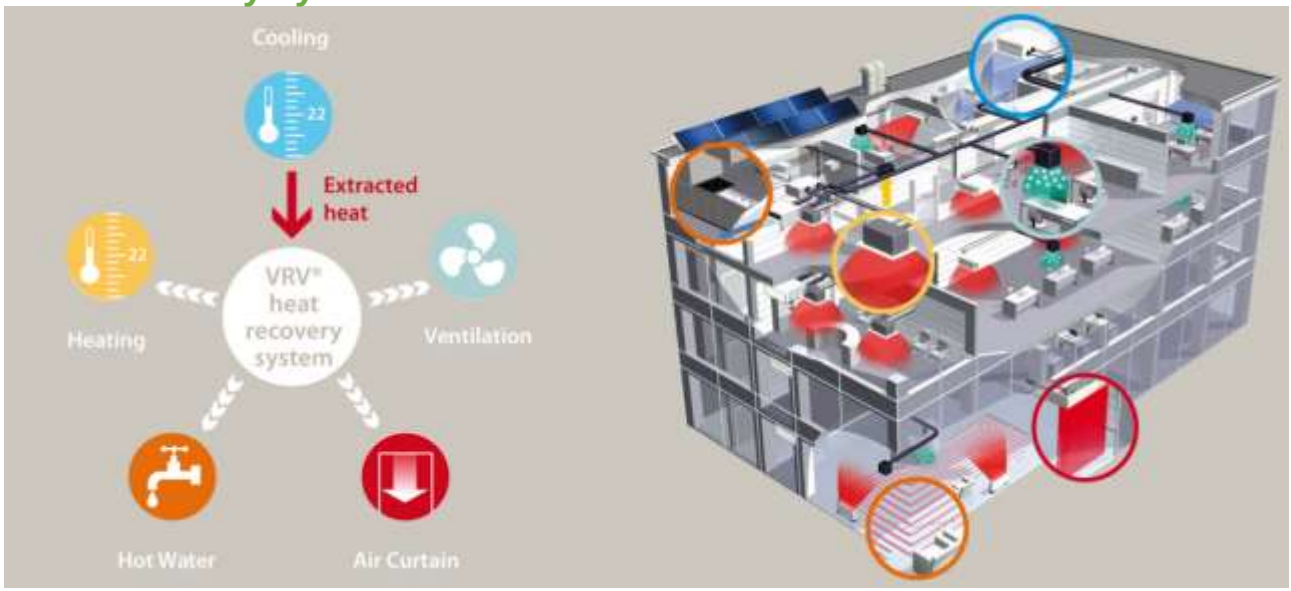
2.8 Energy Efficient Practices and Features (Up to 2 points)

Use of energy efficient practices and features which are innovative and/or have positive environmental impact.

1 point for every 1% energy saving over the total building annual energy consumption

(Up to 2 points)

Heat Recovery system



Light shelf



Section 2

2.9 Renewable Energy (Up to 6.5 points)



a) Solar Energy Feasibility Study (1 point)

b) Solar Ready Roof (1.5 points)

- Structural Readiness
- Electrical Readiness
- Spatial Readiness

c) Adoption of On-site Renewable Energy (4 points)

Energy Use Intensity (EUI) [kWh/m²/yr]	% Replacement of Building Electricity Consumption by Renewable Energy
≥ 120	1 point for every 0.5%
80 ≤ EUI < 120	1 point for every 1.0%
50 ≤ EUI < 80	1 point for every 1.5%
< 50	1 point for every 2.5%



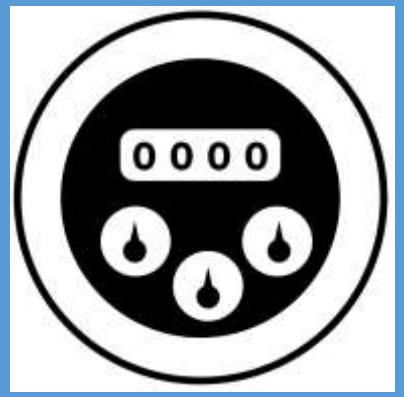
<u>Advanced Green Efforts (Section 5)</u>

- *A max 5 more points beyond the point cap for further percentage electricity replacement by renewable energy can be scored (up to 5 points)*
- *Purchase of renewable energy from licensed electricity retailers (1 points)*
- *Roof leasing for PV installation (1.5 points)*

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Section 3 – RESOURCE STEWARDSHIP











Section 3: Resource Stewardship

11 Criteria
30 Points

	GM Criteria	GM Points
3.1	Water Efficient Fittings	7
3.2	Landscape irrigations	1
3.3	Reduction of water consumption of cooling towers	2.5
3.4	Water monitoring and leak detection	1
3.5	Water usage portal and dashboard	1
3.6	Use of alternative water sources	2
3.7	Green Materials/Products	7
3.8	Recycling facility	3.5
3.9	Storage area for recyclable waste	1
3.10	Promotion of waste minimization	2
3.11	Waste monitoring	2

Section 3

3.1 Water Efficient Fittings (Up to 7 points)

Up to 7 points can be scored based on the number and water efficiency rating of the product type used.

Type of Products
- Basin taps and mixers - Showers - Sink/Bib taps and mixers - Urinals and urinal flush dual-flush Valves - Dual flushing cistern for WC



WELS Rating	Water Efficiency	Weightage for Point Allocation
✓✓	Very Good	5
✓✓✓	Excellent	7

OR

Attain the PUB Water Efficient Building Certificate (5 points)

PUB
Water for All : Conserve, Value, Enjoy

★ *Advanced Green Efforts (Section 5)*

WEB (Silver) *(1 point)*
WEB(Gold) *(2 points)*

Section 3

3.2 Landscape Irrigation (1 point)

a) Provision of water efficient automated irrigation system for at least 50% of landscape areas (0.5 point)

b) Use of drought tolerant plants for at least 50% of landscape areas (0.5 point)



3.3 Reduction of Water Consumption of Cooling Towers (2.5 points)

a) Use of cooling tower water treatment system which can achieve 7 or better cycles of concentration at acceptable water quality (1 point)

b) Use of NEWater or on-site recycled water from approved sources (1 point)

★ c) Provision of heat recovery system or equivalent device that helps to reduce heat rejection required through the cooling towers (0.5 point)





Section 3

3.4 Water Monitoring and Leak Detection (1 point)

a) Provision of private meters for all major water uses in the buildings (0.5 points)

b) Provision of smart remote metering system with alert features for leak detections and monitoring purposes (0.5 points)



★

3.5 Water Usage Portal and Dashboard (1 point)

Provision of water usage portal, dashboard or other equivalent forms for monitoring and trending of water consumption and usage pattern

a) Common facilities (0.5 point)

b) Individual tenants (0.5 point)



Section 3

3.6 Use of Alternative Water Sources (2 points)

Use of alternative water sources for non-potable uses: irrigation, washing, water features, toilet flushing, etc (excluding cooling tower make up water) to reduce use of potable water:

Total Potable Water Usage Reduction	Points Allocation
< 10 %	1
≥10 % to 50 %	1.5
> 50 %	2







Section 3

3.7 Green Materials / Products (7 points)

a) Green Certified Building Services Products (Up to 2 points)

- Points will be awarded for Building Services and M&E products by an approved local certification body
- Examples of products:
  - Chillers
  - Auto-tube cleansing system
  - Pumps
  - Transformers









Points Allocation			
Good (1-tick)	Very Good (2-ticks)	Excellent (3- ticks)	Leader (4-ticks)
0.4	0.6	0.8	1.0

Section 3

3.7 Green Materials / Products (7 points)

b) Sustainable Products (Up to 5 points)

- Points will be awarded for Environmentally Friendly products that are certified by approved local certification body.

Point Scored for each product
= Environmental Friendliness X Coverage & Impact

Extent of Environmental Friendliness of Products				Extent of Coverage & Impact	
Good (1-tick)	Very Good (2-ticks)	Excellent (3- ticks)	Leader (4-ticks)	Low	High
0.4	0.6	0.8	1.0	0.5	1.0

Section 3

3.8 Recycling Facilities (3.5 points)



a) Common recyclables in commingled or sorted form (1 point)
- Paper, glass, metal and plastic











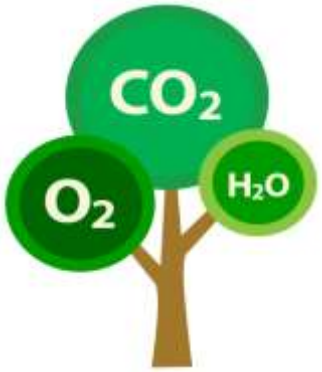
b) Specialized Waste Stream (Up to 2 points)
- E-Waste, light bulb/ fluorescent tubes and food waste (1 point each)











c) Horticultural waste (0.5 point)





Section 3

3.9 Storage Area for Recyclable Waste (1 point)



Provision of proper dedicated storage area at a central location for recyclable waste



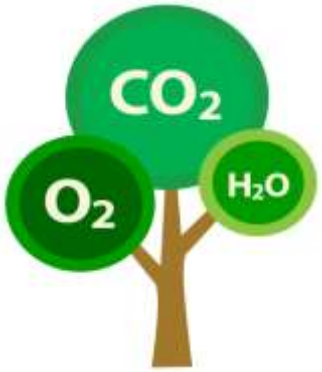


3.10 Promotion of Waste Minimization (2 points)





Promote and encourage waste minimization and recycling among occupants, tenants and visitors **(1 point per avenue)**



3.11 Waste Monitoring (2 point)



Quantifying and monitoring the waste collection and recycling programme for continuous improvement

- Tonnage of waste disposed **(1 point)**
- Tonnage of recycled waste **(1 point)**

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Section 4 – SMART AND HEALTHY BUILDING









© Can Stock Photo



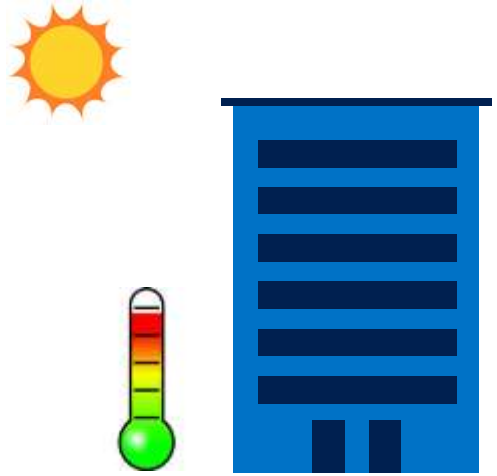
Section 4: Smart and Healthy Building

10 Criteria
40 Points

	GM Criteria	GM Points
4.1	Occupant comfort	5.5
4.2	Outdoor air Control	1.5
4.3	Enhanced Filtration Media	2.5
4.4	Indoor contaminants	2.5
4.5	Lighting Quality	4
4.6	Acoustics	1
4.7	Biophilic features	2
4.8	Level I – Energy monitoring	11
4.9	Level II – Demand control	5
4.10	Level III – Integration and analytics	5

Section 4

4.1 Occupant Comfort (5.5 points)



a) Thermal Comfort (1 point)

Indoor dry-bulb temperature within 23°C – 25 °C and relative humidity <70%



b) Temperature Control (0.5 point)

- Occupants can control indoor temperature by zones
- Temperature set point shall not go below 23°C



c) Post Occupancy Evaluation (POE) (2 points)

POE is conducted and corrective actions are taken accordingly to promote occupant satisfaction

d) IAQ Management (2 points)

Implementation of IAQ management practices according to WSH Guidelines



Section 4

4.1 Occupant Comfort



Advanced Green Efforts (Section 5)

Use of innovative solutions to achieve thermal comfort while reducing energy consumption such as high temperature cooling with increased air speed (2 points)

Advanced Green Efforts (Section 5)

IAQ surveillance audit

based on the reference methods described in SS 554: 2016

(2 points)



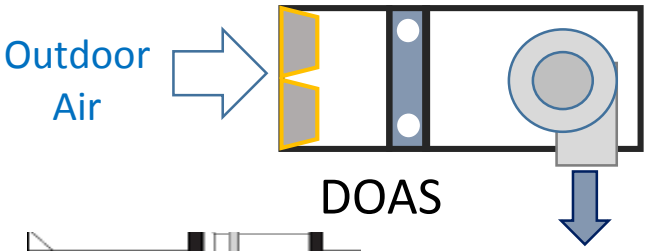
Parameter	Acceptable limit	Measurement method/ Analytical method
Formaldehyde	0.08 ppm	detection tubes or real-time electrochemical sensor **Reference method**: continuous air sampling with dinitrophenylhydrazine (DNPH) cartridges and analysis by High Performance Liquid Chromatography (HPLC)
TVOC	1 ppm	real-time photoionization detector (PID) **Reference method**: continuous air sampling with Tenax tube and subsequent analysis using gas chromatography and mass spectrometry (GCMS)
Respirable Suspended Particle (PM4)	50 µg/m^3	real-time optical scattering or piezoelectric monitoring **Reference method**: gravimetric analysis, beta-attenuation, tapered element oscillating microbalance (TEOM)
Particulate Matter 2.5 (PM2.5)	37.5 µg/m^3	

Section 4

4.2 Outdoor Air Control (1.5 points)

a) Dedicated Outdoor Air System (DOAS) (1 point)

Provision of DOAS such as precool units





Source: Indoor Air Quality Guide, ASHRAE

b) Demand Control Ventilation (0.5 point)

Use of demand control ventilation strategies such as carbon dioxide sensors or equivalent devices to regulate the quantity of fresh air



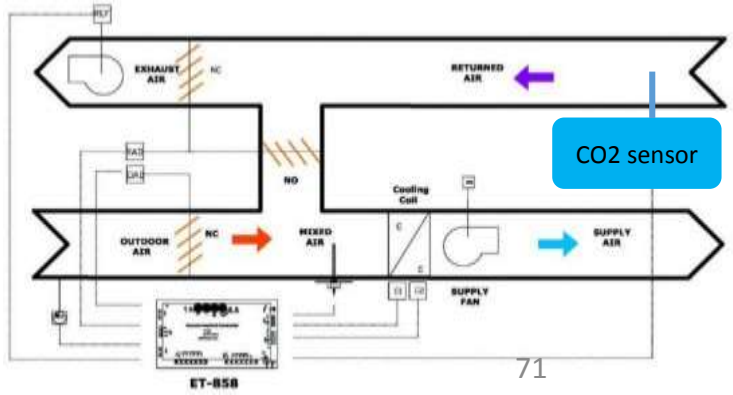
Advanced Green Efforts (Section 5)

Outdoor Airflow Measurement and Monitoring System

To monitor outdoor airflow volume by permanent devices at

a) All precool units (e.g. PAHUs) (1 point)

b) All AHUs (1 point)



Section 4

4.3 Enhanced Filtration Media (2.5 points)

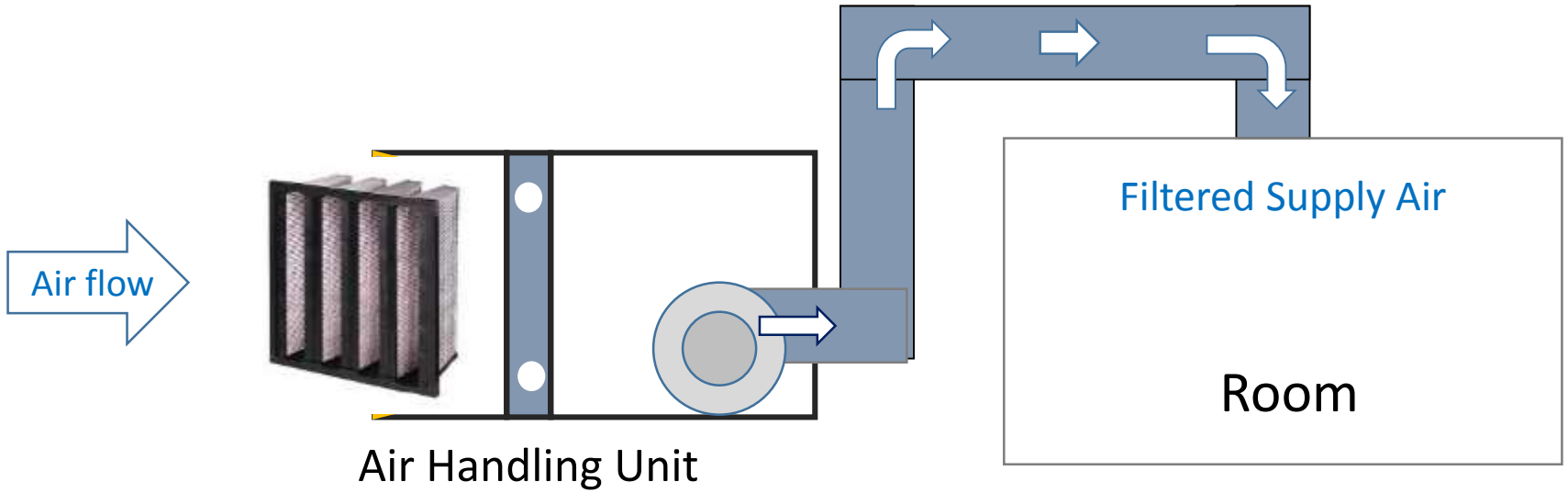
a) Outdoor air filtration (0.5 point)

At least MERV 6 all the time and MERV 14 when outdoor pollution level is in the unhealthy range

or

b) Permanent provision of MERV 14 or equivalent filters to all precool units (1 point)

c) Permanent provision of MERV 14 or equivalent filters to all AHUs (1.5 points)



Section 4

4.4 Indoor Contaminants (2.5 points)

a) UVGI or equivalent airborne disinfection technologies (Up to 1 point)

To provide UVGI (Ultra Violet Germicidal Irradiation) system or equivalent to control airborne infective microorganisms

- Coverage between 30% and 50% (0.5 point)
- Coverage > 50% (1 point)



Picture courtesy of the NEWS

b) IAQ Display (Up to 1.5 points)

To provide display panels for temperature, relative humidity and CO_2 information at each floor/ tenancy, to raise awareness among building occupants on the indoor air conditions



Section 4

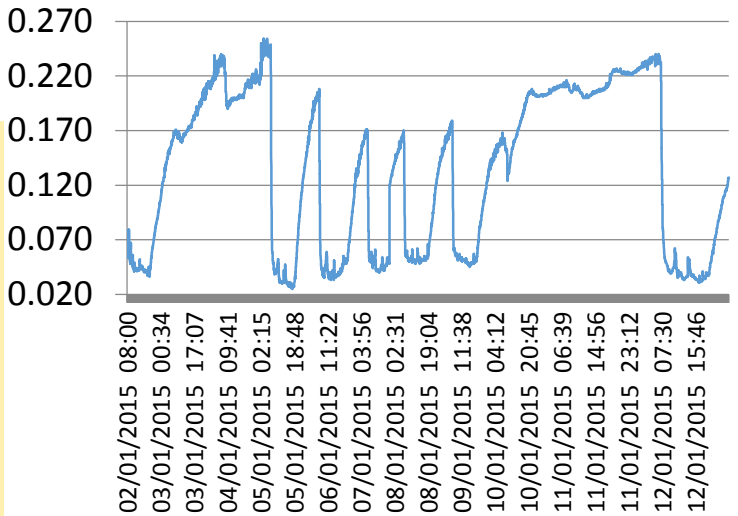
4.4 Indoor Contaminants

Advanced Green Efforts (Section 5)

IAQ Trending & Monitoring

a) Temperature and Relative Humidity (1 point)

b) At least one common indoor air pollutant such as formaldehyde, Total Volatile Organic Compounds (TVOC) and particulate matters (1 point each, up to 3 points)



Advanced Green Efforts (Section 5)

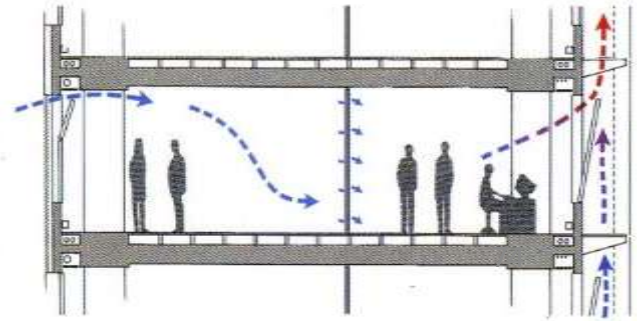
Local Exhaust and Air Purging System

a) Local isolation and exhaust systems to remove the pollutants at source such as photocopier room with exhaust system (0.5 point)

b) Air purging system to replace contaminated indoor air with outdoor fresh air (0.5 point)



Source: Indoor Air Quality Guide, ASHRAE

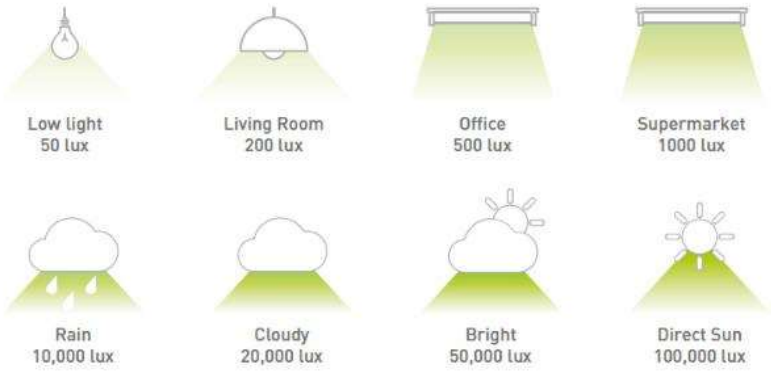


Section 4

4.5 Lighting Quality (4 points)

a) Lighting Level (1 point)

lighting levels comply with the recommended illuminance (average lux level) in SS 531 : 2006 Part 1 or CP 38 : 1999



b) Task Light (1 point)

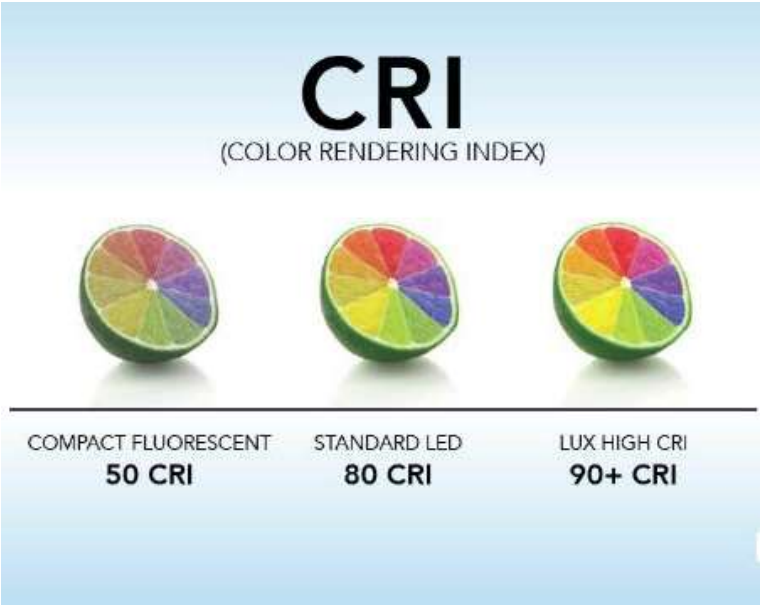
Task lighting provided for workstations

c) Flicker Free Fittings (1 point)

Provide high frequency ballasts with frequency >20kHz and equivalent performance characteristics from LED drivers

d) Colour Rendering Index (1 point)

lightings meet the minimum colour rendering index (Ra or CRI) in Clause 5 of SS 531 : 2006



Section 4

4.6 Acoustics (1 point)

Indoor sound levels comply with the recommended ambient sound levels in SS 553 : 2009 or CP 13 : 1999 (1 point)



4.7 Biophilic Features (2 points)





Biophilia is the inherent human inclination to associate with nature to improve our physical and mental wellbeing. Biophilic design features include:

a) Direct experience of nature (access to plants, water features, aquarium etc.)
b) Indirect experience of nature (images, natural materials, texture, geometry etc.)





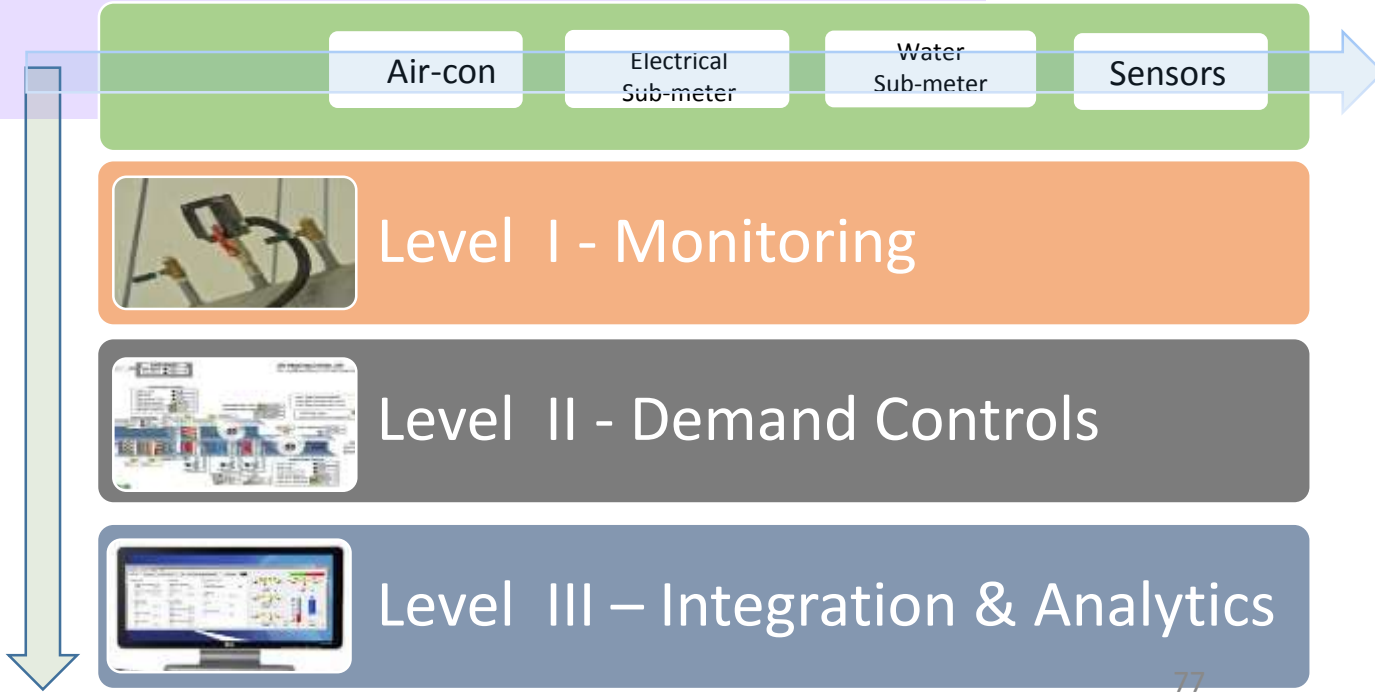






Section 4: Smart and Healthy Building

- From “Designing Right” to “Operating Right”
- Persistence of High-performance
  - Design and Delivery Integration
  - Continuous Monitoring
- Smartness → High-Performance, Operational Excellence
  - Integration in Breath & Depth
  - Open Standard and Future Ready



Section 4: Smart and Healthy Building

Overview: Level of Smartness



- Level 1 – Energy Monitoring (11 points)
  a) Submetering
  b) Energy Dashboard/Portal
  c) Open Protocol and Data Exchange
  d) Connect to BCA's Chiller Portal
- Level 2 – Demand Control (5 points)
  a) Occupancy sensors for common areas to moderate light and ACMV
  b) And for occupied/tenanted areas
- Level 3 – Integration & Analytics (5 points)
  - Optimise system performance and workflow









Section 4

4.8 Level I – Energy Monitoring (11 points)

a) Electrical Sub-meters, linked to BMS (6 points)

HVAC Airside (AHUs, FCUs)	2 points
Lighting for common area	1 point per system, up to 4 points
Lighting for non-common area	
Lift and Escalators	
Carpark MV system	



b) Energy Portal & Dashboard (3 points)

- Accountability and awareness influence behaviour

For internal FM staff	1 point
Digital panel display in public area	1 point
For tenants/occupants	1 point



Section 4

4.8 Level I – Energy Monitoring

Advanced Green Efforts (Section 5)

- *Sub-meter every floor and major energy load area (e.g. server room, central kitchen, auditorium) (1 point)*

Hot Water System

- *Permanent Instrumentation for M&V of Hot Water System (1 point)*

VRF System

a) *Power meters installed for VRF system at least for all Condenser Units (1 point)*

b) *Permanent M&V of VRF condensing units (2 points)*





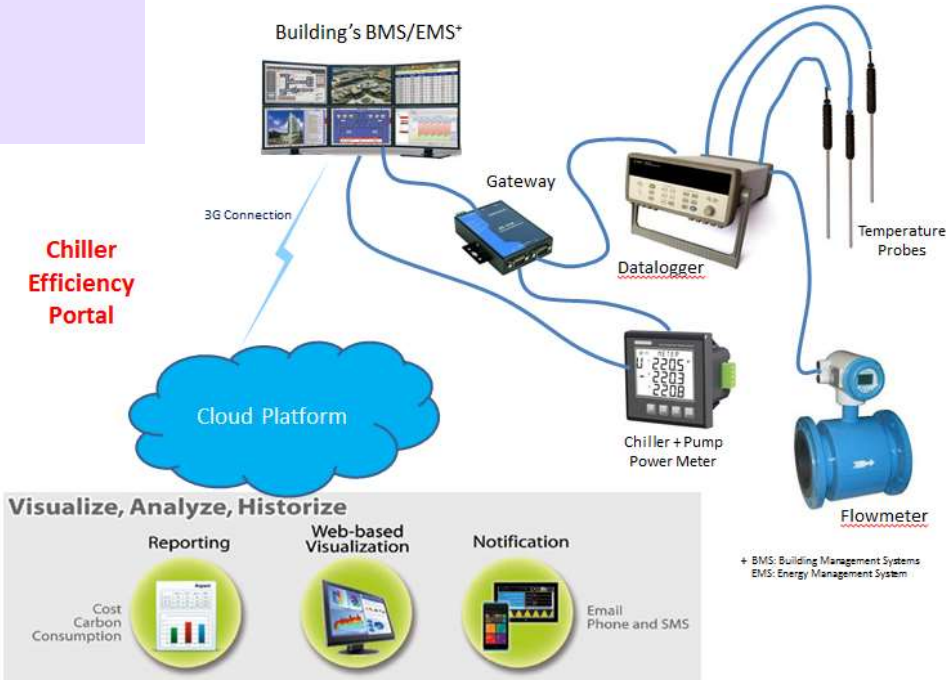
Section 4

4.8 Level I – Energy Monitoring (11 points)

c) BAS and Controller with Open Protocol (1 point)
- e.g. BACnet or Modbus
- Supports scheduled and automated data export



d) Connects to BCA Chiller Portal (1 point)
- Using the defined REST API



Section 4

4.9 Level II – Demand Control (5 points)

Integrate with lighting control systems and ACMV control systems to moderate brightness, temperature and ventilation rate

a) for each common areas such as: (2 points)

- Atrium
- Staircases
- Lift lobbies
- Toilets
- Corridors

} 0.5 point for each common areas type (>50% coverage)

b) for occupied/tenanted areas such as: (3 points)

- Offices
- Retail shops
- Hotel guest rooms

} 1 point for 25% of occupied areas



Section 4

4.10 Level III – Integration and Analytics (5 points)

a) Basic

- Basic detection of fault and deviation from norms
  - Comparison of outputs (controllers) set points to actual conditions to find failed devices (i.e. broken/leaking valves, broken/stuck dampers, sensors out of calibration)
  - Identify when the chiller plant deviates from statistically expected performance
  - Use of BCA Chiller Portal alert rules
- Basic adaptive control algorithms
  - Cooling tower with weather station
- Equipment exceptions monitoring
  - Unintentional manual overrides
  - detecting equipment that run beyond intended operating hours





… not exhaustive

0.5 point each

Section 4

4.10 Level III – Integration and Analytics(5 points)

b) Advanced

- Whole system optimisation using a network of HVAC equipment
  - Chiller sequencing such that each one is part-loaded enough to keep it in its most efficient operating zone
- Integration of sub-systems to optimise resource use or improve user experience
  - Integration of ID card access system to direct hot-desk scheme
- Use of BIM or similar applications that provide location-based visualisation of multiple sensors: energy & water use, spatial condition e.g. temperature, RH
- Demand Response Control (DRC)
  - Load shedding thus reducing energy use

…not exhaustive

1 point each

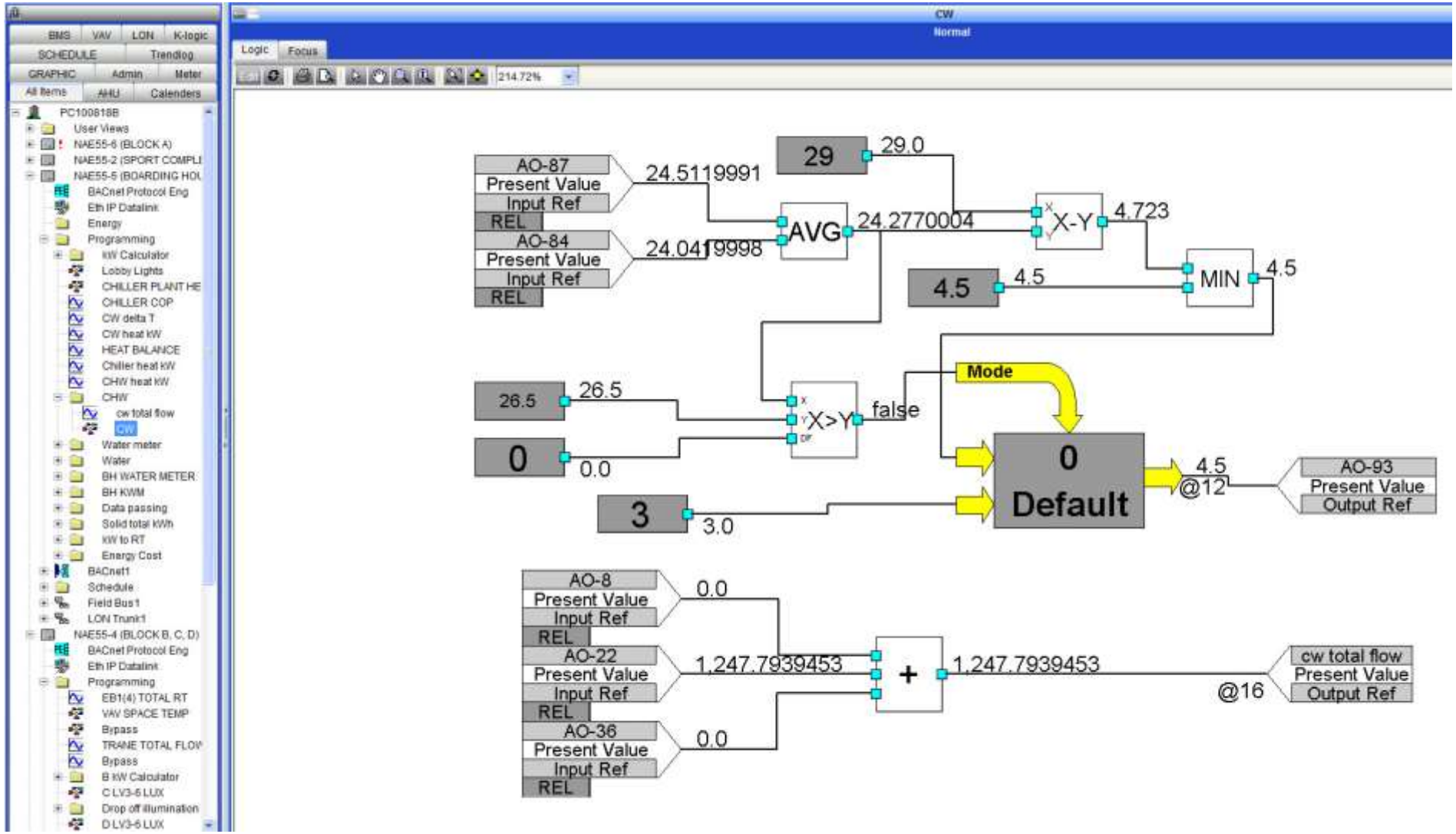




Section 4

4.10 Level III – Integration and Analytics(5 points)

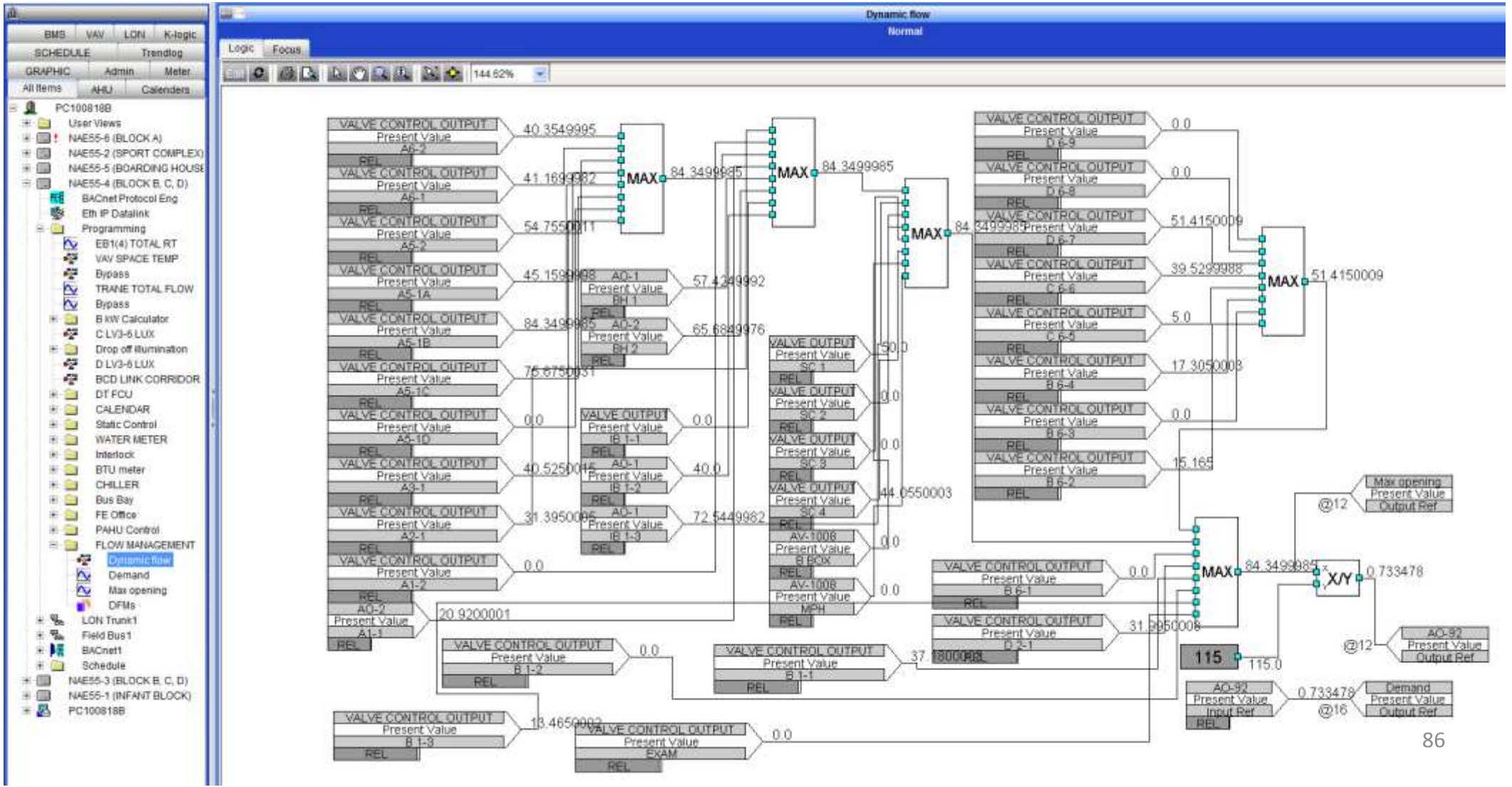
Basic ”Adaptive CT Control”



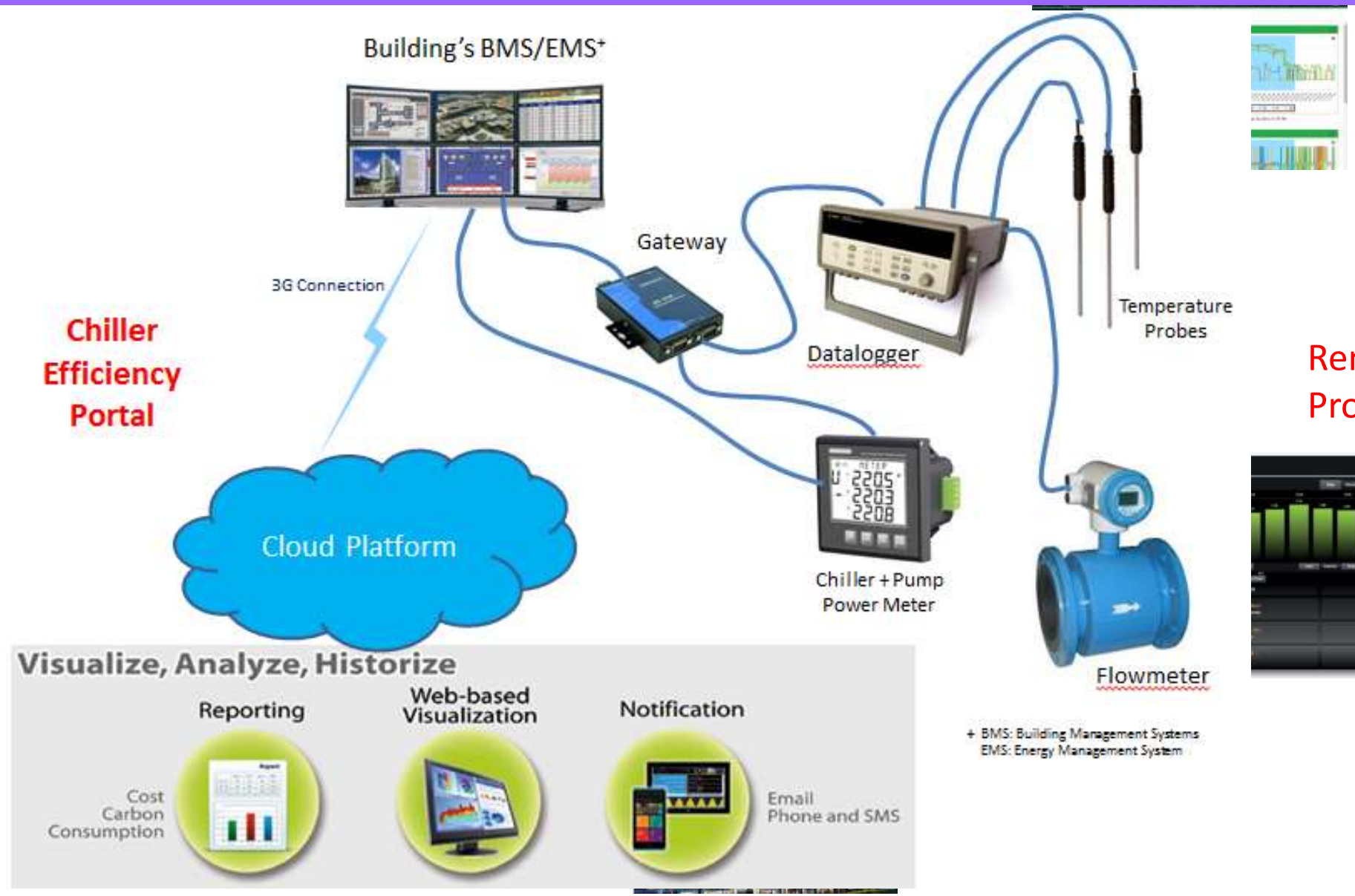
Section 4

4.10 Level III – Integration and Analytics(5 points)

Advanced ”Dynamic Flow Management”



BCA Smart Chiller Portal



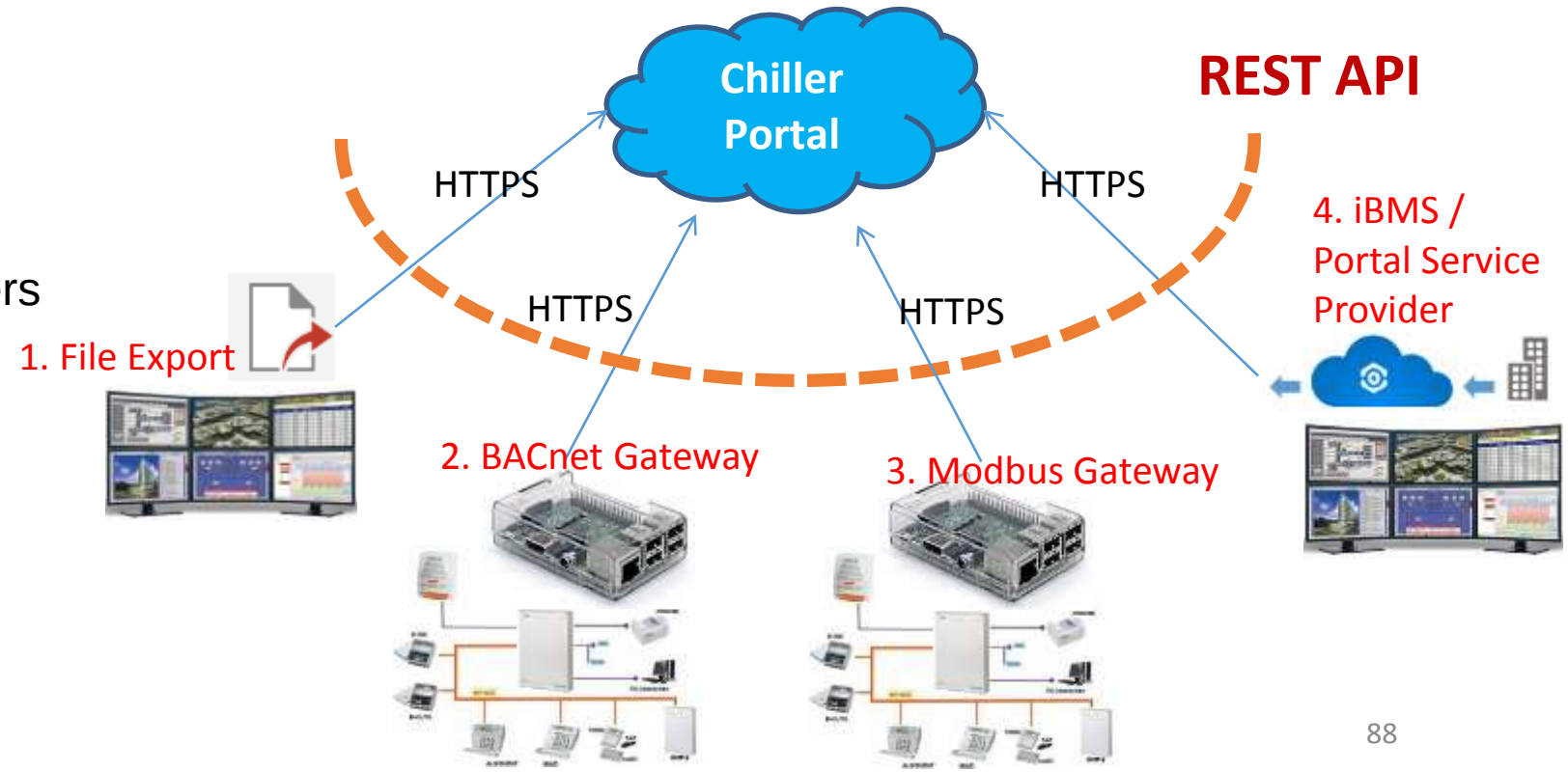
Remote Service Provider

Sma

BCA Smart Chiller Portal

Standardised Interface

- Universal and easy connection
- BCA
  - Publish the interface and installation examples
- Building Owners
  - Direct feed, or
  - Feed in from their iBMS
- Portal Service Provider
  - Feed in for their subscribers

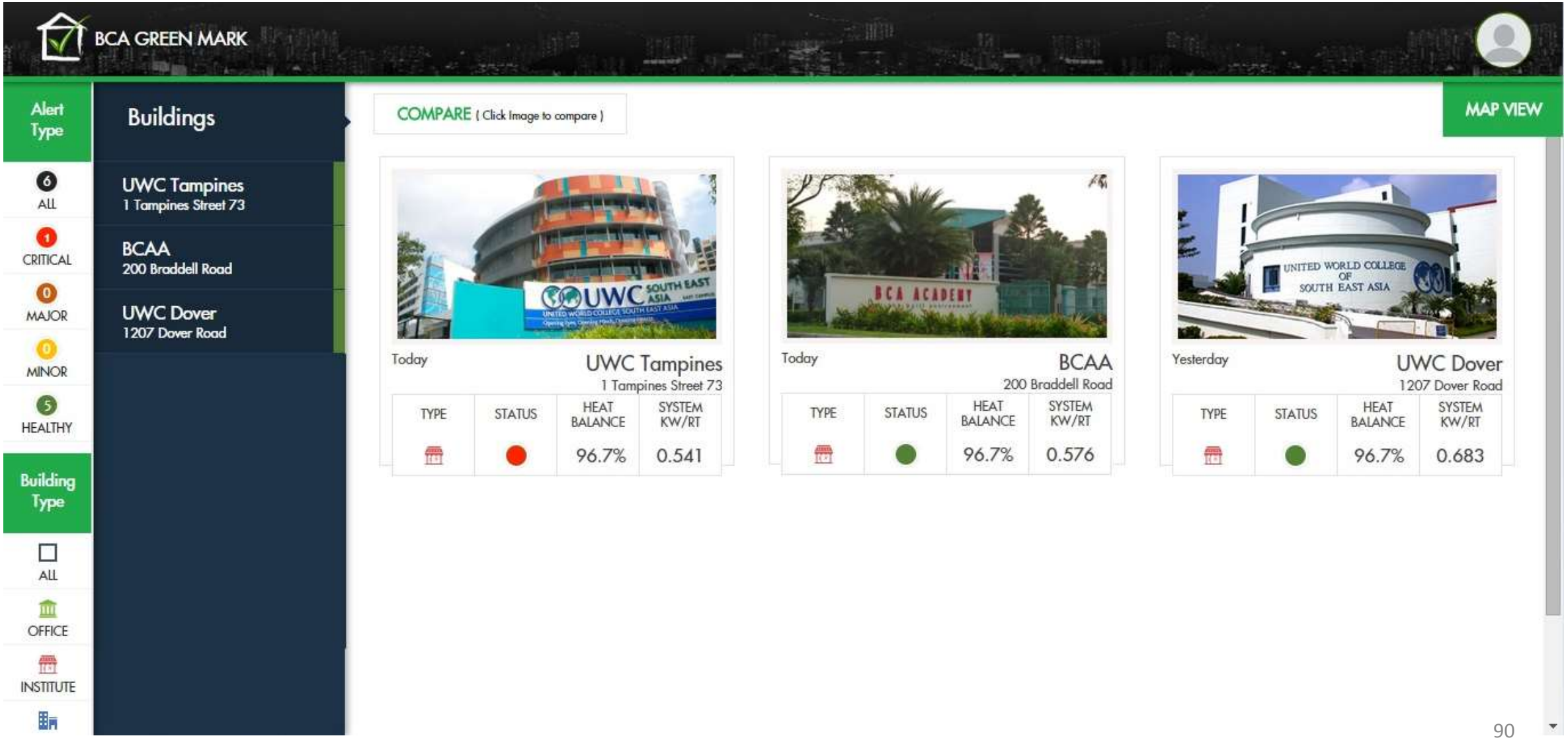


* iBMS = Integrated Building Management System

BCA Smart Chiller Portal

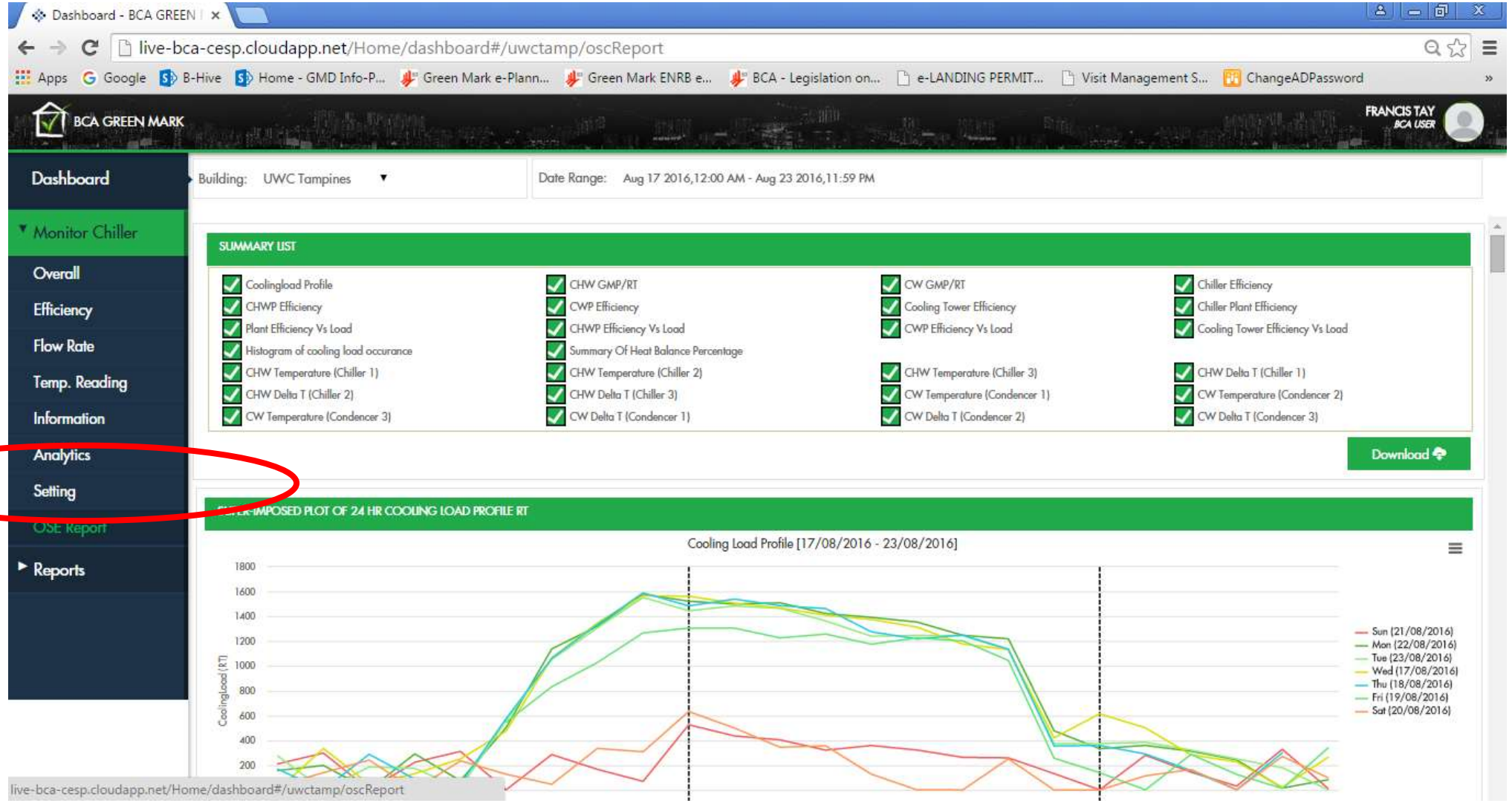
Title	*REST API to insert chiller plant raw data (Draft)*	
URL	*http://bca_cesp.portal.com/api/ImportRawData*	
Method	*The request type* - **POST**	
URL Params	*Not Required*	
Data Params	*[* *{* *"BuildingId": "buildinga",* *"ObjectId": "chiller",* *"ObjectNo": "1",* *"DataFieldId": "power",* *"Value": "110",* *"Timestamp": "2016-01-16 02:15:01",* *"Key": "secretkey"* *},*	 *{* *"BuildingId": "uwctamp",* *"ObjectId": "chiller",* *"ObjectNo": "1",* *"DataFieldId": "SupplyTemparatue",* *"Value": "110",* *"Timestamp": "2016-01-16 02:15:01",* *"Key": "secretkey* *"},* *]*
Success Response	*Code:* 200	
Error Response	*Code:* 400*, if buildingId not valid* *Code:* 402*, if building object datafield mapping not valid* *Code:* 403*, if secrectkey for that building is not correct* *Code:* 404*, Other problem*	

BCA Smart Chiller Portal



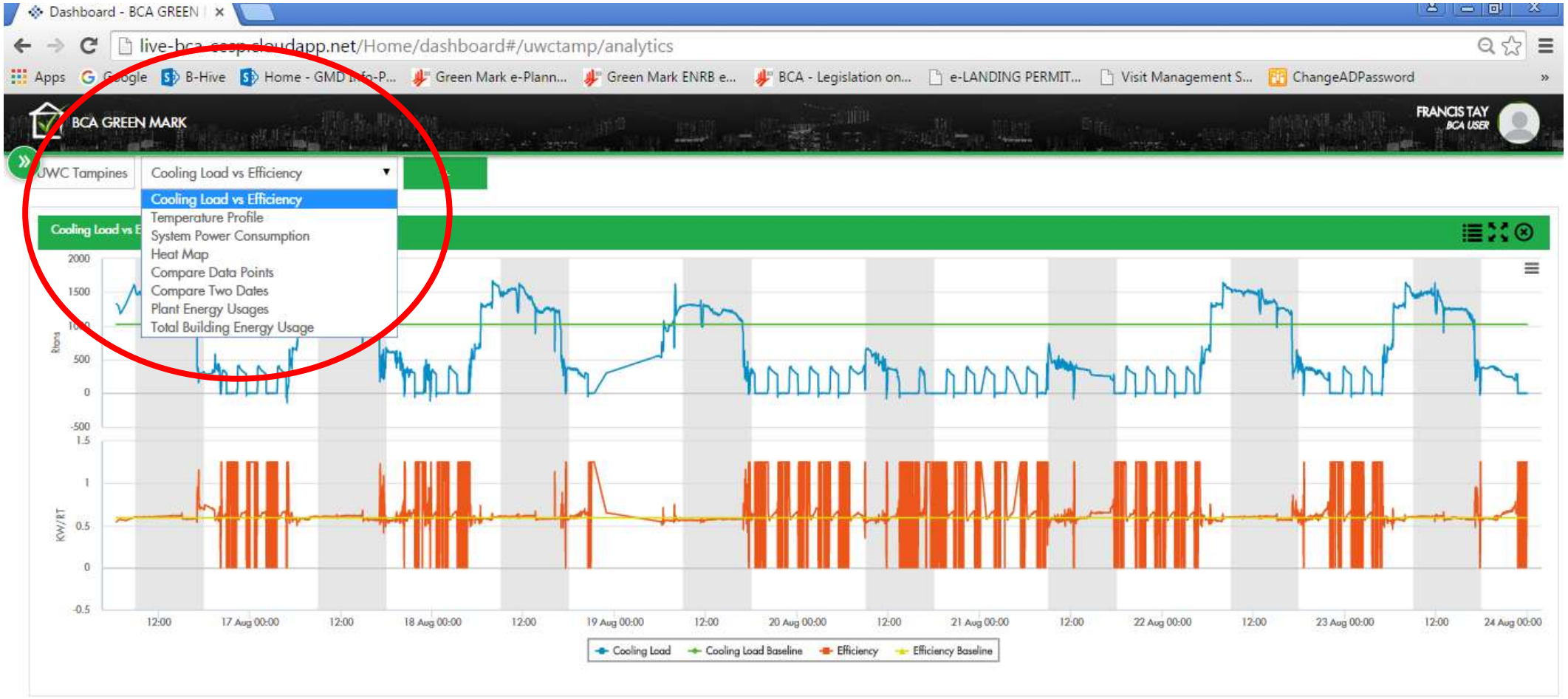
BCA Smart Chiller Portal

Facilitate Energy Audit (OSE) Report Generation



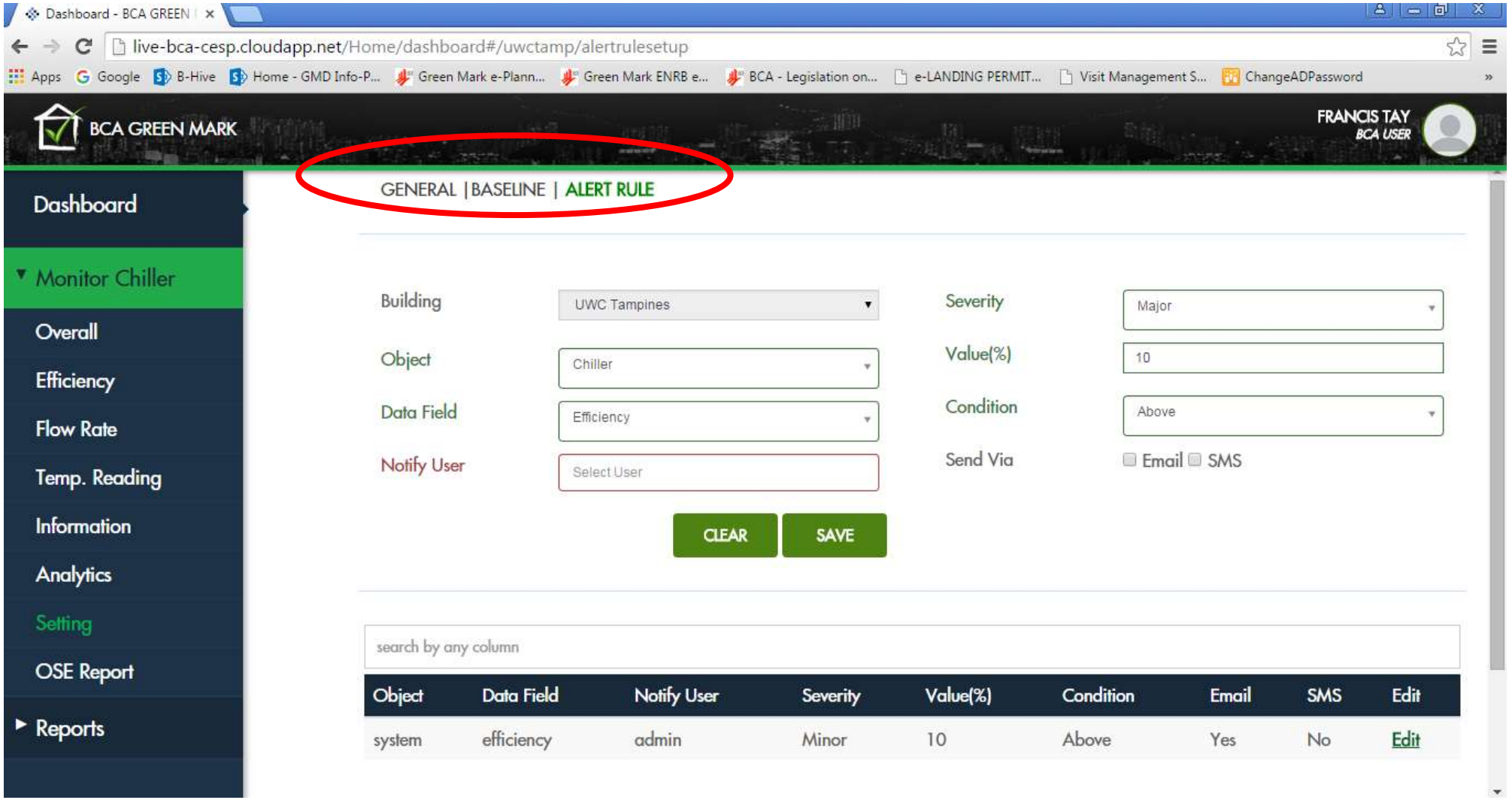
BCA Smart Chiller Portal

Analysis for Trouble shooting



BCA Smart Chiller Portal

Baseline & Alert Rules



BCA Smart Chiller Portal

Integral to Green Mark EB Scheme

- Leadership in Chiller Efficiency mandate
- Active tool in continuous commissioning for sustained performance
- Facilitate Green Mark Re-certification
  - Better value
  - More market friendly
  - Simpler
  - Lower Cost of Compliance

BCA GREEN MARK

GM ENRB 2017

Section 5 – ADVANCED GREEN EFFORTS











Section 5

Advanced Green Efforts (20 points)



Points shall be awarded based on the advanced green efforts which are highlighted within the Green Mark ENRB:2017 criteria.

OR

Projects can demonstrate substantial performance to a specific sustainability indicator or outcome addressed within Green Mark. This will be reviewed on a case-by-case basis

Section 5

Advanced Green Efforts (20 points)

S/N	Example of items under advanced green efforts	Points available
1	ETTV <40W/m2	1
2	Air distribution system efficiency <0.2 kW/RT	2
3	Permanent Instrumentation for M&V of Hot Water System The use of energy efficient hot water system can reduce the energy consumption	1 2
4	Replacement of electricity by on-site renewable energy Purchase of renewable energy from licenced electricity retailers Roof leasing for PV installation	5 1 1.5
5	Water Efficient Building (WEB) Silver Certificate Water Efficient Building (WEB) Gold Certificate	1 2
6	Use of innovative solutions to achieve thermal comfort while reducing energy consumption such as high temperature cooling with increased air speed	2

Section 5

Advanced Green Efforts (20 points)

S/N	Example of items under advanced green efforts	Points available
7	To provide monitoring and trend logging for the following parameters, linked to a centralised system a) temperature and relative humidity b) At least one common indoor air pollutant such as formaldehyde, Total Volatile Organic Compounds (TVOC) or particulate matters	 1 1 for each parameter
8	IAQ surveillance audit is conducted based on the reference methods described in SS 554: 2016 by an accredited laboratory under Singapore Accreditation Council	2
9	To monitor outdoor airflow volume by permanent devices at a) All precool units (PAHUs and PFCUs) b) All AHUs	 1 1
10	a) Local isolation and exhaust systems to remove the pollutants at source such as photocopier room with exhaust system b) Air purging system to replace contaminated indoor air with outdoor fresh air	0.5 0.5

Section 5

Advanced Green Efforts (20 points)

S/N	Example of items under advanced green efforts	Points available
11	a) Power meters installed for VRF system at least for all Condenser Units b) permanent M&V of VRF condensing units	1 2
12	Accredited Green Facility Management Companies	1
13	<u>Complementary Certifications</u> a) at least 1 tenant certified under Green Mark Occupant-Centric Schemes b) achieving Green Mark Pearl Award c) achieving Green Mark Pearl Prestige Award	 1 1 2
14	Display Green Mark Plaque	0.5
15	Other Advanced Green Efforts	2 points each for high impact item 1 point each for medium impact item 0.5 point each for low impact item

Re-certifying Green Mark Buildings

4

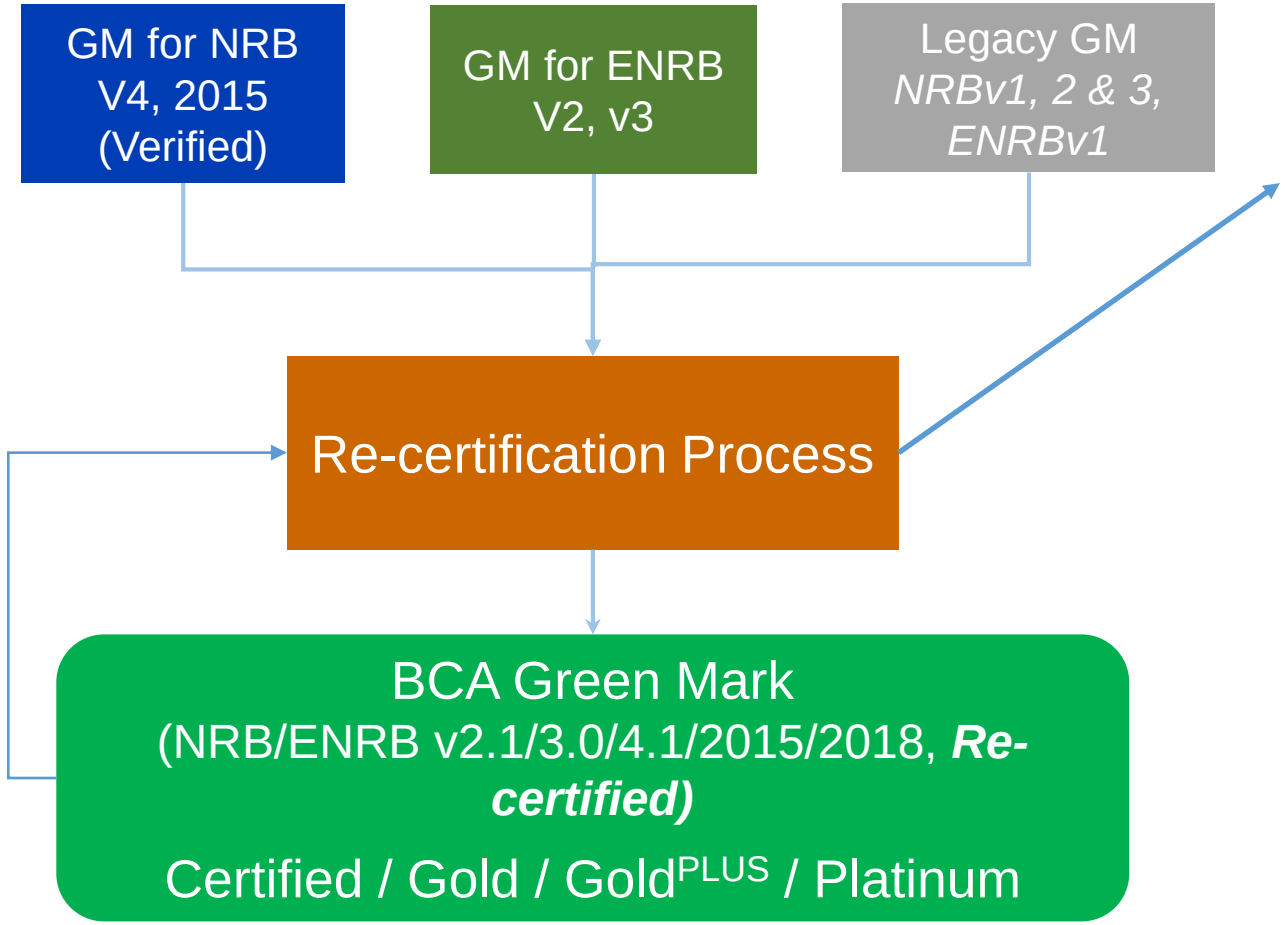






Re-certifying Green Mark Buildings

- Retain same GM scheme and rating
- Has not been retrofitted



- ✓ Environmental policy
- ✓ Cooling System
  - Chiller Operating System Efficiency / Audit report
  - Meet pre-requisite efficiency for its GM version*
- ✓ 3-year Energy Consumption & EUI, <5% deviation
- ✓ 3-year Water Consumption, <5% deviation
- ✓ Update water efficiency improvement plan
- ✓ Waste recycling report
- ✓ Occupant satisfaction survey
- ✓ Green procurement policy
- ✓ IAQ audit report
- ✓ Lux and Noise
- ✓ Updated Building Info Template
- ➢ Option to connect to Chiller Portal

** NRBv1, 2 & 3, ENRBv1 will be benchmarked to and recertified as ENRBv2.1*

Re-certifying Green Mark Buildings

Green Mark Recertified Enables…

- Use data to better manage building
- Develop a energy and water policy
- Target, Measure and Review policy
- Account for its waste footprint and disposal
- Continually meet occupants' satisfaction



Re-certifying Green Mark Buildings

Assessment Process

- Performance metrics, e.g. Chiller Plant Audit Report
- 3-year Energy and Water consumption
- Waste Recycling
- Policy statements
- IAQ Reports, Occupants' Survey

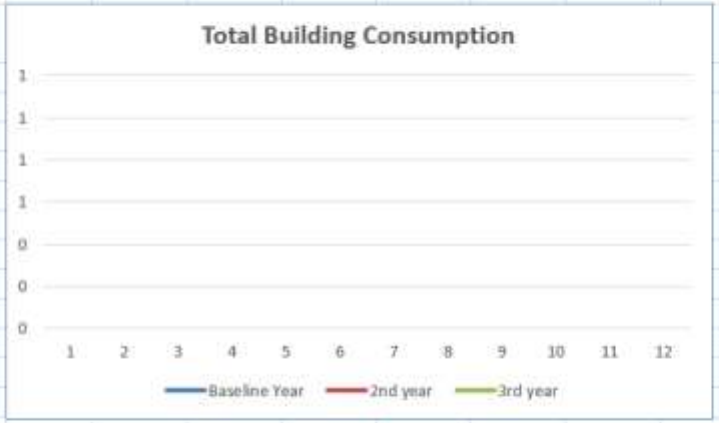


- Checklist
- Site walk and inspection
  - M&V instrumentations
  - Major energy systems, waste disposal area, indoor environment

Re-certifying Green Mark Buildings

Part 1 Energy Utility Index (3 Years Electricity Bill)

Energy Consumption (1st Year, Baseline)		Year	2015
Month	Total Consumption (kWh)	Tenant's Consumption (kWh)	Landlord's Consumption (kWh)
Jan			0.0
Feb			0.0
Mar			0.0
Apr			0.0
May			0.0
Jun			0.0
Jul			0.0
Aug			0.0
Sep			0.0
Oct			0.0
Nov			0.0
Dec			0.0
Yearly Consumption	0.0	0.0	

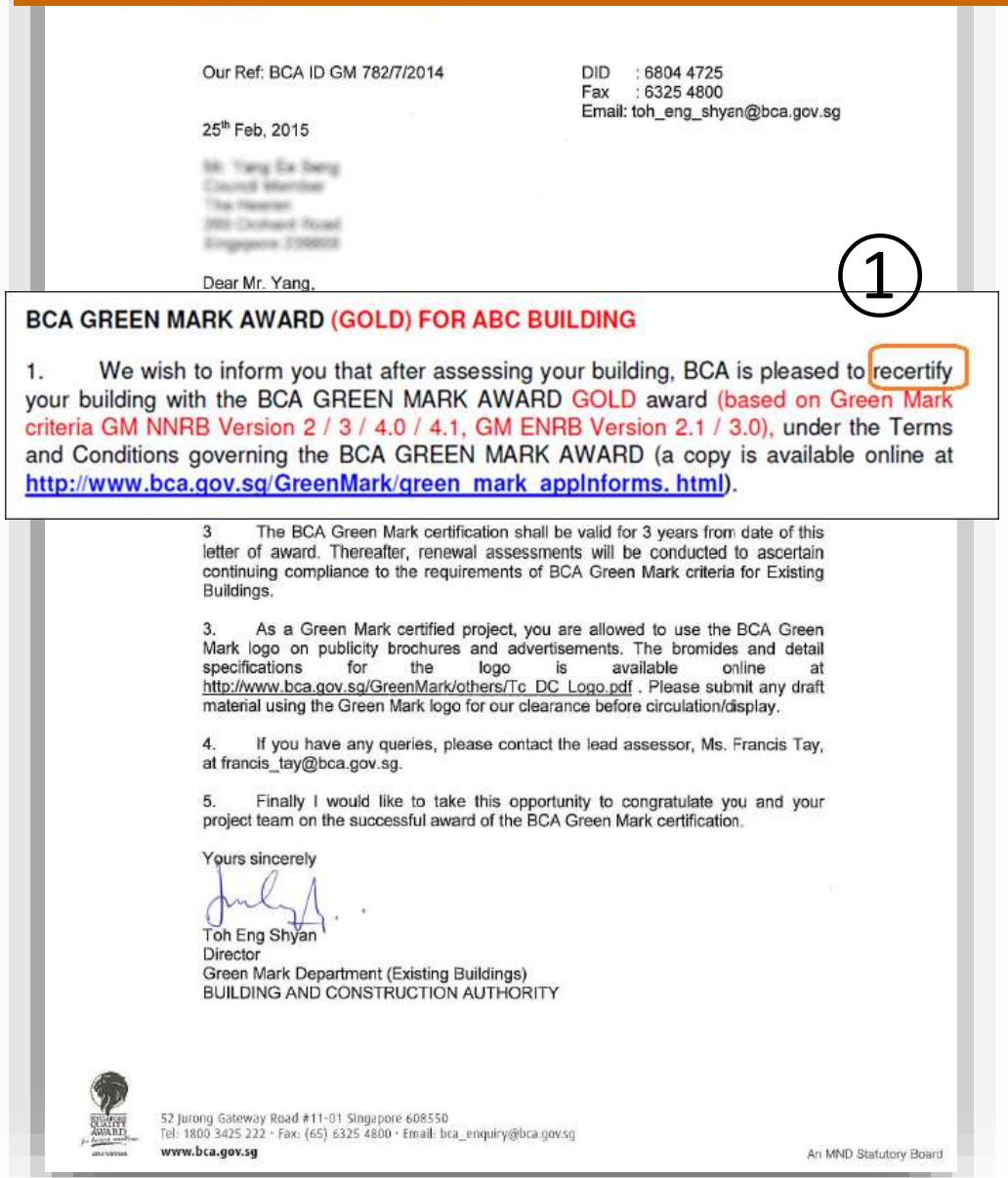


Energy Consumption (2nd Year)		Year	2016
Month	Total Consumption (kWh)	Tenant's Consumption (kWh)	Landlord's Consumption (kWh)
Jan			0
Feb			0
Mar			0
Apr			0
May			0
Jun			0
Jul			0
Aug			0
Sep			0



Front page | Part 1 OSE or Audit Report | Part 1 Temperature Sensors | Part 1 3-year EUI | Part 2 Water Consumption | Part 2 Water Improvement Plans | Part 2 CoC | Part 3 Sustainable OM | Part 4 IEQ

Re-certifying Green Mark Buildings



Our Ref: BCA ID GM 782/7/2014

DID : 6804 4725
Fax : 6325 4800
Email: toh_eng_shyan@bca.gov.sg

25th Feb, 2015

[redacted]

Dear Mr. Yang,

BCA GREEN MARK AWARD (GOLD) FOR ABC BUILDING

1. We wish to inform you that after assessing your building, BCA is pleased to recertify your building with the BCA GREEN MARK AWARD GOLD award (based on Green Mark criteria GM NNRB Version 2 / 3 / 4.0 / 4.1, GM ENRB Version 2.1 / 3.0), under the Terms and Conditions governing the BCA GREEN MARK AWARD (a copy is available online at http://www.bca.gov.sg/GreenMark/green_mark_applnforms. html).

3 The BCA Green Mark certification shall be valid for 3 years from date of this letter of award. Thereafter, renewal assessments will be conducted to ascertain continuing compliance to the requirements of BCA Green Mark criteria for Existing Buildings.

3. As a Green Mark certified project, you are allowed to use the BCA Green Mark logo on publicity brochures and advertisements. The bromides and detail specifications for the logo is available online at http://www.bca.gov.sg/GreenMark/others/Tc_DC_Logo.pdf . Please submit any draft material using the Green Mark logo for our clearance before circulation/display.

4. If you have any queries, please contact the lead assessor, Ms. Francis Tay, at francis_tay@bca.gov.sg.

5. Finally I would like to take this opportunity to congratulate you and your project team on the successful award of the BCA Green Mark certification.

Yours sincerely

Toh Eng Shyan
Director
Green Mark Department (Existing Buildings)
BUILDING AND CONSTRUCTION AUTHORITY

52 Jurong Gateway Road #11-01 Singapore 608550
Tel: 1800 3425 222 · Fax: (65) 6325 4800 · Email: bca_enquiry@bca.gov.sg
www.bca.gov.sg

An MND Statutory Board

①



BCA GREEN MARK
(New Building for Non-Residential Buildings - Version 4.1) Re-Certified

2015

AWARD

Gold Plus

presented to

A Certain Building

Chairman
Building and Construction Authority

Chairman
Green Mark Advisory Committee

Date of Original Issue:
26 March 2015

Date of Expiry:
31 March 2019

Building and Construction Authority
We shape a safe, high quality, sustainable and friendly built environment.

The scheme this project originates

②

③

1. Assessed with Re-cert process
2. Public acknowledgement of commitment

Thank you.

GM ENRB: 2017

- Enhanced ENRB scheme: holistic, smarter, more market-friendly
- Accelerates our efforts towards **national target of greening 80% buildings by 2030**



