COMPARATIVE STUDY ON GREEN CRITERIA DEVELOPMENT TOWARDS SUSTAINABLE INFRASTRUCTURE IN INDONESIA

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***ABSTRACT*:** Indonesia just started in implementing green building criteria in its infrastructure development. First green rating tool was introduced by the Green Building Council of Indonesia (GBCI) in 2010 while the first government regulation on green building was introduced in 2012. Twenty years earlier, in 1990, UK have developed their green rating tool, BREEAM, that often be used as a reference for many council and nations in developing their green building criteria. Since Indonesia is very late in developing green criteria, Indonesia needs a shortcut in finding direction for the development. Lesson learned from developed country in implementing their green criteria could be used by Indonesia as a basis or reference in developing appropriate green building criteria.
This paper presents a comparative study of green building criteria in developing countries, green building criteria in GBCI green-ship rating, and also green building criteria of Jakarta government regulation. The comparison is done by mapping any criteria listed in those documents. This study will also map the changes process of the criteria development in order to find the direction of the development of each criterion or each rating tools.
In this study, the background or formulation contexts of each green criterion need to be carried out. Especially the environmental context is required to be analyzed in order to find the differences between green criteria. This study will focus on sustainability aspects so the comparative study can produce precise direction for the development of green building criteria with appropriate context towards Indonesia's sustainable Infrastructure development

KEYWORDS: green building, green criteria, infrastructure development

1. INTRODUCTION

Currently there are two government regulations and one rating tool that applies in Indonesia related to green building criteria. The first is Ministry of Environmental Decree Number 08/Year 2010 on Criteria and Certification of Eco-friendly Building launched in 2010, the second is Jakarta's Government Regulation (Jakarta's Decree) Number 38/ Year 2012 on Green Building. The Ministry of Environmental Decree actually more focused on certification and accreditation efforts that will require for the Eco-friendly Buildings assessment. However, there also mention about certain criteria of Eco-friendly Building. Jakarta's Decree is a mandatory regulation that must be followed by all buildings located in Jakarta which meet certain requirement. This regulation shall apply not only to new buildings but also for buildings under construction and existing buildings.
The only one rating tool in Indonesia is Green-ship Rating Tools, developed by Green Building Council

Indonesia (GBCI), which was founded in 2009 by several parties that interested in green building issue (professional, government, industry, education, associations and societies). The first Green-ship was launched in June of 2010. Currently available are 4 rating tools for new building, existing building, interiors and home. Rating tools for new buildings even been revised for the third times.

It has been over 3 years since it was first, the Green-ship certify has certified 3 new buildings and 3 and several buildings that are still in the process of registration and assessment. While Malaysia rating tool, GBI (Green Building Index) in the fourth year now, until July 2013 has certified more than 60 million square feet, or more than a hundred buildings. While Singapore rating tools, Green-mark, currently has certified more than 1,500 buildings in eight years.

This paper will discuss criteria of green buildings that listed in Green Mark, GBI, Green-ship, Jakarta's Decree. Those fourth green building criteria have similarity in climate context. However Green-mark will be positioned as benchmark since it is the most leading and established among them. Discussion will done by exploring the background of each green building criteria, and then make a detailed comparison of the criteria and weighting as well as its development. Comparison is limited only on Non-Residential New Construction related to the research that is being conducted. Result of the discussion will be a recommendation for further development of green building criteria in Indonesia both for regulatory and rating tools.

2. OVERVIEW

2.1 Green-ship GBCI

GBCI launched a voluntary Green-ship Rating Tool in June 2010 that could be applied in all administrative region of Indonesia. In order to represent Indonesia, GBCI invited stake holders from all over Indonesia to contribute in process of developing criteria by joining Technical Advisory Group Meeting or giving opinion on consensus stage.

It seems that the issue of green building only attracts small amount of people of Indonesia. The lack of attention was reflected from the amount of participant that involved in the process of formulation as part of technical advisory group (59 participants) and participated in the consensus process (148 participants) from professional associations, universities, contractors, developers, government agencies, building owners, and NGOs (compared with more than 250 million people of Indonesia). It might be also reflected on the achievement of green building certification that only 3 new buildings and 3 existing buildings until mid 2013.

Indonesia consists of more than 17,000 islands, even though not all of the islands were populated, and most of the 250 million peoples of Indonesia live in the 5 big islands. One of the main issues of the government's effort to develop infrastructure is equitable development. The focus of development is still in island of Java where almost 65% people of Indonesia lives. The impact are uneven infra structure development in all Indonesia's regions include uneven information in such way that people don't have the same opportunity to get information. GBCI effort to develop green building criteria that could represent and applicable to all Indonesia's region was faced with those uneven condition of infrastructures. GBCI have to develop standard that could be implemented in a big city surrounded by infrastructure facilities and could also be implemented in small cities without infrastructure facilities

Moreover, since Green-ship is voluntary based rating tool, it should be supplementary to the state and local government regulations. The problem that

rise is most of local government depends on the state regulation. In some cases, state regulation could not cover the problems that are faced by local government, and yet do not have local regulation to control. Green-ship should determine a position between the state and local regulations in order to complete the building standards and to be feasibly implemented in all regions of Indonesia.

2.2 Jakarta's Decree on Green Building

Jakarta's Decree on green building is the first of local government regulation of green building in Indonesia. This regulation is mandatory and applies to all existing buildings or new buildings that meet certain minimum area requirement in the region of Jakarta. To develop green building criteria, Jakarta provincial government supported by the IFC (International Finance Corporation) in updating information building development in Jakarta and simulation of building performance. They also discuss with various parties involved in green building issues to obtain input for the regulation to be feasibly implemented.

According to the Central Statistics Agency of Jakarta, based on Gross Domestic Product, economic growth of Jakarta in year of 2012 reached 6.5%. The highest growth was achieved by the transport and communications sector (11.8 %), followed by the construction sector (6.9 %), and trade, hotels and restaurants (7.2 %). Yet, the rapid development still leaves many problems to be solved. One of them is the infrastructure, which include limited supply of clean water, electricity, and lack of drainage system. Limited clean water supply by government caused increasingly amount of deep well exploitations. Limitations of drainage system caused flood during the rainy season. The building is required to have a retaining tank / pounds to collect storm water and flush it when the rain had passed. Limitation of sewer system requires every building to process waste by their self.

Another problem is public transportation, although it is available but only a small portion that meets the security and comfort as well as integrated with other modes of transportation. It cause more people choose to use their own vehicles, both cars and motor cycles. Then it creates traffic jam all over the city at certain time.

The Jakarta's government effort to initiate the Green Building Regulations needs to be appreciated. This regulation was made to complete the state existing regulations and tailored to the unique requirement of Jakarta. Since it is mandatory, it should be feasibly implemented and enforced also could be revised to meet the building development in Jakarta.

2.3 Green mark

Singapore's commitment to sustainable development is realized one of them with the support of green building issues. Singapore Building and Construction Authority (BCA) in January 2005 introduced the Singapore Green Mark rating tools as part of Singapore's efforts to encourage the construction industry more friendly to the environment. BCA is trying to promote the concept of sustainability to the designers, developers and contractors as an integral part of the life cycle of the building since the initiation, design, construction, utilization and demolition. The efforts is not only limited to request to comply regulation but also the provision of various incentive schemes for those who apply the principles of sustainability

In 2013, Green mark rating tools available in the 17 categories to accommodate the requirements. The five main aspects that will be assessed are energy efficiency, water efficiency, environmental protection, Indoor Environment Quality, Other Green Features. Assessment carried out not only during the process of design, but also construction process. For non residential new construction, two

dominant aspects are energy efficiency (61.1 %) and Environmental Protection (22.1 %). The amount of weighting is part of Singapore's commitment to energy and the environment as they have limited assets. Total points collected will be use for basis of rating which are certified, gold, gold plus, and platinum.

Based World Bank data, Singapore's GDP in 2012 reached US$ 51,709 per capita. This GDP is the biggest GDP in Asia, surpassing Japan (US$ 46.135), even beyond the United States (US$ 49,965) and the UK (US$ 38,514). Limitations of land and natural resources made Singapore have particular sustainable development principles to optimize the usage. The Singapore sustainable development embraces three principles, which are efficient (develop with less resources and waste), clean (develop without polluting our environment), green (develop while preserving greenery, waterways and our natural heritage)

2.4 Green Building Index (GBI)

Green Building Index (GBI) is Malaysian rating tools launched the first time in 2009 and initiated by PAM (Malaysian Institute of Architects) and ACEM (Association of Consulting Engineers of Malaysia). Formulation of the criteria involves discussion with various building construction stakeholders in Malaysia and supported by a comparative study of the various rating tools that already established in the world as well as visitation to Australia and Singapore to discuss with experts and explore the rated buildings. GBI claims that his rating tools different with Green mark Singapore since it customized to suit the climate, the development of the country and the availability of resources.

Seven rating tools are now available to use for assessment of green building for residential, non-residential, industrial and township. Green building assessment criteria, for non-residential new construction covering six main criteria, which are sustainable site planning and management, energy efficiency, indoor environment quality, material resources, water efficiency and innovations. Same with the other rating tools, assessment is done on design stage and post construction. The two biggest weights on the GBI rating tools found on energy efficiency criteria (35 %) and indoor environment quality (21 %). Total points accumulated will then be used as a basis for rating the Green Building Index, which include certified, silver, gold, platinum

3. RESULT

3.1 Minimum GFA Requirement

Green mark actually do not determine a minimum limit of Gross Floor Area (GFA) for assessment, but there is provision of the Singapore government for new building and retrofitted existing building that exceed 2000m2 should be minimum green mark certification, which is certified. Similarly, GBI do not determine minimum GFA to be assessed, but there is a limit of at least 2000m2 for registration fee, which means the building with GFA less than 2000m2 still have to pay registration fee same as the 2000m2. (Table 1)

Table1 Minimum GFA Requirement

Green mark NRB v4.1	GBI NRNC v1.0	Jakarta Decree NC	Green-ship NB 1.2
-	-	50.000m2	2500m2

GBCI determine GFA 2500m2 as a minimum requirement to be assessed based on discussions with several professional expert that it believed will be multiple storey and require a certain electrical and mechanical equipment to support and require a certain treatment for the waste. Jakarta’s government regulation determined 50,000m2 as a minimum GFA for office building to comply with. It could be understood since the regulation was new for Jakarta’s property players and indeed the building

with GFA more than 50,00m2 will require a lot of energy to support and require a treatment for it waste. It is believed that 50,000m2 is a result of discussion with all property stakeholders in Jakarta.

3.2 Comparison of Main Criteria

The main criteria reflect the basic requirement that need to be concerned. As it shows in Table 2, It seems that all of those four agreed on three main issues, which are energy, water, and indoor quality. For 'Energy' main criteria, Green mark, GBI and Jakarta Decree choose the term 'Energy Efficiency'. Green-ship prefer to use term GBCI 'Energy Efficiency and Conservation', although there are not provide explanation about the difference between efficiency and conservation. Similarly with 'Water' main criteria, Green mark, GBI and Jakarta Decree prefer to use term 'Water Efficiency' and Green-ship prefer to use term water conservation, yet the details of the criteria are quite same.

Table 2 Main Green Building Criteria

Main Criteria	Green mark NRB v.4.1	GBI NRNC v1.0	Jakarta Decree 38/2012	Green-ship NB v.1.2
Energy	X	X	X	X
Water	X	X	X	X
Indoor Quality	X	X	X	X
Other Issues:				
Site		X	X	X
Material		X		X
Environment	X			
Construction			X	
Other Features	X			
Innovation		X		
Management				X

Table 3 shows comparison of main criteria weighting. Green mark, GBI and Green-ship agreed to give a largest portion on the energy criteria which reflected from the amount of points or percentage of all criteria, which are varies from 61,1% (green mark), 35% (GBI) and 25,7% (Green ship). It could be understood that Green mark give much attention to energy usage since Singapore have a limited energy resources, and it is part of their strategy to be sustainable.

Table 3 Weight of Main Criteria

Main Criteria	Green mark NRB v4.1	GBI NRNC v1.0	Jakarta Decree 38/2012	Green-ship NB 1.2
Energy	61, 1%	35%	0	25,7%
Water	8,9%	10%	0	20,8%
Indoor Quality	4,2%	21%	0	9,9%
Other Issues:				
Site		16%	0	16,8%
Material		11%		13,9%
Environment	22,1%			
Construction			0	
Other features	3,7%			
Innovation		7%		
Management				12,9%

Second largest weights of main criteria are different between those three rating tools. Green mark gives more emphasis on the environment (protection), GBI on indoor (environment) quality and Green-ship on water (conservation). Singapore attention to the environment protection could be understood since natural resources are limited there. While Green-ship emphasis on water conservation might be based on limitation of clean water supply, especially during dry season. Jakarta even faced with intrusion of sea water to land as an impact of uncontrolled deep well exploitation. In order to face clean water scarcity, Singapore develop various sources, which are local catchment water, imported water, highly purified water and desalinated water. Indonesia, especially Jakarta, could also find an innovative solution to solve the clean water supply limitation.

Different with those three rating tools, Jakarta's Decree is not equipped with weighting. All building in Jakarta

that meet the requirement should complied to all criteria listed in the regulation or otherwise will not have a permit to operate.

3.3 Comparison of Sub Criteria

Table 4 shows a comparison of sub criteria listed in 'Energy' main criteria. There are 6 (six) sub criteria that likely to be concerned among those green building criteria, which are

1. Building Envelope
2. Lighting System
3. Electrical System
4. Ventilation
5. Energy Efficient
6. Air Conditioning

There are 2 (two) sub criteria that are listed only on three green building criteria. The first is 'renewable energy' are not listed literally in Jakarta Decree and 'building internal transportation system' that are not listed literally in Green Building Index. Only GBI that literally mentioned about commissioning requirement and only Green-ship that literally mentioned about climate change impact as part of energy criteria that request a report of CO_2 emission reduction for building to be assessed.

Comparison of sub criteria that listed on 'water' criteria is shown at Table 5. Four of them mentioned about 5(five) sub criteria that need to be concerned, which are

1. Efficient fitting
2. Efficient usage
3. Water Recycling
4. Water for landscape and irrigation
5. Rain water harvesting

On Indoor quality sub criteria, commonly the three rating tools have same concern on thermal, visual and noise comforts and healthy environments (shown in Table 6). Jakarta Decree concern also on healthy environment, include air flow, CO and CO_2 monitoring, and non hazardous refrigerant. Yet the Jakarta Decree are not literally mentioned about comforts, except thermal and humidity standard that listed in 'energy' criteria.

The 'other' sub criteria comparison is shown on Table 7. Four of them concern about site and supporting facilities, which include

- Concern about urban guideline or government regulation (density, urban redevelopment)
- Concern about accessibility and connectivity (public transportation, bicycle, parking, public facilities)
- Concern about greenery

Four of them also concern about green construction process which include

- Concern about materials (source, fabrication, module, emission, reuse, recycle, green certified)
- Concern about construction process (earth work, green management, construction waste)
- Concern about workers (healthy and safety working environment)
- Concern about management (green professional, green contractor)

The sub criteria that left differently between those four green building criteria are

- Innovation (listed in Green mark and GBI)
- Refrigerants and Non ODS Usage (listed in green mark, GBI and Green-ship, yet Jakarta Decree listed in 'indoor quality' criteria)
- Occupant Survey (listed in green-ship)
- Commissioning (listed in green-ship, yet GBI listed in 'energy' criteria)
- Building/Fit-out Manual (listed in GBI and Green-ship)
- Microclimate and green building submission data (listed only in Green-ship)

Table 8 shows Green Mark criteria development of New Construction Non Residential from version 3.0. revised by 4.0 version and then adjusted by 4.1 version. The 3.0 version is effectively valid from 31 January 2008 until 30 November 2010 and revised by version 4.0 effectively valid from 1 Dec 2010.

Table 4 Comparison 'Energy' Sub Criteria

Sub Criteria **Energy**	**Green mark** **NRB v.4.1**	**GBI** **NRNC v.1.0**	**Jakarta Decree** **38/2012**	**Green-ship** **NB v.1.2**
Building Envelope	Thermal Performance of Building Envelope ETTV for air con areas	(OTTV and RTTV listed in Min EE Performance)	Building Envelope System	OTTV Calculation (P)
	Building envelope , design and thermal parameter for non air con areas			
Lighting System	Day lighting	Lighting zoning	Lighting System	Natural Lighting
	Artificial lighting			
Electrical System	Automatic electric lighting system	Electrical Sub metering and tenant sub metering	Electrical System	Electrical Sub Metering (P)
Ventilation	Natural / mechanical ventilation for non air con areas	(ventilation listed in indoor air quality and innovation criteria)	Ventilation System	Ventilation (an efficient ventilation)
	Ventilation in car parks			
	Ventilation in common areas			
Renewable Energy	Renewable energy	Renewable Energy	----------	On Site Renewable Energy
Energy Efficient	Energy efficient practices and features	Minimum EE Performance	Energy efficient equipment and audit energy	Energy Efficiency Measures
		Advance EE Performance		
		EE Verification		
Air conditioning	Air conditioning system	(Air condition listed in min EE performance criteria)	Air conditioning system	Air conditioning system
Building Transportation System	Lifts and escalators	…….	Building Transportation System	Vertical Transportation System
Others		Enhanced Commissioning		
		Post Occupancy Commissioning		
		Sustainable Maintenance		
				Climate Change Impact

The revision include

- The 50 points cap is no longer applicable to encourage energy efficient design
- Additional pre-requisite requirements
- Enhance the weight of certain criteria (passive strategies, sustainable construction, water efficient fitting, greenery provision)
- Reduced weight that already become standard (artificial lighting, lift and escalator, ventilation in car parks, thermal comfort, noise level)
- Additional New Items (daylight provision, storm water management, sustainable products, indoor quality management)

The 4.0 version then adjusted with version 4.1 which is valid from 15 January 2013. The adjustments are much focus on details than revising main or sub

Table 5 Comparison of 'Water' Sub Criteria

Sub Criteria Water	**Green mark NRB v.4.1**	**GBI NRNC v.1.0**	**Jakarta Decree 38/2012**	**Green-ship NB v.1.2**
Efficient Fitting	Water efficient fitting	Water efficient fitting	Water efficient fitting design	Water Fixtures
Efficient Usage	Water usage and leak detection	Metering and leak detection system	Water Usage Design	Water Usage Calculation (P)
				Water Metering (P)
				Water Use Reduction
Water Recycling	Water consumption of cooling tower	Water recycling	Water recycling system	Water Recycling
Irrigation and landscaping	Irrigation system and landscaping	Water efficient-irrigation, landscaping	Source of water for landscape	Water Efficiency Landscaping
Alternative Water Resources	Rain water for landscape	Rainwater harvesting	Rain water harvesting	Rainwater Harvesting
				Alternative Water Resources

criteria and weighting system. The adjustment include additional details, such as

- Operational hours
- Minimum score under sustainable products
- Building developments with more than 30% area non air conditioned
- Baseline air distribution type

Since it first launched in June 2010, Green-ship for new construction version 1.0 have adjusted in February 2012 with version 1.1 and then adjusted again in April 2013 with version 1.2. The adjustment in 1.1 version include

- Additional sub criteria of water calculation
- Adjustment of term environmentally processed product into environmentally friendly materials; modular design into prefab material
- Additional details on sub criteria.
- Additional assessment stage into 'design recognition' and 'final assessment' and maximum point that could be collected

The Adjustment from 1.1 version to 1.2 version are more focused on additional details on sub criteria, such as

- Encourage green roof implementation
- Storm water intensity rate
- Encourage reduction of OTTV value

4. DISCUSSIONS AND CONCLUSION

Comparisons of main criteria and sub criteria among three rating tools (Green Mark, GBI, Green-ship) and one government regulation (Jakarta's Decree) above tends to have same criteria. The main criteria are almost the same (energy, water, indoor quality, and site) with the differences among them are subject to stake holder's understanding of each country existing condition (infrastructure, economy, politic, etc). A majority of latest issue on each main criterion has been covered in the sub criteria. Although at some points need to elaborate to be more understood such as term efficiency and conservation. The Main difference among them essentially is weights of each main and sub criteria. Additionally, the differences among them are subject of stake holders understanding around the criteria.

Table 6. Comparison of Indoor Quality Sub Criteria

Sub Criteria Indoor Quality	**Green mark NRB v.4.1**	**GBI NRNC v.1.0**	**Jakarta Decree NC**	**Green ship NB v.1.2**
Thermal	Thermal comfort	Thermal comfort & controllability system		Thermal Comfort
Visual	High frequency ballast	High frequency ballast Electric lighting level		
		Day lighting Daylight glare control		Visual Comfort
		External views		Outside View
Audial	Noise level	Internal noise level		Acoustic Level
Healthy environment		Air changes Effectiveness	Calculating air changes flow	Outdoor Air Introduction
		Carbon Dioxide monitoring and control	CO_2 Monitoring device	CO_2 Monitoring
			CO monitoring device	
		Environmental Tobacco Smoke Control		Environmental Tobacco Smoke Control
	Indoor air pollutant Indoor air quality management	Indoor Air pollutant Minimum IAQ		
		IAQ before and during occupancy		
				Chemical Pollutant
			Non CFC Refrigerant Non hazardous Refrigerant	
		Mould prevention		
		Post occupancy comfort survey : verification		

Green Mark could be considered as a comprehensive reference for Green-ship and Jakarta Government to develop green building criteria.

As a conclusion, green building criteria that have been developed by Jakarta's government or GBCI already covered all the latest main issue of green building although need continuous update and elaboration. This is important to ensure community's right to obtain a high qualified public infrastructures with green consideration that respect nature (eco-system, water, energy) and human well-being.

Table 7 Comparison of Others Sub Criteria

Sub Criteria Others	**Green mark NRB v.4.1**	**GBI NRNC v1.0**	**Jakarta Decree 38/2012**	**Green-ship NB v.1.2**
Site development and Transportation	• Greenery provision • Storm water management • Environmental management practices • Green transport	• Site Selection • Greenery and roof • Storm water design • Development Density and Community Connectivity • Environment Management • Brownfield Development • Public transportation Access • Green Vehicle Priority • Parking Capacity	• Spatial Requirements • Supporting Facility	• Site Selection • Basic Green Area • Storm water Management • Community Accessibility • Site Landscaping • Public Transportation • Bicycle Facility
Material, Environment Protection, Construction, Material, and Waste	• Sustainable construction • Sustainable products	• Earthworks, construction activity pollution control • Worker Site Amenities • Qlassic (Quality Assessment System) • Material reuse and selection • Recycle content material • Storage and collection of recyclable • Regional materials • Sustainable Timber • Construction waste management	• Occupational health and safety • Solid and liquid Waste Management • Hazardous Waste material management	• Pollution of Construction Activity • Environmentally Friendly Material • Building and Material Reuse • Regional Material • Certified Wood • Prefab Material • Basic Waste Management • Advanced Waste Management
Others	• Refrigerants • Green feature and innovation • (green mark professional listed in management sub criteria)	• Refrigerants and clean agents • Innovation in design & environmental design initiatives • Green Building Index Accredited Facilitator • Building user manual	• Water Conservation	• Fundamental Refrigerant • Non ODS Usage • Green Professional • Fit Out Agreement • Occupant Survey • Proper Commissioning • Data Submission • Micro Climate

5. SUGGESTION

Combining mandatory government regulation and voluntary rating tools are perfect strategy to promote implementation of green building ideas in property business. Indonesia's government regulations need to be continuously updated to minimum GFA requirement in order to support implementation in a 'wider context and gradually intensify building

Table 8 Development Criteria of Green Mark

Green mark Non Residential v.NRB/3.0	**Weight**	**Green mark New Non Residential v.NRB/4.0**	**Green mark New Non Residential v.NRB/4.1**	**Weight**
Building Envelope ETTV	15	Thermal Performance of Building Envelope ETTV	Thermal Performance of Building Envelope ETTV	12
Air conditioning system	27	Air conditioning system	Air conditioning system	30
Building envelope , design and thermal parameter	29	Building envelope , design and thermal parameter	Building envelope , design and thermal parameter	35
Natural ventilation (exclude car-parks)	13	Natural ventilation / mechanical ventilation	Natural ventilation / mechanical ventilation	20
……		Day-lighting	Day-lighting	6
Artificial lighting	12	Artificial lighting	Artificial lighting	12
Ventilation in car-parks	5	Ventilation in car-parks	Ventilation in car-parks	4
Ventilation in common areas	5	Ventilation in common areas	Ventilation in common areas	5
Lifts and escalators	3	Lifts and escalators	Lifts and escalators	2
Energy efficient practices and features	12	Energy efficient practices and features	Energy efficient practices and features	12
Renewable energy (bonus)	20	Renewable energy	Renewable energy	20
Water efficient fitting	8	Water efficient fitting	Water efficient fitting	10
Water usage and leak detection	2	Water usage and leak detection	Water usage and leak detection	2
Irrigation system and landscaping	2	Irrigation system and landscaping	Irrigation system and landscaping	3
Water consumption of cooling tower	2	Water consumption of cooling tower	Water consumption of cooling tower	2
Sustainable construction	14	Sustainable construction	Sustainable construction	10
…….		Sustainable products	Sustainable products	8
Greenery	6	Greenery provision	Greenery provision	8
Environmental management practices	8	Environmental management practices	Environmental management practices	7
Public transport Accessibility	2	Green transport	Green transport	4
Refrigerants	2	Refrigerants	Refrigerants	2
…….		Storm water management	Storm water management	3
Thermal comfort	2	Thermal comfort	Thermal comfort	1
Noise level	2	Noise level	Noise level	1
Indoor air pollutant	2	Indoor air pollutant	Indoor air pollutant	2
……		Indoor air quality management	Indoor air quality management	2
High frequency ballast	2	High frequency ballast	High frequency ballast	2
Green feature and innovation	7	Green feature and innovation	Green feature and innovation	7
	140			190
	160			

performance requirement, supporting with incentives to use more efficient energy and minimize impact to environment. Green-ship also need to continuously update criteria and weighting since rating tools will be act as complement device for property business to go beyond regulation in order to achieve world recognition on green building

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