Green Building Performance Analysis in the Stimi Campus Building

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Abstract: Every building construction must consider environmental conditions that have an impact on the quality of life around it, the increase of global warming, and spend more than 1/3 of the world's resources for construction. Green building is a building concept that pays more attention to the environment, not only applied to buildings that will be built, but also applied to existing buildings. This study aims to determine the criteria and performance of green building based on the Greenship Rating Tools Version 1.1 standard in built buildings. The research was conducted in Meulaboh, STIMI Campus building in West Aceh Regency. The methods used were direct observation, interviews and distribution of questionnaires. All data are collected based on Greenship Rating Tools Version 1.1, consisting of 6 (six) categories, namely Land Use (Appropriate Site Development / ASD), Energy Efficiency and Conservation (EEC), Water Conservation (WAC), Material and Cycle (MRC), Health and Comfort in Indoor Health and Comfort / IHC and Building and Environment Management (BEM), which consists of 40 criteria with a maximum total number of 117 points. . The results of the study are based on data collected on 40 Greenship criteria from six categories consists of ASD, EEC, WAC, MRC, IHC and BEM, each of which scores 8, 12, 3, 4, 13 and 2 points. The highest value is found on the IHC criteria (13 points) and the lowest value on the BEM criteria (2 points). The overall results obtained a value of 42 points, and have met the criteria as a building that applies the green building concept, including in the bronze rank. But based on the results of interviews with building managers, the management concept has not yet applied the green building concept.

1 INTRODUCTION

Nowadays, big cities in Indonesia are developing to support economic development so that they need many new buildings to develop their economies, such as the construction of business centers, office buildings, educational buildings, shopping center, hospital etc. If the infrastructure continues developing without considering or paying attention to environmental conditions such as the accuracy of land use, energy use (electricity) and water as well as the use of building materials will certainly have an impact on the quality of life around it. This is what is considered to have a big role in increasing global warming, so that the awareness and knowledge of construction actors on the influence of the existence of the building is very much needed (Green Building Council Indonesia, 2010; Badan Standarisasi Nasional, 2000b).

One of the mitigation actions taken is by making an international commitment framework with an achievement target called Intended Nationally Determined Contributions (INDCs). INDCs are national targets of each country requested by the FCC UN for COP 21, Paris. INDCs are reported to have a higher binding capacity than national commitments in 2009. INDC Indonesia has a target of 29% reduction in emissions, 3% higher than the target set in 2009 (Badan Standarisasi Nasional, 2000a; Badan Standarisasi Nasional, 2001; Badan Standarisasi Nasional, 2004).

In overcoming these problems, the Green Building concept emerged as a solution. Green Building is a building concept whose process is more concerned with the environment, both from the use of resources, energy, the use of materials, eliminating negative impacts and improving the quality of human life. This concept is not only applied to buildings that will be built, it can also be applied to existing buildings, namely by applying the Green Building concept when renovating and maintaining buildings (Badan Standarisasi Nasional, 2005; Badan Standarisasi Nasional, 2009).

The Green Building Council Indonesia (GBCI) which was established in 2009 is an independent (non-government) and non-profit (non-profit)

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institution that is committed to community education in applying environmental best practices and one of its programs is to certify Green Buildings in Indonesia based on a typical Indonesian assessment tool called greenship.

The application of the Green Building concept is expected not only to be applied to commercial buildings, but also to various other buildings such as universities. The Eco-campus program is one program that supports the implementation of green buildings on campus which also play a role in reducing global warming.

Therefore, the researchers wanted to know the extent of the application of Green Buiding on the campus building of the Indonesian Management College (STIMI) in Meulaboh, West Aceh based on the Greenship-GBCI.

2 LITERATURE REVIEW

2.1 Green Building

Regulation of the Minister of Environment No. 8 of 2010 about Environmental Friendly Building Criteria and Certification Chapter I Article 1, Green Building is a building that applies environmental principles in the design, construction, operation and management and important aspects of handling the effects of climate change.

According to the Green Building Council Indonesia / GBCI (2010), a Green Building is a building where from the planning, construction, operation to the operational stages of maintenance shows aspects in protecting, saving, and reducing the use of natural resources, maintaining quality from quality air in the room, and pay attention to the health of its inhabitants (Badan Standarisasi Nasional, 2000b; Peraturan Menteri Negara Lingkungan Hidup, 2010).

2.2 Green Building Concept

With the concept of green building, it is expected to reduce the use of energy and pollution impacts while building design is environmentally friendly (https://green.radenintan.ac.id/mau-tahu peringkat-kampus-terhijau-di indonesia/,). In the National Quality Month and World Standard Day, 2008 explained that in designing "Intelligent and Green building" must pay attention to:

- Sustainable use of materials,
- Linkages with local ecology,
- Energy conservation,
- Efficient use of water,
- Handling waste,
- Strengthening linkages with nature,
- Reuse / renovate buildings.

2.3 Case Study of the Application of Green Building in Campus Buildings

The Bandung Institute of Technology and Science Campus (ITSB) is the first Green Campus in Indonesia which has also been certified by GBCI and received the title Gold certified-Design Recognition with 107 points in total. The ITSB campus received the award for being able to efficiently and economically save through the single building corridor, application of double skins on site, waste management, composting and rainwater utilization. This savings is done by maximizing natural lighting and reducing the use of air conditioning (AC).

In Indonesia, in addition to the Greenship standard, there is another ranking standard that is devoted to conducting the greenest university ranking, namely UI GreenMetric conducted by the University of Indonesia. UI GreenMetric is the greenest university ranking system that has received official credibility from the International Ranking Expert Group (IREG) at the IREG-6 conference in April 2012 in Taipei. IREG is an institution based in Belgium and is an important institution because of its role as a quality assurance institution with an audit and certification program for world ranking institutions.

UI GreenMetric assessment is applied to all campus areas, starting from lecture buildings, laboratories and campus supporting facilities and infrastructure. The assessment philosophy of GreenMetric UI is based on 3E, namely Environmental, Economic and Equity & Education (Environment, Economics, and Justice & Education).

The aim of the Greenmetric UI is to provide online survey results based on actual conditions and policies related to the implementation of Green Campus and campus sustainability in all universities in the world. More attention will be drawn to efforts to prevent global climate change, energy and conservation of water resources, recycling of solid waste, and green transportation. (UI Greenmetric, 2012).

The implementation of the Greenmetric UI has been implemented since 2010 and at that time 95 universities from 35 countries participated. And the

participation of tertiary institutions is increasing over the years as found in Table 1.

Table 1: UI GreenMetric 2018 Ranking Results for Greenest Universities in Indonesia

NO	UNIVERSITY	SCORE
1	Universitas Indonesia	7625
2	Institut Pertanian Bogor	7450
3	Universitas Dipenogoro	7025
4	Institut Teknologi Sepuluh November	6975
5	Universitas Negeri Semarang	6925
6	Universitas Gajah Mada	6850
7	Universitas Sebelas Maret	6600
8	Universitas Islam Indonesia	6650
9	Universitas Padjadjaran	6150
10	Telkom University	5975
11	Universitas Muhammadiyah Yogyakarta	5650
12	Universitas Brawijaya	5575
13	Universitas Multimedia Nusantara	5375
14	Universitas Sumatera Utara	5300
15	Universitas Riau	5075
16	Institut Teknologi Bandung	4975
17	Universitas Airlangga	4900
18	UIN Raden Intan Lampung	4800
19	Universitas Negeri Medan	4475
20	Universitas Lampung	4400
21	Universitas Teuku Umar	4375
22	Universitas Syiah Kuala	4325
23	Universitas Pelita Harapan	4325
24	Universitas Andalas	4250
25	Universitas Medan Area	4225
26	Yogyakarta State University	4150
27	Universitas Surabaya	4125
28	Universitas Hasanudin	4125
29	Universitas Bengkulu	4100
30	Universitas Mataram	4075

Source : UI Green Metric (2018)

The criteria in the greenship rating for Existing buildings shows in Table 2 below.

Table 2: Criteria in Greenship for Existing Building

Category	Criteria		
	Precondition	Credit	Bonus
ASD	2	7	-
EEC	2	7	-
WAC	1	8	-
MRC	3	5	-
IHC	1	8	-
BEM	1	5	-
Total Kriteria	**10**	**40**	**-**

Source: GBCI (2011)

Credit criteria have certain points which if the building can be achieved in accordance with the minimum total points required by GBCI, the building is certified with a predicate level as found in Table 3.

Table 3: Greenship Predicate Level for New Buildings

Predikat	Minimum Poin	Persentasi (%)
Platinum	83	73
Emas	66	57
Perak	53	46
Perunggu	41	35

Source: GBCI (2012)

3 RESEARCH METHODOLOGY

This study was specifically examined at the STIMI Campus Building in West Aceh Regency, located at National Road, Meulaboh-Tapak Tuan, Langung Village, Meureubo District, and West Aceh Regency. The building used by lecturers, students, and other employees has an important role as campus management facility to accommodate academic activities.

In this study, data management was carried out, while the data needed were primary data and secondary data contained in the field or research location, after the data was collected followed by analyzing data with the help of several instruments, that is Greenship Rating Tools for Existing Building Version 1.1, Indonesian National Standards and Regulations (SNI) related to the criteria stated in the Greenship, and Regulation of the Minister of Public Works concerning Green Buildings (Green building).

In analyzing the performance of green building must use Greenship green building standards compiled by GBCI which are applied in Indonesia as a tool of assessment consisting of:

- Greenship for residential homes
- Greenship for new buildings,
- Greenship for buildings built,
- Greenship for interior spaces.

This study uses the Greenship Rating System for Building Built Version 1.1 This Greenship Preparation is supported by the World Green Building Council and carried out by the Rating Commission of GBCI, consisting of 6 (six) categories with a total prerequisite criteria of 10 criteria and 41 credit criteria. The six categories of Greenship in question, namely:

- Land Use (Appropriate Site Development / ASD),
- Energy Efficiency and Conservation (Energy Efficiency and Conservation / EEC)
- Water Conservation (WAC)
- Sources and Material Cycles (Material Resources and Cycle / MRC)
- Health and Comfort in Indoor Health and IHC.
- Building Environment Management (BEM)

4 RESULTS AND DISCUSSION

The study was conducted based on the data contained in Chapter III. The results showed in form of data

on the requirements and feasibility of the Meulaboh STIMI campus building and describe the green building concept in this campus building.

Green Building Assessment is a criterion that must be fulfilled and applied in a building. In Greenship, if these criteria cannot be met, then the criteria and benchmarks in a category cannot be evaluated and the Green Building assessment process cannot be continued. There are 10 prerequisites in the Greenship Existing Building which represent 6 categories.

4.1 Appropriate Site Development/ASD

Good land use by taking into account the development impacts in an area on the environment and the surrounding environment is a benchmark in this aspect of land use. According to Briassoulis (2000) changes in land use are changes that occur in a land use with a specific purpose.

The right aspect of land use is expected to be able to reduce the negative influence of land use change by development on the environment. Next is the rating and assessment in the aspect of ASD which consists of 2 criteria prerequisites and 7 normal criteria with a maximum total score of 16 points.

Table 4: The results of the calculation of land use categories (ASD) at the Meulaboh STIMI campus building.

ASD	CREDIT CRITERIA	EVALUATION POIN	POINT
1	Community Accessibility	2	3
2	Motor Vehicle Reduction	1	0
3	Site Landscaping	2	2
4	Heat Island Effect	3	1
5	Stormwater Management	2	1
6	Site Management	2	1
7	Building Neighbourhood	2	1
TOTAL		16	9

4.2 Energy Efficiency and Conservation/EEC

Energy conservation is an energy efficiency improvement that is used or commonly referred to as the energy saving process (Untoro et al. 2014). Electricity is one of the largest energy consumption in a building; electricity is used in almost entire operational cycle of the building. Electrical energy for campus building of STIMI Meulaboh is supplied from PLN and used to operate equipment such as air conditioning, lighting, pumps and others.

With the large energy consumption, an effort needed to limit the use of energy with a system and an efficient way. The following are the criteria and assessments in the EEC aspect which consists of 2 criteria preconditions, 7 usual criteria and 2 bonus criteria with a maximum total value of 36 points.

Table 5: Measurement results (EEC) Meulaboh STIMI campus building

EEC	CREDIT CRITERIA	EVALUATION POINT	POINT
1	Optimized Efficiency Building Energy Performance	16	0
2	Testing, Re-commissioning or Retro-commissioning	2	0
3	System Energy Performance	12	11
4	Energy Monitoring and Control	3	1
5	Operation and Maintenance	3	0
6	On Site Renewable Energy	5 B	0
7	Less Energy Emission	3 B	0
Total		**36**	**12**

4.3 Water Conservation/WAC

Stating that water conservation is an action taken to reduce the use of clean water. Therefore, the benchmarks found in the aspect of water conservation in GBCI's greenship rating tools are generally regarding the application of water quality maintenance and maintenance measures, as well as management of building management towards the use of clean water.

The WAC category consists of 1 criteria precondition, 8 usual criteria and 1 criterion bonus with maximum total points is 20 regular points and 2 bonus points.

Table 6: Criteria In Water Conservation (WAC)

ASD	CREDIT CRITERIA	EVALUATION POINT	POINT
1	Water Sub-Metering	1	0
2	Water Monitoring Control	2	0
3	Fresh Water Efficiency	8	0
4	Water Quality	1	0
5	Recycled Water	5	1
6	Potable Water	1	0
7	Deep Well Reduction	2	2
8	Water Tap Efficiency	2b	0
Total		**20**	**3**

4.4 Material Resource and Cycle /MRC

In a development, building materials are needed to support construction. These building materials come from natural resources, and nature has a limited number so that one day they will run out if exploited continuously without any effort to maintain the sustainability of nature.

In addition to the impact on nature, another thing to consider is the health of the users of the building itself. If the building materials used do not pay attention to the appropriate procedures. So the main

objective of this aspect is the management of a good and environmentally friendly material life cycle.

Next is the rating and assessment in the MRC aspect which consists of 3 prerequisite criteria and 5 usual criteria with a maximum total score of 12 points.

Table 7: Criteria In Categori Material Resouce and Cycle (MRC)

MRC	CREDIT CRITERIA	EVALUATION POINT	POINT
1	Usage Non ODS	2	1
2	Material Purchasing Practice	3	2
3	Waste Management Practice	4	2
4	Hazardous Waste Management	2	0
5	Management of Used Good	1	0
Total		12	3

4.5 Outdoor Health and Comfort

In the comfort and health category in space, there are 1 prerequisite and 8 criteria that have a maximum total value of 20 points.

Table 8: Criteria In Category Outdoor Health And Comfort

ASD	CREDIT CRITERIA	EVALUATION POINT	POINT
1	Outdoor air introduction	2	0
2	Environmental tobacco smoke	2	1
3	CO2 and CO	2	0
4	Physical chemical and pollutans	6	6
5	Biological Pollutans	3	1
6	Visual convort	1	1
7	Acustic level	1	1
8	Building User survey	3	3
Total		19	13

4.6 Building Envirinment Managemennt

The BEM category consists of 1 criteria precondition, 5 criteria and with maximum total points of 13 points.

Table 9: Criteria In Building Environment Management (BEM)

MRC	CREDIT CRITERIA	EVALUATION POINT	POINT
1	Innovation	5	2
2	Design Intent & Owner Project	2	0
3	Green Operational	2	0
4	Green Occupancy/Lease	2	0
5	Operation And Maintenance	2	0
Total		13	2

After the measurement is done by interview and direct observation of each green building criteria, each criterion will be assessed according to its application. The results obtained in this study show that there are still many prerequisites and criteria that have not been fulfilled, along with the assessment results listed in the table.

From table 7 above, shows that the largest percentage of the values obtained per day criteria is IHC, which is 65%. For more details the comparison of the criteria values for the points obtained can be seen in Figure 1 below

Table 10: Criteria in Greenship for building built

NO	CREDIT	EVALUATION POINT	POINT	%
1	ASD	16	8	50
2	EEC	36	12	33
3	WAC	20	3	15
4	MRC	12	4	33
5	IHC	20	13	65
6	BEM	13	2	15
Total		**117**	**42**	**40**

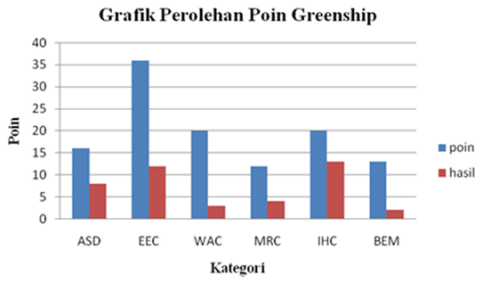

Figure 1: graphs the points obtained on the criteria of ASD, EEC, WAC, MRC, IHC and BEM.

5 CONCLUSION

Based on the 40 criteria in the Greenship category, Meulaboh STIMI campus building received 42 points from 117 maximum points, consisting of ASD = 8, EEC = 12, WAC = 3, MRC = 4, IHC = 13 and BEM = 2 points, so that it deserves a bronze rating. The the comparison results from the evaluations of green building performance each obtained Land Use (Appropriate Site Development / ASD) 50%, Energy Efficiency and Conservation (Energy Efficiency and Conservation / EEC) 33%, Water Conservation (WAC) 15%, Source and Material Cycle (Material Resources and Cycle / MRC) 33%, Health and Comfort in Indoor Health and IHC 65%, and Building Environment Management (BEM) 15%. The highest value in the Energy Use Efficiency category (IHC) is 13 points, and the lowest is in the category (BEM) 2 points.

6 SUGGESTIONS

- The attention from governments is needed and also other institutions such as local regional development agency (BAPPEDA) to improve the

performance of green building in built buildings by giving awards to buildings that have applied the concept of green buildings.

- To the campus building management of STIMI Meulaboh be able to improve the understanding of environmentally friendly buildings and the application of the concept of green building, and pay attention to energy (electricity), water and material use to make it more comfortable in the impact of quality of life.
- It is expected that users of the Meulaboh STIMI campus building can improve their understanding of environmentally friendly buildings and green building
- To the campus management, they can pay attention to the development of campus buildings in terms of green construction and green buildings so that they become more comfortable and environmentally friendly campuses.

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