Green building construction rating assessment in The LL Dikti Office Building, XIV Biak Region, Papua

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Abstract. The number of CO2 emissions produced by buildings harms the environment. Green building is an action to reduce negative impacts on the surrounding. This research had conducted to assess the rating of green building concepts that applied to the LL Dikti building, Papua. The result is the accumulation of points from each criterion such as land use, energy efficiency and conservation, water conservation, material resource, and cycle, indoor air health and comfort, and building and environment management. The total acquisition result for the building was 41 points and awarded the silver rating. Several things can do to increase the rating, such as install a kWh meter to measure electricity consumption in each load group and equipment system, use of alternative water sources, and the existence of installations or facilities to sort and collect household-like waste.

Keywords: Green Building, Greenship Rating, GBCI

1. Introduction

The thing that underlies the importance of the green building at this time is the Global Warming Issue. The economic development has resulted in an increasing number of energy needs [1]. The source of electricity in Indonesia is mostly from Steam Power Plants (PLTU), which indicates the usage of fossil fuel energy was high (around 85%) [2]. It can cause the depletion of the ozone layer and have an impact on global warming.

The concept of green buildings has begun as a necessity in the global warming phenomenon. This concept appears to be one of each solution to minimize environmental pollution as well as reduce waste emissions from the construction sector [3]. In Indonesia, the reference standard for assessing the Green Building criteria is Greenship developed by the Green Building Council Indonesia (GBCI).

LL Dikti Office Building and infrastructure area will be built in XIV Biak Region, Papua, and is currently still in the design stage. It will become a pioneer of environmental education in Eastern Indonesia through the realization of the LL Dikti office by applying the concept of Eco-Office and support the green building or smart building movement that has been applied to buildings around the world to reduce the impact of global warming.

This research will assess the rating of the building in the planning stage based on Greenship certification for new buildings V1.2 and what is the percentage level of conformity with the existing guidelines. Then based on the assessment, the building will be given a predicate base on standards: platinum, gold, silver, or bronze.
2. Literature Study

2.1. Green building rating
The Greenship categorization has approved by the World Green Building Council (WGBC). A Greenship assessment instrument is a form of assessment that consists of each item of the assessment aspect known as criteria. Each criterion has many separate assessment benchmarks. Several countries have also developed a building appraisal system based on references endorsed by the Green Building Council (GBC). GBC Indonesia has compiled a guideline since 2010, known as Greenship. This Greenship uses as an assessment instrument to determine whether a building is a green building or not.

New building appraisal guidelines use Greenship V.1.2. Greenship Assessment Tool divides into two, Design Recognition (DR) and Final Assessment (FA). At the design stage, the project is allowed to get a provisional award according to the assessment published by Greenship. Appraisal in the planning process obtains a maximum score of 77 points [4]. At the final project, Final Assessment (FA), the experts project the overall plans, development plan on the building design, and the final operational plan of the building with a maximum value of 101 points [5]. Three predicates can acquire by a new building that is Platinum 56 total point (73%), Gold 43 total point (57%), Silver 35 total point (46%), Bronze 27 total point (35%) [4].

Green buildings are not only seen from the physical aspects but in all components that must integrate as a form that does not stand independently, during the construction process to the overall operation as a pattern in an environmentally friendly and efficient building context. There are some criteria based on the Green Building Council Indonesia [4] if a building wants to classify as a green building concept, including:

a. Appropriate Site Development- ASD
   When designing a site development, it needs to pay attention to several ecological principles and deepen the knowledge of appropriate land management to reduce negative impacts on the surrounding environment. For this reason, the appropriate site development factor has 17% of the total maximum value of the new building Greenship assessment instrument.

b. Energy Efficiency and Conservation- EEC
   This criterion is not only set on the scope of energy used but also the surrounding environment that has been impacted by exhaust gases and other things such as heat pollutants, excess lighting sources, and the resulting noise, excessive use of energy sources, such as air conditioning where Indonesia has quite comfortable climate conditions. This criterion is also talking about the natural lighting from the sun lighting that is an unlimited source of energy and light. This criterion has 25% of the total maximum value on the new building Greenship assessment instrument.

c. Water Conservation- WAC
   These criteria apply a water-saving system starting from the savings program, management, and the selection of other water output regulators. Water management originating from rain is one example of a design concept that can be applied to be more efficient in terms of water used to preserve the environment. This criterion has 21% of the maximum total on the new building Greenship assessment instrument.

d. Material Resource and Cycle- MRC
   Reuse of material to optimize the use of one material and extend the material recycling period with efficiency and conservation to minimize final waste and carbon footprint. This criterion applies at the stage of building design, product exploitation, production, and operation. Also, this criterion implies a reduction in material use as well as an extended material life. For material classification, it is necessary to pay attention to the impact that occurs on the environment as well as humans, by eliminating the use of hazardous and toxic materials (B3). This criterion has 14% of the maximum total on the Greenship assessment instrument for new buildings.

e. Indoor Air Health and Comfort- IHC
Room climate conditioning is rather influential on every building occupant because 90% of them stay in the room. This criterion has 10% of the maximum total on the new building Greenship assessment instrument.

f. Building and Environment Management-BEM

One application of this criterion is to categorize organic and inorganic garbage. The purpose is that the environment will not pollute by garbage that generate in those buildings. This criterion has 13% of the maximum total on the new building Greenship assessment instrument [4].

From the assessment criteria above, each of them has prerequisite criteria, credit criteria, and bonus criteria. Prerequisite criteria display the minimum benchmark requirements for eco-friendly buildings. If any of the prerequisite criteria not being met, then it did not follow up for the next assessment criteria. b). Credit criteria, each category is not obliged to be achieved. The determination of credit criteria equates to the advantages that have existed since the design stage. c) Bonus criteria, there is additional value submission that is not required to meet. This achievement is quite rare and difficult to achieve in the field.

2.2 Previous Research

Many researchers have conducted rating assessments in several green buildings in Indonesia, as done by [6], [7], [8], [9], [10]. The entire building received a gold predicate. Research has also examined the need for more time-consuming design considerations compared to conventional buildings, such as the need to use recycled water and alternative water sources [11]. Green building also requires more costs because it has to meet several aspects of the criteria [1], [12], [13].

3. Methodology

The building design reviewed in this study is a building consisting of three floors and one basement. The function of the building is an office and museum. It locates in the city of Biak, Papua. Green building rating assessment refers to Greenship v.1.2 assessment instrument for new buildings and performs at the design stage.

The data obtained from the design specifications and direct interviews with the designer to check the list of variables. All the variables reviewed include an Appropriate Site Development-ASD, Energy Efficiency and Conservation-EEC, Water Conservation-WAC, Material Resource, and Cycle-MRC, Indoor Air Health, and Comfort-IHC, Building and Environment Management-BEM. The assessment process can be seen in Figure 1.
4. Result

The assessments have made in the design stage. The total actual points can see in the following table. The final result of the assessment is 41 total points, similar to 53.24%, which categorize as a building with a silver predicate (minimum 35 points) as shown in Table 1.

Table 1. Total point of assessment results Greenship V.1.2

| Category | Actual points/greenship points | Bonus | Persentage |
|----------|--------------------------------|-------|------------|
| ASD      | 14/17                          | -     | 18,18%     |
| EEC      | 12/26                          | -     | 15,58%     |
| WAC      | 8/21                           | -     | 9,10%      |
| IHC      | 5/5                            | -     | 7,80%      |
| MRC      | 2/2                            | -     | 2,60%      |
| BEM      | 0/6                            | -     | 0%         |
| **Total**| **41/77**                      | **0** | **53,24%** |
Indoor Air Health and Comfort-IHC are criteria that have been fully applied in the design, while Building and Environment Management-BEM did not apply in this building. Indoor Air Health and Comfort-IHC cover Outdoor Air Introductions, Air Monitoring, Smoke Control in the Environment, No Chemical Pollutants, Outdoor View, Comfort, Noise Level. Meanwhile, Building and Environment Management-BEM, One application of this criterion are to categorize organic and inorganic garbage. The purpose is that the environment will not pollute by garbage that generates in those buildings.

5. Discussion
This building has applied almost all of the ASD criteria include the existence of a landscape area in the form of vegetation, which is free from building structures and simple structures of garden buildings (hardscape) above ground level or below ground. For new construction, the area is at least 10% of the total land area. It has vegetation following Permendagri No. 1 of 2007 Article 13 (2a) with a composition of 50% of the land is covered by trees of small size, medium size, large size, half tree shrubs.

In the EEC variable, this building design has no plans for the installation of kWh meters so that the electricity loading is centered on the main panel and is not efficient. Based on the author's recommendations according to the Greenship v1.2 certification standard, the building needs to install and plan the placement of all sub-meters so that they are easy to access in measuring electricity usage in other equipment systems such as air conditioning systems, lighting systems, and any other loads. Some of the EEC criteria have been applied, such as installing a kWh meter to measure electricity consumption for each load group and equipment system.

In handling efficient use of water in buildings (WAC), according to Greenship, it is necessary to limit the use of groundwater and PDAM as use for irrigation in landscapes by replacing them with other alternative water sources. Replacing each clean water use system or water from a drinking water company with rainwater or water from ablution can be a solution applied to buildings for other purposes such as watering plants. All of these buildings still use water from a drinking water company (PDAM).

This building has applied MRC criteria by not using Chloro Fluoro-Carbon (CFC) as refrigerant and halon as a fire extinguisher and IHC with a room design that shows the potential for the introduction of minimal outside air. Building environmental management (BEM) is also part of the Greenship rating requirements. In the building design, it is necessary to add facilities or installations to select and collect the same waste based on inorganic, organic, and hazardous waste types. Of course, it is prominent to pay attention to the level of waste that goes to the final disposal site by mobilizing a movement to determine the type of waste in a simple way that makes it easier to recycle waste. This building has not facilities that support BEM yet.

In the future, the building expected will be able to implement a construction waste management system in moving the waste process to the final disposal site and reducing air pollutants during the construction process by the provision of an area for collecting, sorting systems, and waste recording systems. Waste can distinguish to become solid waste and liquid waste. Solid waste disposed of in landfills, then reuse after going through the recycling process. The contractor should pay attention to liquid waste so as not to pollute urban drainage by the quality of any water discharge that occurs during construction activities.

The silver rating can upgrade to gold rating after going through the results of the evaluation and building recommendations by adding sub-meters, efficient water utilization, grid calculations, emission factor, and advanced waste management. It will get a total of 46 points with a percentage of 59.74% and getting a gold rating.
6. Conclusion

The acquisition points of the LL DIKTI Region XIV, Biak Papua Building at the design recognition stage is 41 points, with a percentage of 53.24%. Thus, LL DIKTI Region XIV Biak Papua got a silver rank. The building has implemented ASD, MRC, and IHC as well as part of EEC and WAC, but has not implemented BEM yet. Some suggestions to increase the rating need to be implemented, such as providing waste management facilities, utilizing clean water from groundwater and rain, (not only from drinking water company) and installing kWh meters to measure electricity consumption in each load group and equipment system.

In the next research, some measurements can calculate after the LL DIKTI Biak Building completed, such as measurements of natural lighting, the influence of climate change, and thermal comfort. Research can also do to find out how much additional costs are required to make green buildings.

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