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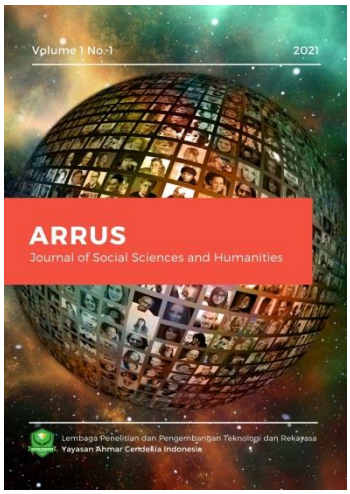

*Corresponding author: Regina Deisi Grasye Porajow, Faculty of Engineering, Sam Ratulangi University, Manado, Indonesia

E-mail: reginadgporajow@gmail.com

RESEARCH ARTICLE

Analysis of Green Building Implementation in the Southeast Minahasa Regent's Office Building Based on the Greenship Existing Building Rating Tool

Regina Deisi Grasye Porajow*, M. D. J. Sumajouw, & Isri R. Mangangka

Faculty of Engineering, Sam Ratulangi University, Indonesia

Abstract: Southeast Minahasa Regency increase the construction of infrastructure and buildings in every year. This development certainly resulted in major changes in the surrounding environment. This is the basis for this study to evaluate the Southeast Minahasa Regent's Office building based on *the Greenship Existing Building*. This research aims to evaluate the implementation of *green buildings* in the Southeast Minahasa Regent's Office building, then provide recommendations for improvements in aspects that have yet to be achieved without changing the structural and architectural aspects of the building. Based on the evaluation results of six aspects in the Greenship Existing Building version 1.1 criteria, Southeast Minahasa Regent's Office building received a total score of 18 points or 15.38% of a maximum of 117 points. Thus, the Southeast Minahasa Regent's Office building does not meet the criteria as a green building concept, and it is necessary to provide recommendations in order to meet the green building criteria.

Keywords: Green Building, Greenship Existing Building

1. Introduction

The earth, a place of human life and other living beings' existence, currently needs to improve its quality of the environment (Diana et al., 2021; Wijayanti & Chamdani, 2022). In the last 150 years since the industrial revolution, carbon dioxide levels have risen from 280 ppm to 379 ppm. The IPCC also summarizes that over the past 50 years, 90% of human-produced greenhouse gases, such as carbon dioxide, nitrous oxide, and methane, have significantly caused the earth's temperature (Allen et al., 2015; Ding et al., 2018).

The property or building sector is the largest contributor to greenhouse gases, especially in lighting and air conditioning energy use (Ricardianto et al., 2022; Utomo et al., 2022; Wiryomartono, 2015). The largest amount of energy consumed in residential homes is in the use of 32% air conditioning, 26% hot water, 23% lighting, and 19% other energy (Sahid et al., 2021; Shen & Faure, 2021; Zhang et al., 2019).

Commercially useful buildings, such as offices, shops, shopping centers, hotels, and apartments, can contribute to large emissions. The new development's environmental impact is enormous, resulting in major changes in the surrounding environment. A development concept that pays attention to environmental conditions is required to prevent this situation (Berawi et al., 2019; Wimala et al., 2016). This concept is known as the green building concept. Jonathan Westeinde explained that implementing the green building concept is the fastest, cheapest, and most effective tactic for reducing greenhouse gas emissions. This implementation provides ecological benefits and economic value because it can reduce

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building operational and maintenance costs (Ding et al., 2018; Huang et al., 2021; Zhang et al., 2019).

In Indonesia itself, there is already a national certification institution, namely the Green Building Council Indonesia (GBCI), as an independent institution that was established in 2009 and was registered by the Indonesian Ministry of Environment as a provider of environmentally friendly building certification services on July 21, 2011, with a Competency registration number: 001/LPJ/BRL/LRK/KLH (Romauli et al., 2020; Sahid et al., 2020; Virgayanti, 2017). The benefits of having Green Building certification, apart from being a form of environmental compliance business, also provide benefits, namely improving the image and perception of the community, which in turn makes the market/investment value more than conventional buildings (GREENSHIP, 2013).

GBCI has developed a rating tool called the Greenship Existing Building specifically designed for already constructed buildings, considering that the number of existing buildings applying the green building concept in Indonesia still needs to grow (Bayu Mogana Putra & M. Zikra Zizo Alfieta, 2022; Mediastika & Lie, 2015; Panneerselvam & Srinivasan, 2022; Roshaunda et al., 2019). Green building certification for existing buildings can be carried out by implementing several changes to the building to make it more environmentally friendly. These changes are intended to minimize the use of energy and water without compromising the health and comfort of its users.

2. Literature Review

The research was conducted in the Southeast Minahasa Regent's Office building located on Jalan Soekarno, Lowu Utara, Ratahan District. This research has been done using the rating or assessment method by measuring the Greenship Existing Building criteria of 1.1 version. Collecting data in this study was from from primary data and secondary data. Primary data is obtained through field measurements, surveys, interviews, and questionnaires. Meanwhile, the secondary data researchers obtained from other parties had been documented in the form of notes, reports, and other supporting data. The data obtained is then processed and calculated according to the assessment criteria of the Greenship Existing Building of 1.1 version to obtain the results of the analysis, which was later used as a reference in the assessment. After being analyzed and obtaining the percentage of the total rating, then classified according to the green building rating level. If the analysis results are ≤ 35 points or a percentage ≤ 35%, the building does not apply the green building concept.

3. Research Method and Materials

3.1. Research Location

The Southeast Minahasa Regent's office is on Jalan Soekarno, North Lowu, Ratahan District. The land area of the Regent's Office is approximately 5614 m². This 3-storey building has a building area of 3448 m². This building was completed in early 2021. Currently, the building is used by the Regent, Deputy Regent, Regional Secretariat, Assistant for General Administration, Assistant for Government and People's Welfare, and Assistant for Economy and Development.

3.2. Analysis of Greenship Conformity Criteria in the Office Building of the Southeast Minahasa Regent

a. Appropriate Site Development (ASD)

In the appropriate land use category, there are two prerequisite criteria and seven criteria with 16 points.

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Table 1. Results of Appropriate Land Use Category (ASD) Rating

Code	Criteria	Points
ASD P1	Site Management Policy	P
ASD P2	MotorVehicle Reduction Policy	P
ASD 1	Community Accessibility	0
ASD 2	Motor Vehicle Reduction	0
ASD 3	Site Landscaping	0
ASD 4	Heat Island Effect	1
ASD 5	Storm Water Management	0
ASD 6	Site Management	0
ASD 7	Building Neighborhood	0
	Total Acquired Value	1

Source: Measurement results, 2023

b. Energy Efficiency and Conservation (EEC)

There are two prerequisite criteria in the energy conservation and efficiency category: five criteria with 36 points and two with eight bonus points

Table 2. Results of the Energy Efficiency and Conservation Category Rating

Code	Criteria	Points
EEC P1	Policy and Energy Management Plan	P
EEC P2	Minimum Building Energy Performance	P
EEC 1	Optimized Efficiency Building Energy Performance	0
EEC 2	Testing, Re-commissioning or Retro-commissioning	2
EEC 3	System Energy Performance	2
EEC 4	Energy Monitoring and Control	0
EEC 5	Operations and Maintenance	2
EEC 6	On-Site Renewable Energy	0
EEC 7	Less Energy Emissions	0
	Total Acquired Value	6

Source: Measurement results, 2023

c. Water Conservation (WAC)

In this category, there is one prerequisite criterion and six criteria which have a maximum total score of 20 points.

Table 3. Results of the Water Conservation Category Rating

Code	Criteria	Points
WAC P	Water Management Policy	P
WAC 1	Water Sub-Metering	0
WAC 2	Water Monitoring Control	0
WAC 3	Fresh Water Efficiency	0
WAC 4	Water Quality	0
WAC 5	Recycled Water	0
WAC 6	Potable Water	0
WAC 7	Deep Well Reduction	0
WAC 8	Water Tap Efficiency	0
	Total Acquired Value	0

Source: measurement results, 2023

d. Material Resource and Cycle (MRC)

There are three prerequisite and five criteria in the material sources and cycles category with a maximum total score of 12 points (Table 4).

e. Indoor Health and Comfort (IHC)

There is one prerequisite criterion, and eight criteria in the Health and Comfort in Space category that have a maximum total score of 20 points (Table 5).

f. Building Environment Management (BEM)

The Building Environment Management category has one prerequisite criterion and five criteria with a maximum total score of 13 points (Table 6).

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Table 4. Results of Material Source and Cycle Category Rating

Code	Criteria	Points
MRC P1	Refrigerant Fundamentals	P
MRC P2	Material Purchasing Policy	P
MRC P3	Waste Management Policy	P
MRC 1	Non-ODS Usage	2
MRC 2	Materials Purchasing Practice	0
MRC 3	Waste Management Practice	1
MRC 4	Hazardous Waste Management	0
MRC 5	Management of Used Goods	0
	Total Acquired Value	3

Source: Measurement results, 2023

Table 5. Results of Health and Comfort Rating in Space

Code	Criteria	Points
IHC P	No Smoking Campaign	P
IHC 1	Outdoor Water Introduction	0
IHC 2	Environmental Tobacco Smoke Control	2
IHC 3	CO2 and CO Monitoring	0
IHC 4	Physical, Chemical, and Biological Pollutants	1
IHC 5	Thermal Comfort	1
IHC 6	Visual Comfort	0
IHC 7	Acoustic Level	0
IHC 8	Building User Survey	2
	Total Acquired Value	6

Source: Measurement results, 2023

Table 6. Results of Building Environment Management Rating

Code	Criteria	Points
BEM P	Operation and Maintenance Policy	P
BEM 1	Innovations	0
BEM 2	Design Intent and Owner's Project Requirement	2
BEM 3	Green Operation and Maintenance Team	0
BEM 4	Green Occupancy/Lease	0
BEM 5	Operations and Maintenance Training	0
	Total Acquired Value	2

Source: measurement results, 2023

Based on the results of the analysis above, recommendations are needed for the Southeast Minahasa Regent's Office building to increase point values, as follows:

a) Provide at least five public facilities within a distance of 500m from the site, public transportation stops within 300m of the building area. Thus, bus stops can be placed along Jalan Soekarno and provide pedestrian facilities to connect existing public facilities.
b) Provide supporting facilities for cyclists. It is expected that the use of bicycles to work will increase. In addition, bicycle parking should also be equipped with a security system to lock bicycles. As an additional point on the third benchmark, bathroom shower facilities are also provided to fulfill these criteria.
c) Build a terrace garden beside the building, a vertical garden on the side of the wall in the parking area, and use 60% local plants.
d) Build the infiltration wells in order to prevent or reduce the occurrence of floods and stagnant water.
e) Implementation of SOP for controlling pests and weeds using non-toxic materials.
f) Install kWh meters for each load and equipment system, including those that are separated, such as kWh meters for the air conditioning systems, lighting systems for the use of lamps, and contacts for plug load (stop contact) system, in order to determine the amount of electrical energy consumption from each of these loads.

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g) The use of new and renewable energy sources, one of which is currently widely used, namely photovoltaic (PV) technology, better known as solar panels, as an energy source that utilizes solar energy.
h) Installation of a water consumption sub-meter to determine the amount of water consumption used in the building.
i) Carry out the implementation and maintenance of equipment in the plumbing system using it according to the procedure every 6 months.
j) If water consumption is 20% above SNI 03-7065-2005, the efforts must be carried out to reduce water consumption. Every 10% decrease gets 1 point. If it can be lowered, every 3% decrease will get 1 point.
k) To meet the water quality criteria, laboratory tests are required on primary source water every 6 months.
l) Use the auto stop feature to use 80% of the total faucet units in public areas.
m) Develop Standard Operating Procedures, training, and reports for collecting and selecting organic waste, inorganic waste, and B3 waste. After selecting waste, processing organic waste and inorganic waste independently or in collaboration with an official body for processing organic waste and inorganic waste, which adheres to the 3R principle (Reduce, Reuse, Recycle).
n) Install a CO2 gas sensor installation which has a mechanism to regulate the amount of outside air ventilation so that the CO_2 concentration in the room is not more than 1.000 ppm. The sensor is placed 150cm above the floor near the return air grille.
o) Collaborate with laboratories to conduct indoor air quality testing, to determine levels of pollutant gases, dust levels, levels of Volatile Organic Compound (VOC), levels of formaldehyde, levels of asbestos, and levels of bacteria.
p) The building manager can participate in or provide a training program on the concept of green building.

4. Conclusion

In the Southeast Minahasa Regent's Office building, three prerequisites meet, namely Energy Conservation and Efficiency (EEC P2), Material Sources and Cycle (MRC P1), and Spatial Health and Leisure (IHC). The points for implementing Green Building at the Southeast Minahasa Regent's Office are 18 points with a percentage of 15.38%. So that the total value of 18 points ≤ 35 minimum with a Bronze rating. So the Southeast Minahasa Regent's Office Building cannot be said to be a building with a Green Building concept. Suppose the Southeast Minahasa Regent's Office Building can apply some of the recommended credit and bonus criteria. In that case, the building can be categorized as a Green Building, with the rating obtained being Silver with a total value of 53 points with a percentage of 45.3%.

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