

# The Evaluation of Low-Cost Apartment Building Lampung University (Rusunawa Unila) Using Greenship Rating Tools for Existing Buildings

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## Article Information:

Received:  
11 July 2024

Received in Revised form:  
30 October 2024

Accepted:  
29 November 2024

Volume 6, Issue 2, December 2024  
pp. 95 – 102

<http://dx.doi.org/10.23960/jesr.v6i2.171>

## Abstract

The assessment of the green building at the Rusunawa Lampung University was conducted using the Greenship Rating Tools for Existing Building Version 1.1. Measurements were carried out to examine the overall sub-criteria of each greenship assessment category. The greenship rating tools for existing buildings version 1.1 are quite complex, as there are 6 (six) feasibility tests and sub-criteria. Based on field measurements and analysis of the green building assessment criteria using the greenship existing building rating tools version 1.1 at the Rusunawa Unila, as there used rating score of 17 points. The final result, the Rusunawa Building Lampung University does not have a rating for the Green Building criteria. To achieve a minimum bronze rating, and an assessment of the greenship assessment categories, the parties felt necessary to obtain recommendations for the improvements according to the assessment matrix that can enhance the Green Building rating for Rusunawa Lampung University.

**Keywords:** Greenship Rating Tools, Green Building, Existing Building.

## I. INTRODUCTION

The term of green building refers to high-rise structures or residential homes designed with a focus on health and comfort aspects. Additionally, green buildings play a role in reducing energy consumption, minimizing water usage, and decreasing environmental waste.

The concept of green building is evident from the initial planning stage of a structure, extending through construction and continuing into the operational phase after its utilization. From the selection of building materials to the utilization of resources and energy usage, everything must align with environmental principles and sustainable development.

In Indonesia, there is an annual increase in demand for building construction due to a 1,25% population growth rate per year in 2020, according to data from the Central Statistics Agency. Such development has the potential to produce carbon gas emissions exceeding 40%, which can significantly impact environmental quality and contribute to global warming (Ervianto, 2012).

Lampung University (UNILA) is one of the universities in Indonesia that actively participates in implementing green development initiatives. UNILA is committed to the concept of a smart, friendly, and forest campus, and also committed to innovate in green building development. UNILA is dedicated to becoming a sustainable and welcoming university for all academic communities and the public.

This research focused on the Rusunawa Lampung University, conducting measurements according to the Green Building criteria based on the Greenship Rating Tools for Existing Building Version 1.1. The measurements were carried out to assess the overall sub-criteria of each Greenship assessment category.

This study aims to determine the Green Building rating of the Lampung University Rusunawa Building using the Greenship Rating Tools for Existing Building Version 1.1.

## II. MATERIALS AND METHODS

### A. Location

The research location was at the Rusunawa Building of Lampung University, located at Jl. Prof. Dr. Ir. Sumantri Brojonegoro No.1, Bandar Lampung City. The building consists of four floors and is utilized as a dormitory for undergraduate students at Lampung University.



Figure 1. Research Location  
(Source: Google Earth Application)



Figure 2. Lampung University's Rusunawa Building  
(Source: Google Earth Application)

### B. Theoretical Framework

Green Building or sustainable building, is a concept encompassing the design, construction, operation, and maintenance of buildings. This concept aims to preserve environmental health, enhance occupant productivity, ensure efficiency in the use of natural resources, and reduce negative impacts caused by surrounding developments (Gupta, 2013).

In general, Green Building is a concept that aims to improve efficiency in the use of resources required to construct a building or area. The resources utilized include water, energy, and other materials.

Implementing this concept is expected to mitigate negative impacts affecting human health and the surrounding environment (Sulistiyanto, 2011).

GreenShip is a green building standard developed by the Green Building Council Indonesia (GBCI). The Green Building Council Indonesia (GBCI) is an independent institution committed to promoting public education and encouraging building practitioners to apply environmentally friendly practices and transition to sustainable building industries. The institution was founded by professionals in the design and construction sectors who were concerned about the implementation of green buildings in Indonesia in 2009.

According to GBCI (2021), a building is considered to have adopted green building principles if it has undergone an evaluation process using a rating system as a benchmark for the assessment. This system comprises assessment aspects that assign points if met. The total points obtained then can be certified at the provided certification level.

Before initiating the rating assessment process, buildings must undergo an evaluation to meet the eligibility criteria stipulated by GBCI. These criteria encompass:

- a) A minimum building area of 2500 m<sup>2</sup>. For this assessment, required documents include drawings demonstrating the building layout covering an area of 2,500 m<sup>2</sup>, accompanied by floor area details.
- b) Building function compatible with the land use designation based on the Regional Spatial Plan (RTRW) of the area.
- c) Possession of an Environmental Impact Analysis (AMDAL) plan or Environmental Management Effort (UKL) and/or Environmental Monitoring Effort (UPL).
- d) Compliance with fire protection standards.
- e) Compliance with earthquake resistance standards.
- f) Compliance with accessibility standards for persons with disabilities.

Once the building satisfies the initial evaluation prerequisites, it can undergo a rating assessment classified by the Green Building Council of Indonesia (GBCI) into six GreenShip categories, namely:

- 1) *Appropriate site development*
- 2) *Energy efficiency and conservation*
- 3) *Water conservation*
- 4) *Material resource and*
- 5) *Indoor health and comfort*
- 6) *Building environmental management*

### C. Methods

Research variables utilized include green building categories based on the rating system provided in the

GreenShip assessment tool for existing buildings Version 1.1. These variables encompass six eligibility tests and selected sub-criteria derived from general variables referring to the Green Building Council Indonesia (GBCI).

Data used in this research consisted of (a) Primary data, which were collected and processed by the researchers. Primary data were obtained through direct observation, measurements using tools, interviews with building management, user comfort questionnaires, photographic documentation, and (b) Secondary data, obtained from other parties and documented for use by other parties (researchers). Secondary data included literature studies, data from building management such as floor plans and site plans of the Lampung University's Rusunawa Building, as well as GreenShip assessment tools according to the building's conditions.

Research instruments to be used in the Rusunawa Building Lampung University include: (a) Literature studies required for the preparation of this research. (b) Observation or direct observation. Data from direct observation were obtained from a checklist form of building eligibility requirements and greenShip prerequisite categories, criteria categories, and greenShip bonuses. The checklist comprises a set of statements arranged based on criteria outlined in greenShip, providing response columns to be filled with "yes" or "no" along with additional explanations. The aim is to collect field data using audit techniques, (c) Research equipment used to assist the researcher in collecting primary data. Primary data were collected in rooms according to the provisions of the GreenShip Rating Tools for Existing Building Version 1.1 form or rooms with the most dominant user activities, (d) Interviews, where the interviewees in this research were building household staff to obtain information related to building operation and maintenance. The information obtained should be supported by formal documents, (e) Questionnaires used to facilitate surveys regarding user comfort in the building, including building cleanliness, room conditions (temperature), sound comfort, room lighting levels, and the presence of pest control. Selected respondents constitute a minimum of 30% of the total building users, (f) Documentation, involving the collection of information in the form of photos aimed at capturing the existing conditions of the building according to greenShip benchmarks.

Data collection utilized methods tailored to the GreenShip Rating Tools for Existing Building Version 1.1, as follows:

- a) Method for Eligibility Measurement,
- b) Method for Prerequisite Criteria Measurement, which are criteria that must be fully met beforehand.

If these criteria are not met, credit and bonus assessments cannot be carried out. Eligibility measurements are conducted before the assessment

process.

Data were obtained from observation results, field measurements, interviews, documentation, and distribution of questionnaires to selected respondents, supported by necessary secondary data during the research to obtain data in line with GreenShip assessment criteria for Existing Building Version 1.1. All collected data were then processed and calculated to obtain analysis results, which would be used as a reference for assessment.

Subsequently, the next step involved analyzing the processed primary and secondary data for each criterion in the GreenShip Existing Building Version 1.1 category. Following this, points were obtained for each criterion and could be totaled to determine the overall points acquired.

Lastly, the final assessment (FA) stage was conducted, with a maximum score of 117 points. This stage was to determine the overall performance of the building, thereby establishing the GreenShip rating level for Rusunawa Building. GreenShip rating levels include Platinum, Gold, Silver, and Bronze. The assigned rating reflects the extent of Green Building concepts applied based on GBCI standards.

### III. RESULTS AND DISCUSSIONS

Lampung University has three Rusunawa, the first Rusunawa was built in 2005 and handed over to Unila in 2007 by the Ministry of Public Housing. The second Rusunawa was built in 2018 and handed over to Unila in 2019 by the Ministry of Public Works and Public Housing. The third Rusunawa was built in 2020 and handed over to Unila in 2023 by the Ministry of Public Works and Public Housing.

Administratively, the research location is located within Lampung University's at Jl. Soematri Brojongoro, Gedung Meneng, Bandar Lampung City, Lampung Province. The Rusunawa location is adjacent to Unila's swimming pool (to the North), Rajabasa terminal (to the South), residents' land (to the West), and marsh/swamp (to the East).

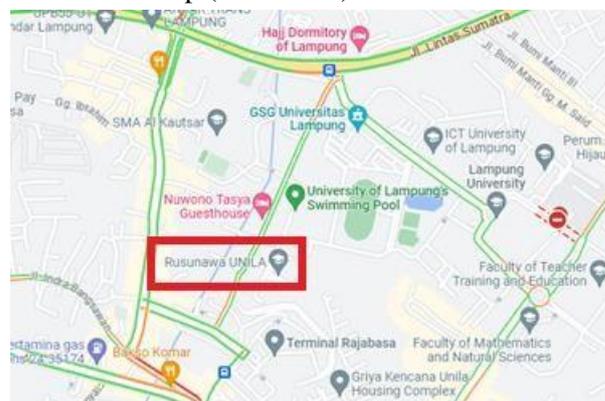


Figure 3. Lampung University's Rusunawa Building Location (Google Maps, 2023)

After the building meets the initial assessment requirements, a rating system can be implemented and categorized by the Green Building Council of Indonesia (GBCI) into six Greenship categories.

### 3.1 Building Eligibility Requirements

In the Republic of Indonesia Law Number 20 of 2011 concerning Apartment Towers, it is explained that apartment towers are multi-story buildings constructed within a divided environment that is functionally structured, both horizontally and vertically, and constitutes units that can be owned and used separately, especially for residential purposes

equipped with shared areas, shared objects, and shared land.

The eligibility criteria outlined in Greenship for Existing Buildings are based on the laws and regulations established by the government. The minimum building area for Greenship application testing is 2,500 m<sup>2</sup>. The total building area is 4,784 m<sup>2</sup>, comprising Building A with an area of 1,438 m<sup>2</sup>, Building B with an area of 2,136 m<sup>2</sup>, and Building C with an area of 1,210 m<sup>2</sup>.

After conducting an analysis of building eligibility based on the Greenship Rating Tools for Existing Buildings, the results obtained are presented in the matrix as shown in Table 4.1 below:

Table 3.1. Building Eligibility Criteria

No.	Criteria	Eligible	Not-Eligible
1.	Minimum building area of 2500 m <sup>2</sup>	✓	
2.	Building function by the land use zoning based on the Regional Spatial Plan (RTRW) of the area	✓	
3.	Have an Environmental Impact Analysis (AMDAL) plan or Environmental Management Effort (UKL) and/or Environmental Monitoring Effort (UPL)		✓
4.	The building meets the standard safety requirements for fire protection	✓	
5.	The building meets appropriate earthquake resistance standards	✓	
6.	The building meets appropriate accessibility standards for people with disabilities		✓

### 3.2. Analysis of Greenship Rating Tools Pre-Requisites for Existing Buildings

Pre-requisites in Green Building assessment are criteria that must be fulfilled and applied in a building. If these criteria cannot be met, then the criteria and benchmarks in a category cannot be evaluated, and the Green Building assessment process cannot proceed. There are 9 (nine) prerequisites in Greenship for existing buildings version 1.1 representing 6 (six) categories.

Table 4.2 below is the matrix of interview results with the Household Staff of the Lampung University's Rusunawa Building, document checks, and field observations, regarding the Pre-Requisites of Greenship Rating Tools for Existing Buildings against the Lampung University's Rusunawa Building.

### 3.3. Analysis Of Compliance Greenship Criteria In Lampung University's Rusunawa Building

The analysis of compliance is obtained by comparing the checklist results with the Greenship regulations used. After adjustments, points are obtained for each criterion, which is then summed up to obtain the total points and determine the rating category in Greenship.

#### 3.3.1. Appropriate Site Development Category

In the appropriate site development category, there are 7 (seven) criteria with a maximum total score of 16 points. After analyzing the calculation results in the Appropriate Site Development category (ASD), several criteria meet the established benchmarks, resulting in 6 points.

#### 3.3.2. Energy Efficiency and Conservation Category

Within the energy efficiency and conservation category, there are 7 criteria with a total maximum score of 36 points. After calculations within the Energy Efficiency and Conservation (EEC) category, some criteria met the established standards, resulting in 1 point.

#### 3.3.3. Water Conservation

In the water conservation category, there are eight criteria with a total maximum score of 20 points. After analyzing the results of the water conservation category (WAC), 5 criteria met the established standards, resulting in a score of 2 points.

**Table 3.2.** Matrix of Prerequisites for GreenShip Assessment Tool

No.	Category	Prerequisite	Fulfilled		
			Yes	No	
1.	ADD	P1	Presence of a formal commitment statement from top management regarding the upkeep of the building's exterior, implementation of integrated pest management (IPM), weed control, and habitat management using eco-friendly materials.	✓	
		P2	The presence of a formal commitment statement from top management to adopt various measures aimed at reducing the reliance on private motor vehicles, such as carpooling, feeder buses, public transport incentives, and differentiated parking tariffs		✓
			Implementation of a campaign to promote the reduction of private motor vehicle usage, with visible and permanent promotional materials on each floor, including stickers, posters, and email announcements.	✓	
2.	EEC	P1	Presence of a formal commitment statement from top management outlining procedures (SOP) for monitoring, setting energy-saving targets, and establishing action plans within specified time frames by the energy management team.	✓	
			Implementation of a campaign to promote energy conservation, accompanied by permanent promotional materials on each floor, including stickers, posters, and email announcements.	✓	
		P2	Display of electrical energy consumption (IKE) data for the past 6 months, demonstrating consumption below the standard reference levels set by GBC INDONESIA (Offices 250 kWh/m <sup>2</sup> .year, Malls 450 kWh/m <sup>2</sup> .year, and Hotels or Apartments 350 kWh/m <sup>2</sup> .year).		✓
			Demonstration of achieving energy savings of 5% or more compared to the average energy consumption of the previous year.	✓	
3.	WAC	P1	Presence of a formal commitment statement from top management detailing procedures (SOP) for monitoring, setting water conservation targets, and developing action plans within specified time frames by the water conservation team.	✓	
			Implementation of a campaign to promote water conservation, with visible and permanent promotional materials on each floor, including stickers, posters, and email announcements.		✓
4.	MRC	P3	Presence of a formal commitment statement from top management addressing waste management practices, including the separation of Organic Waste, Inorganic Waste, and Hazardous Waste, along with a campaign to encourage proper waste sorting behavior.		✓
			Implementation of a campaign to promote waste segregation, supported by visible and permanent promotional materials on each floor, including stickers, posters, and email announcements.		✓
5.	IHC	P1	Existence of a formal commitment statement from top management aimed at minimizing smoking activities within the building premises.		✓
			Implementation of a no-smoking campaign highlighting the adverse effects of smoking on health and the environment, with visible and permanent promotional materials on each floor, including stickers, posters, and email announcements.		✓
6.	BEM	P1	Development of an operation and maintenance plan aligned with the objectives of GREENSHIP EB ratings, focusing on Mechanical and Electrical Systems, plumbing systems, water quality, building maintenance, procurement, and waste management.	✓	
			Inclusion of organizational structure, Standard Operating Procedures (SOPs), training programs, work schedules, budget allocation, and quarterly reporting requirements.		✓

### 3.3.4. Material Resource and Cycle

In the material resource and cycle category, there are 5 criteria with a maximum total score of 12 points. After the analysis in the Material Resource and Cycle (MRC) category, none of the criteria meet the established benchmarks, resulting in 2 points for the Lampung University's Rusunawa Building.

### 3.3.5. Indoor Health and Comfort

In the indoor health and comfort category, there are eight criteria with a maximum total score of points. After the analysis in the Indoor Health and Comfort (IHC) category, several criteria meet the established benchmarks, resulting in nine points.

### 3.3.6. Building Environmental Management

In the building environmental management category, there are 5 criteria with a maximum total score of 13 points. The criteria used are:

1. Innovation

2. Project Owner and Design Policy
3. Environmentally Friendly Maintenance and Operational Team
4. Green Contracts
5. Operation, Maintenance, and Training

After analysis, it was found that none of the listed criteria and benchmarks had been applied. Some criteria could be studied if the building were to be registered for assessment. Therefore, for the building environmental management category, Lampung University's Rusunawa Building did not receive any points.

### 3.4. Determination of GreenShip Rating

All the assessments above were then tabulated into the GreenShip rating tools matrix for existing buildings version 1.1. Subsequently, the final assessment (FA) was conducted, with a maximum score of 117 points. The final score obtained by the Lampung University's Rusunawa Building is explained in Table 4.3.

**Table 3.3** Final Result of GreenShip Rusunawa Universitas Lampung

Code	Criteria	Maximum Value	Value
ASD 1	Community Accessibility	3	1
ASD 2	Reduction of Motorized Vehicles	2	9
ASD 3	Landscape on Land	3	3
ASD 4	Urban Heat Island Effect	2	0
ASD 5	Rainwater Runoff Management	2	0
ASD 6	Site Management	2	1
ASD 7	Building Environment	2	1
<b>SUBTOTAL</b>		<b>16</b>	<b>6</b>
EEC 2	Testing, Recommissioning, or Retro-Commissioning	2	0
EEC 3	Energy System Utilization	12	1
EEC 4	Energy Supervision	3	0
EEC 5	Implementation and Maintenance	3	0
EEC 6	On-site Renewable Energy	5 (bonus)	0
EEC 7	Energy Emission Reduction	3 (bonus)	0
<b>SUBTOTAL</b>		<b>36</b>	<b>1</b>
WAC 1	Water Sub-Metering	1	1
WAC 2	Water Monitoring	2	0
WAC 3	Clean Water Efficiency	8	0
WAC 4	Water Quality	1	0
WAC 5	Water Recycling	5	1
WAC 6	Drinking Water	1	0
WAC 7	Reduction of Deep Well Usage	2	0
WAC 8	Tap Water Efficiency	2 (bonus)	0
<b>SUBTOTAL</b>		<b>20</b>	<b>2</b>
MRC 1	Non-ODS Usage	2	2
MRC 2	Material Procurement	3	0
MRC 3	Waste Management	4	0
MRC 4	Hazardous Waste Management	2	0
MRC 5	Used Goods Management	1	0

<b>SUBTOTAL</b>		<b>12</b>	<b>2</b>
IHC 1	Outdoor Air Introduction	2	0
IHC 2	Cigarette Smoke Control	2	2
IHC 3	CO <sub>2</sub> and CO Monitoring	2	0
IHC 4	Physical, Chemical, and Biological Pollution	8	2
IHC 5	Thermal Comfort	1	0
IHC 6	Visual Comfort	1	0
IHC 7	Noise Level	1	1
IHC 8	Building User Survey	3	1
<b>SUBTOTAL</b>		<b>20</b>	<b>6</b>
BEM 1	Innovation	5	0
BEM 2	Owner and Design Policy	2	0
BEM 3	Environmentally Friendly Maintenance and Operations Team	2	0
BEM 4	Green Contracts	2	0
BEM 5	Operations, Maintenance, and Training	2	0
<b>SUBTOTAL</b>		<b>13</b>	<b>0</b>
<b>Total Maximum Score</b>		<b>117</b>	<b>17</b>

Based on the assessment results, the Rusunawa building of Lampung University does not meet the requirements, even for the lowest Green Building category. The minimum points to achieve a bronze rating is 35, while Lampung University's Rusunawa Building only scored 17 points.

To qualify for at least a bronze rating, a thorough study of the Greenship assessment categories is needed to provide recommendations for improvements according to the assessment matrix, which can enhance the point acquisition

#### IV. CONCLUSIONS

Based on field measurements and analysis of the green building assessment criteria using the Greenship existing building version 1.1 assessment tool at the Lampung University's Rusunawa Building, a score of 17 points was obtained. With a score of 17 points, Lampung University's Rusunawa Building does not have a rating for green building criteria. To qualify for at least a bronze rating, a study of the Greenship assessment categories is necessary to provide recommendations for improvements according to the assessment matrix, which can enhance the Green Building rating.

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