Assessment Of Environmentally-Friendly Building Criteria Using Fuzzy Simple Additive Weighting (FSAW) Method To Support Energy-Saving Movements (Study: Office Building Pringsewu Regency)

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ABSTRACT

The recent energy crisis forces everyone to have a conscious awareness of energy. Energy-saving activities can be done in various ways such as turning off unused lights, turn on television as necessary and many more activities undertaken one of them is building a that has an environmentally friendly concept. The purpose of this research is to know the rating / certification as a benchmark of how far the application of green building office criteria in Pringsewu Regency. The research used qualitative and quantitative descriptive method and using Fuzzy Simple Additive Weighting Analysis (FSAW). The result of research shows that the application of environmentally friendly building in Office Building Pringsewu Regency has not been done completely, based on 27 items of environmental friendly building assessment criteria, there are only few categories that can be fulfilled either in the concept of building and the concept of the management or the occupant of building.

Keywords: Environmentally Friendly Building, FSAW

1. Introduction

The energy crisis is getting special attention for the countries in the world, as energy demand continues to increase as the world population increases. Energy is needed in all areas of life, not only for the needs of households, government, state-owned enterprises, BUMDs, private etc. require the amount of energy supply a lot, human development is increasingly making energy also increases. The energy crisis in Indonesia has started to show symptoms. In 2015, Indonesia is estimated to be short of oil and gas supply of 2.4-2.5 million BOEPD. It is predicted that there will be no new reserves around 11-12 years later Indonesia will run out of oil and gas and become net importer.

Industrial development in all fields after the industrial revolution that ultimately makes the need for energy increasingly bloated. Executive Director of the Indonesian Petroleum Association (IPA) Dipnala Tamzil said energy demand in 2010 was 3.3 million BOEPD. Energy demand exists in all forms, such as oil, gas, and coal. By 2025, energy demand will increase to 7.7 million BOEPD. Of these, the proportion of energy from oil and gas is currently about 47 percent.

The Indonesian government has now announced to begin national energy savings, in the form of fuel savings, electricity and water savings in government offices, state-owned enterprises, local companies and street lighting. One of the real efforts that can be done is to apply the Green Building Concept. The Green Building concept is one of the energy-saving steps that can be applied to buildings, as it will be more energy efficient, designed, built and operated to minimize total environmental impact (Greenship, 2011).

This concept can be applied to commercial buildings, offices and also in various universities in Indonesia. The concept of Eco-Campus, one of which includes the application of green building concept that has been developed throughout the campus in Indonesia.

Therefore, it is necessary to study the application of green building assessment criteria in office buildings in Pringsewu Regency, to know the assessment /

certification as a benchmark of how far the level of application of green building office building criteria in Pringsewu Regency, This research can also be used as the green building program in the future. The existence of research on green building performance criteria especially in Pringsewu Regency is expected to be used as a comparison to study other buildings in all districts in Pringsewu Regency especially hotel buildings, campuses, and others, as part of efforts to adjust green building criteria.

Goals and Objectives
The expected objectives of this research are:
a. Identify the application of environmentally friendly buildings (green building) in office buildings in Pringsewu Regency.
b. Obtained information on the extent to which the application of green buildings in office buildings in Pringsewu Regency

2. Research Method.

Data of Respondents
By distributing questionnaires to residents of office buildings in the Pringsewu Regency office complex.

Water consumption
Water consumption can be calculated by multiplying the use of water multiplied by the amount of water consumption and multiplied by the number of daily work.
Example:
Attendance of each occupant per day is 47 people, with requirement per person is 50 liter / person / day. Water requirement in ITS office of university head Building every day:
= 52 people x 50 liters / person / day
= 2600 liters / day x 22 days
= 57200 liters per month.

Electricity Consumption
Electricity consumption can be seen from the evidence of electricity payment every month, and from there can be seen the electricity consumption every day.

Temperature
The room temperature measurements use a space thermometer at a predetermined point and repeated three times.

Measurement of Light Intensity
The measurement of light intensity is done on each research plot and averaged, with Luxmeter prepared and opened Luxmeter cover and then turned on. Wait until the number on the Luxmeter screen is constant and record the numbers listed.

3. Discussion.

Measurement result:

No	Point	Temperature (^{0}C)	Light Intensity
1	1	31	13 X 2000
2	2	29	20 X 2000
3	3	29	10 X 2000
4	4	28	1 X 2000
5	5	28	27 X 2000
6	6	30	1 X 2000
7	7	28	32 X 2000
8	8	28	5 X 2000
9	9	27	65 X 2000
10	10	29	1 X 2000
11	11	27	104 X 2000
12	12	30	3 X 2000
13	13	31	200 X 2000
14	14	28	14 X 2000
15	15	29	30 X 2000

Light intensity
Based on the measurement, the dependence of office building on the use of lighting is very dominant, it is clear when the lights are turned off then that happens there are some rooms that become dark because of the lack of light access into the room.
The room is dark and covered with no light coming in, the condition would be very humid and had poor air quality. There are two types of lighting, namely natural lighting and artificial lighting. Indoor lighting is very important, especially in the form of natural lighting. This is because the sun exposed to the room is one powerful way to eradicate and kill germs in the room.

Air temperature
Basically everyone's bodies produce heat. As much as 20% of the heat generated is used for basal and muscle metabolism. Then what the rest? As much as 80% of the rest are released. When in a room, the body adjusts to the temperature in the room. Weight of room temperature is too high or

low, can affect our comfort and health. Then how to know the ideal room temperature? To find out can be done by measuring using the air humidity gauge. If there is a sudden change in temperature of more than 70C from the temperature it should, can lead to the shrinking of blood vessels. Therefore, it is recommended that the temperature difference inside and outside the room be the ideal temperature conditions in the area of recidence.

Simple Additive Weighting Method (SAW)

The Simple Additive Weighting (SAW) method is often also known as the weighted sum method [6]. The basic concept of the SAW method is to find the number of performance rating weights on each alternative on all attributes. The SAW method requires the process of normalizing the decision matrix (X) to a scale proportional to all existing alternative ratings.

The steps in the SAW method [6], namely:
1. Determination of Alternatives and Criteria
2. Determination of the value of twig each criterion.
3. Determination of the weight value of each criterion (W).
4. Making decision matrix (X)
5. Normalize Matrix Decision (R)
   a.If j is a benefit attribute (benefit):
   b.If j is a cost attribute (cost):
   with Rij is a normalized performance rating of Ai alternatives and on the Ci criterion; i = 1,2, ..., m and j = 1,2, ... n
6. Look for the preference value (Vi) for each alternative, with the formula:
   $= \Sigma = 1Wj\ Rij$
   Vi = preference value of each alternative
   W = weight of each criterion
   R = value of each participant after normalization.
   A larger value of Vi indicates that Ai's main priority is selected.

4. Conclusion.

Based on the results of the analysis above, then drawn some conclusions, among others:

1. Office buildings in Pringsewu Regency office environment have not applied the concept of environmentally friendly building.
2. The criteria that exist in the office building only fulfilled some category items.

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