

## The Implementation Green Building at Syamsudin Noor Airport

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### Abstract

The development of Syamsudin Noor Airport is expected to have a major impact on the economy of the people of South Kalimantan. However, the construction of airports will have an impact on the environment due to the increasing number of human activities. And to anticipate these adverse effects, Syamsudin Noor Airport applies the concept of Green Building. The research method used in this research is a qualitative descriptive research method. This research uses several data collection techniques, including interviews, observation and documentation. The purpose of this study is to provide a descriptive picture of the extent to which Syamsudin Noor Airport has implemented the concept of green building. From the observations, Syamsudin Noor Airport has implemented green buildings such as solar panels, the use of bright glass that allows natural light to enter the terminal space, wastewater treatment facilities, green open spaces in the airport terminal area, bicycle parking and shower compartments, room temperature settings that create comfort in working, and the presence of no-smoking signs. With the implementation of green buildings at Syamsudin Noor Airport to meet the service standards set in the Presidential Law of the Republic of Indonesia No. 1 of 2009, supporting an environmentally friendly workplace and reducing operational costs.

**Keywords:** environment, green building, global warming, Syamsudin Noor Airport.

### I. INTRODUCTION

As a large and vast archipelagic country, Indonesia's need for air transportation is absolute. The increasing public need for air transportation has resulted in all levels of society needing air transportation in carrying out travel activities considered faster, more efficient and economical. So it is undeniable if until now air transportation or aircraft has become a mode of transportation that is often used for long-distance flights such as from one country to another, from island to island, in addition to being faster, aircraft can also reach small islands in Indonesia [1].

Looking at the situation and conditions in Indonesia where there is a need for air transportation facilities, every province has an airport. One of the airports in Indonesia is Syamsudin Noor Airport in South Kalimantan Province. The development of Syamsudin Noor Airport is expected to have a major impact on improving the economy of the regional community. However, the development of airport construction will have an impact on the environment [2].

To anticipate the adverse impact on the environment, Syamsudin Noor Airport applies the concept of Green Building (Eco Building) which aims to save energy in the airport terminal area to meet the service standards set in the Presidential Law of the Republic of Indonesia No. 1 of 2009. Eco Building which is part of green building is one of the alternative options for eco friendly development.

Eco building is an architectural design that produces sustainable construction, which aims to protect the natural environment by using energy efficient technology and appropriate materials so as to minimize waste of resources. It is expected that by using eco-building design can reduce pollution and environmental damage which is the problems in Indonesia [3]. Green building is also known as a sustainable or high performance building [4].

Green buildings are designed to reduce negative environmental impacts by operating efficiently and minimizing the discharge of pollution and waste. Decreased utilisation of energy and water, enhanced indoor air quality, improved well-being and productivity, superior property value, among others, are often cited advantages related to green building. Green building is the act of increasing the efficiency of buildings through their utilization of water, energy and materials and also involves lessening the effect of the building on human well-being and the environment. It also involves finding the balance between building development and the sustainable environment. Awareness of green building is important if practitioners in the property development industry are to promote reduced building footprints adversely impacting the environment holistically [5].

The establishment of green buildings is not only from the aspects of energy efficiency, water, material, and land use but also comfort, health, environmental sustainability aspects, and the benefits of building owners (see Table 1) [6].

Table 1. Barriers of the green building concept implementation in some countries

Rating tools name	BREEAM 2013	LEED	CASBEE	Green Star	Green Marik 4.1	Green Building Index	DGBN 2011	Greenship ver 1.2
Found Year	1990	1993	2001	2003	2005	2009	2009	2009
Country	UK	USA	Japan	Australia	Singapore	Malaysia	Germany	Indonesia
Site Development	5%	24%	17%	7%	22%	-	23%	17%
Transport	8%	-	-	9%	-	-	-	-
Energy Conversation	27%	32%	17%	25%	61%	35%	-	26%
Water Efficiency	8%	9%	8%	14%	9%	10%	-	21%
Material Resources	11%	13%	8%	13%	-	11%	-	14%
Indoor Health & Comfort	9%	14%	17%	15%	4%	21%	23%	10%
Building Management	20%	-	17%	9%	-	16%	10%	13%
Pollution	5%	-	17%	8%	-	-	-	-
Waste	6%	-	-	-	-	-	-	-
Innovation (green features)	2%	6%	-	-	4%	7%	23%	-
Regional Priority	-	4%	-	-	-	-	-	-
Economic	-	-	-	-	-	-	23%	-

Table 1 shows that the concept of green building starts to implement from developed countries then experience adaptation and adoption by developing countries in the world. Therefore, in general green building rating tools accommodate the building's achievement in sustainable concepts such as economic aspects, environmental development, level of knowledge, and regional policies. They will test towards aspects of sustainability, efficiency, comfort, and manageability [6, 7]. Therefore, an assessment of the key success factors in implementing the green building concept is an effort to count the number of buildings in each country to know the growing number of the users' concept. Based on data showing that of all countries with ownership of green building rating tools, Indonesia is the country with the lowest growth of three buildings annually compared to several countries in Asia such as Hong Kong, Singapore, and Malaysia, shows 48, 170, and 35 buildings annually from 2009 to 2013 [8,9].

Based on the impact of global warming that occurs due to excessive water and energy use, increasing development followed by economic development results in increasing energy needs. Based on data from customer complaints related to the comfort and cleanliness of the Syamsudin Noor Airport terminal area is quite extensive which will have an impact on the company's image. During the COVID-19 pandemic starting from 2020 to 2021, there was a significant decrease in passenger traffic in line with the company's Cost Leadership Program related to balancing between expenses and operational costs at Banjarmasin Syamsudin Noor Airport, in maintaining airport service user service standards (green building implementation) with budget optimization set by the company continues to run effectively and efficiently, The effort made is to carry out a strategy that is effective in a good supervision process in achieving more efficient results with limited budget and the number of human resources that are not comparable to the number of facilities at Banjarmasin Syamsudin Noor Airport. Given that in 2022 there has been a significant increase in the amount of tax, companies are required to take preventive steps in trying to implement the concept of green building, maintaining standards which is one of the prerequisites set in accordance with the Presidential Law of the Republic of Indonesia No. 1 of 2009.

## II. METHODS

The research method used in this research is a qualitative descriptive research method. Qualitative research is research that involves data analysis in the form of descriptions and the data cannot be directly quantified. This type of research attempts to transform research objects into a form that can be presented, such as field notes, interview results, conversations, photographs, recordings and memos. This research was conducted at PT. Angkasa Pura Syamsudin Noor Airport, Banjarmasin.

This research uses several data collection techniques, including interviews, observation and documentation. For the interview, an unstructured interview technique was chosen to adapt to the situation and conditions while in the field. The interview was based on open questions asked by the researcher. The next data collection technique is observation, this technique is used to observe the implementation of the green building concept at Syamsudin Noor Airport.

This observation is carried out to better understand the object of observation being researched and to discover things that were not revealed during the interview. The third data collection technique is documents. This technique is carried out to complement research results from interviews and observations.

## III. RESULT AND DISCUSSION

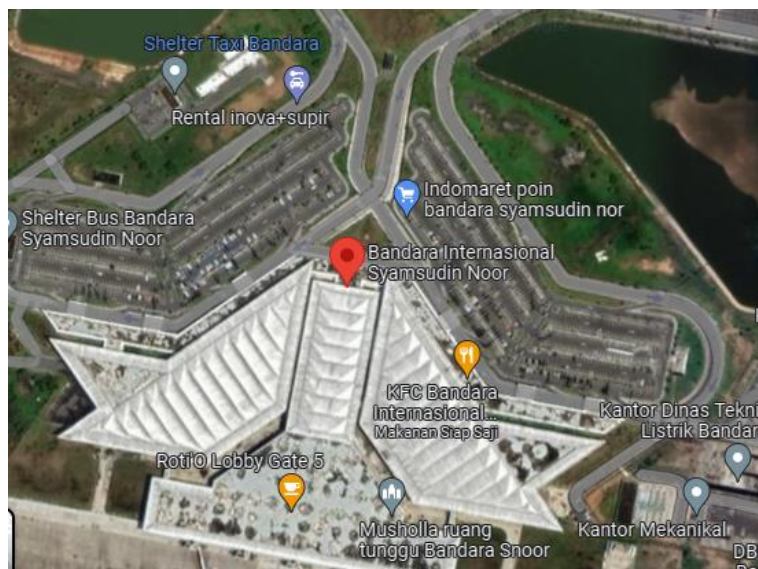


Figure 1. Syamsudin Noor Airport

Syamsudin Noor Airport continues to strive to implement the concept of green building in the context of concern for the environment. In figure 2, you can see the factors causing problems in implementing the green building concept at Syamsudin Noor Airport as below :

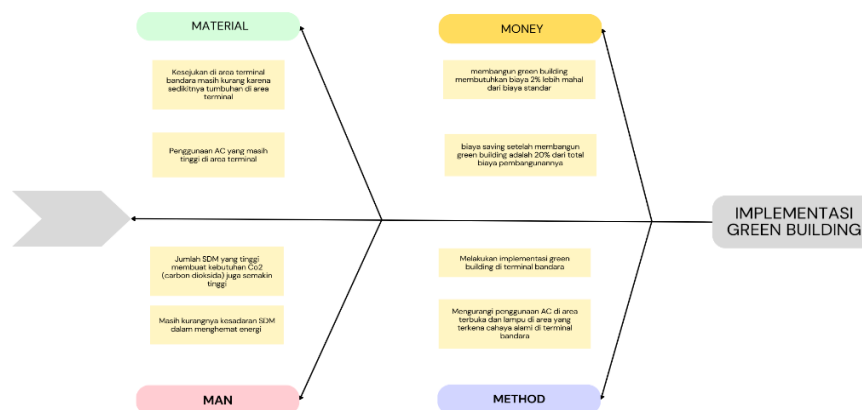


Figure 2. Fishbone Factors Problems Implementing the Green Building Concept at Syamsudin Noor Airport

From figure 2 above, the problem factors in the application of the green building concept are divided into 4 main factors, namely :

1. Materials

Material factors include two things, namely the coolness in the airport terminal area is still lacking because of the lack of plants in the airport area and the use of Air Conditioner (AC) which is still high.

2. Money

The money factor includes two things, namely building a green building costs 2% more expensive than the standard cost and the cost of saving after building a green building is 20% of the total construction cost.

3. Man

Human factors include two things as well, namely the large number of Human Resources (HR) working in the airport area produces high CO<sub>2</sub> and workers still lack awareness in saving energy.

4. Method

Implement green building at the airport and reduce the use of air conditioning in open areas and lights in the airport area as much as possible using natural lighting.

Based on the factors causing problems that have been identified using Fishbone Diagram, it can be concluded that the cause of the implementation of green building at Syamsudin Noor Airport Terminal global warming continues to occur due to increasing human activities and needs. This of course will have an impact on humans because global warming will be very detrimental. Where health problems and discomfort due to air quality and air pollution in occupied buildings that affect occupant productivity, poor air ventilation, and lack of natural lighting.

Green building is a step to reduce the use of energy both contained and starting from the initial construction process to the operational stages of the building through the use of lights or other electrical equipment that requires energy to operate the equipment. If you compare conventional construction methods with construction methods with the application of the green building concept, it can reduce minimum energy use by 30%. The application of the green building concept design can be seen in the design of maximized openings to obtain natural lighting and air, ceilings that are designed higher so as to create space to isolate hot temperatures so as to create room conditions that are maintained quality and still feel cool even without using artificial air conditioning such as air conditioning. Another strategy is to use solar panel technology to create buildings that are more friendly to the environment. This technology is used to subsidize a building's dependence on non-renewable energy. Maintaining the basic coefficient of the building is also one part of the green building concept to efficient energy use, this is because with the existence of green open space on the building site, the quality of air and lighting can be maintained in the building [10].

Green buildings are an effort to mitigate negative effects on the environment and resources while simultaneously enhancing positive effects throughout the building life cycle. While there are varied definitions and rating systems for green buildings around the world, it is generally accepted that green building activities include the planning, design, construction and operation of buildings with several principal considerations, including efficient use of energy, water and material; improvement of indoor environmental quality; and minimization of negative impacts on the environment [11].

### Repair Planning

Syamsudin Noor Banjarmasin still needs other innovations to reduce the adverse effects that will be caused. One of the innovations is to implement green building. The green building concept can be applied to the new terminal building of Syamsudin Noor Airport, this concept includes the design process, construction process, maintenance to renovation of the building. To overcome the root cause of the problem that has been conveyed above, the following is conveyed an improvement plan that can be pursued by the company by implementing 5W + 1H as follows :

1. What

The targets to be achieved through the solutions/recommendations for improvement previously include :

- Get positive feedback from service users
- Able to provide the best service in order to achieve customer satisfaction Index CSI Syamsudin Noor Airport Banjarmasin
- Implementing green buildings has a positive impact on the environment and also provides many benefits in terms of finance, market, industry and positive impacts for Syamsudin Noor Airport.

2. Why

Based on the Fishbone Diagram of green building implementation, improving the environment (green with trees all areas) at Syamsudin Noor International Airport is far from the expectations and provisions that have been set.

This can affect the quality of service in maintaining service quality standards related to the comfort of facilities at Syamsudin Noor International Airport - Banjarmasin.

3. Who

The unit responsible for the follow-up of recommendations for Green Building Implement activities is the unit in charge of Airport Safety, Risk & Performance Management Senior Manager.

4. Where

The scope of implementation of Green Building Implement is the process so that the airport can function effectively and efficiently from an environmental aspect, reviewed according to the Presidential Law of the Republic of Indonesia No. 1 of 2009.

5. When

For the implementation time of implementing the green building concept by creating a timeline starting from :

- Management Review Meeting (RTM)
- Breastfeeding and division of green building application areas
- General Manager approval
- Preparation of Activity Schedule
- Implementation of Activities
- Activity Assessment
- Preparation of Activity Report

6. How

To overcome the root cause of the problem identified above, the following recommendations are submitted that can be used as input for continuous improvement for the Company, namely supervising the airport environment and inviting the Department to take part in carrying out periodic monitoring of the cleanliness of all areas in the terminal of Syamsudin Noor Banjarmasin International Airport.

Implement green building is an effort made by the management of Syamsudin Noor Banjarmasin International Airport to continue to improve quality standards by paying attention to environmental aspects, saving energy and maintaining the quality of the terminal to stay cool and comfortable by applying the concept of green building.

### Implementation of Green Building at Syamsudin Noor Airport

Some applications of the green building concept that already exist at Syamsudi Noor Airport can be explained as below [12] :

a. Use of Solar Panels as Alternative Energy

In addition to electricity from PLN, Syamsudin Noor Airport utilizes sunlight to be converted into energy. There are 2 electricity generated from solar panels, namely electricity on grid and of grid. On grid electricity is electricity generated by solar panels that is directly flowed to equipment that requires electricity. While the electricity of the grid, which is produced by solar panels, is stored in batteries, then the electricity is used for lighting at night and as a backup if the weather is not hot.



Figure 3. Solar Panel

b. The Use of Bright Glass almost Throughout The Interior to Reduce The Use of Room Lighting

Syamsudin Noor Airport is dominated by glass elements (curtain glass) as the boundary between the outer and inner spaces. Such façade processing is intended to utilize sunlight as a source of natural lighting in the building. However, the consequence is the emergence of heat in the building emitted by glass elements baked by sunlight. as a solution, low-e glass is used. In low-E glass, the glass surface facing the inside of the building is applied a transparent heat retaining layer that can inhibit the transmission of glass heat into the building without reducing the intensity of light entering the building. The use of this glass can reduce the use of lights during the day because the building gets quite natural light from sunlight. Even if the area is not cloudy, the light in the building is enough to take advantage of natural light.



Figure 4. Glass Elements

c. Reuse of Domestic Liquid Wastewater for Recycling

A wastewater treatment facility that recycles used dirty water into suitable water for garden flushing and toilet flushing. Dirty and residual water is not immediately discharged into the sewer, but the water is reprocessed into STP (sewage treatment plant). STP (sewage treatment plant) is a liquid waste treatment plant intended for household waste such as sewage, used water to wash dishes or clothes, and also dirty water from kitchens and bathrooms. Meanwhile, Water Treatment Plant is a water treatment plant to obtain water that complies with quality standards and separates it from contaminants to make it cleaner and safer for consumption. This is to minimize the need for clean water. Recycled water has its own pipe installation system, separate from the clean water installation system with its utilization that has currently been carried out, which is reused for watering plants and operational car wash water sources.



Figure 5. Wastewater Treatment

d. Green Open Space Around the Airport

In the Syamsudin Noor Airport building, there is a maximum green open space area on the land where the Syamsudin Noor Airport buildings stand. This green open area is located in a terrace garden in the Syamsudin Noor Airport building.



Figure 6. Green Open Area in the Terminal Area

e. Bicycle Parking and Shower Compartment

Bicycles as a mode of transportation that is clean and does not cause air pollution and does not use fuel are supported by its existence by Syamsudin Noor Airport by providing bicycle parking facilities and shower compartments in toilets for the bathing needs of employees who use bicycle transportation modes.



Figure 7. Bicycle Parking

f. Healthy and Comfortable Work Environment

The workspace design minimizes the potential for outdoor air intrusion (CO<sub>2</sub>), temperature regulation and room humidity. In addition, inside the building is also given a ban on smoking.



Figure 8. Room Temperature Control



Figure 9. No Smoking Sign

The application of the green building concept is the comfort of airport flight service users. Comfort and feeling of comfort are a comprehensive assessment of one's environment. Humans judge environmental conditions based on what enters them through the sense of nerves which are then digested by the brain to be assessed. In this case involved not only physical and biological problems, but also feelings [8]. This is supported by research conducted by Safarin which shows the results that the application of the green building concept affects the comfort of service users at Banyuwangi International Airport. This is shown from the results of the calculated  $t$  test of 12.268 with a significance value of 0.000. The application of the Green Building concept has an influence of 68.9% on the comfort of service users, while the other 31.1% is influenced by other factors outside the Green Building concept. This shows that the application of the green building concept at the Banyuwangi International Airport terminal has a very strong role in terms of increasing the comfort of service users, so the airport must play an active role in reviewing the shortcomings in the application of this concept [13].

#### **Potential and Innovation in the Development of Green Building Syamsudin Noor Airport**

Syamsudin Noor Airport can still maximize potential and innovation to develop the application of the green building concept. Potential and innovation can be seen in the explanation below :

##### **a. Green Roof**

The use of green roofs in tropical countries is one way to save energy and maintain environmental aspects in this era of globalization. Various benefits of green roofs, especially in terms of the environment, include reducing energy use, green roofs remove heat from the air through the process of evapotranspiration, and also act as insulators for buildings, reducing the energy needed to provide cooling and heating. This is supported by research from Menteng, 2012 that green roofs have low thermal diffusivity so that they can delay the increase in temperature on the roof surface, where when without a green roof in a climate in Indonesia with maximum temperatures occurring at 13.30, while using green roofs the maximum temperature occurs at 16.30. This will also have an impact on improving human health and comfort, among others, by reducing heat transfer through the roof of buildings, can increase indoor comfort, and reduce the incidence of heat stress associated with heat waves [14].



Smith and Roeber also conducted a study on the impact of green roofs on UHI in Chicago and concluded that at 19:00 and 23:00 the temperature in the city can drop by about 2-3 K. A similar study conducted by Savio et al. in New York, reported that temperatures at an altitude of 2 m decreased between 0.37 and 0.86 K, while for the rate of decrease in daily average temperature between 0.3 and 0.55 K. Simulations in Japan and China claimed that the impact of reduction at small urban temperatures [14].

According to Beatley, 2013 The benefits of green roofs in improving the quality of life include green roofs providing aesthetic and habitat values for plant and animal species. They enhance human interaction with nature by introducing green space into the built environment. Such a connection with nature has been shown to benefit human physical and mental health and productivity, and reduce blood pressure and hospital stays. According to EPA 2014, the benefits of green roofs are quite significant compared to various mitigation strategies on islands with tropical climates, including the following :

Table 2. Benefits of Green Roof

	Green Roof	Tree and Vegetation	Cool Pavement	Cool Roof
Air Quality	√	√	√	√
Energy Consumption	√	√	√	√
Greenhouse Gas Emissions	√	√	√	√
Human Health And Comfort	√	√	√	√
Night Time Visibility			√	
Rain Water Management	√	√		
Noise From Transportation Activities			√	
Water Quality	√	√		

The use of green roof at the airport has been applied to Minneapolis St. Paul International Airport and can be seen in the picture below :



Figure 10. Green Roof at Minneapolis Airport

b. Vertical Garden

Vertical greenery systems can be defined as structures that spread vegetation that may or may not be attached to a building façade or to an interior wall. It is also called vertical garden, green wall, vertical green and sky-rise greenery. There are four main components in vertical greenery systems: plants, planting media such as substrate and containers, supporting systems which can hold plants, and irrigation systems. According to the strategies under development for vertical greenery systems, they can be categorized as green façade, green wall, green terraces and vertical forest. However, there are some differences between the definitions in various fields. For a more common understanding, within this vertical forest engineering study, characteristics and definitions of various types of vertical greenery systems have been formulated according to the application and location [15].

One example of the application of vertical gardens at airports in the Canadian province of Alberta is covered with 8,000 plants from 32 different species.



Figure 11. Vertical Garden at Alberta Provincial Airport Canada

c. Solid Waste Treatment in Airport Area TPS3R Concept

The integrated waste management program at the airport has an urgent status for the development of current air transportation service needs, due to the growth in the number of passengers significantly affecting the volume of waste produced. The FAA together with EPA have made an important contribution in designing waste management procedures at airports with an approach to systems that manage airports and implementation of measurable and clear actions on waste generated in the airport area. This action is in the form of a waste handling and control strategy at the airport. The handling strategy is directed at identifying the type of waste, and the pattern of waste treatment. Meanwhile, the waste control strategy is directed at the application of redirecting, repurposing, and reuse as well as the use of biodegradable materials.

**Evaluation**

By applying the concept of green building implementation at Syamsudin Noor Airport Terminal, the following differences are conveyed in conditions before and after implementation :

Table 3. Conditions before and after The Implementation Green Building

Conditions before Green Building Implementation	Conditions after Green Building Implementation
<ol style="list-style-type: none"> <li>1. The terminal feels empty because there are no plants inside the airport terminal</li> <li>2. There are still many lights turned on to illuminate the airport terminal The use of air conditioning in the terminal is still high</li> </ol>	<ol style="list-style-type: none"> <li>1. Terminal conditions are cooler because there are plants that decorate the airport terminal</li> <li>2. The use of lamps is reduced due to the concept of natural lamps</li> <li>3. The use of air conditioning is reduced because plants planted in airport terminals make the use of air conditioning can be reduced</li> </ol>

**IV. CONCLUSION**

Green building at this time is very necessary, especially in public service places such as airports. Green building is needed to support an environmentally friendly workplace (considering the increasing issue of global warming) and also improve service quality and reduce operational costs. Syamsudin Noor Airport as an international airport continues to strive to implement the green building concept in the context of caring for the environment. Several applications of the green building concept that have been carried out by the airport include the use of solar panels, the use of bright glass throughout the building, the reuse of domestic liquid waste water for recycling, green open spaces around the airport area, bicycle parking and shower compartments, and the environment. work that is made as healthy and comfortable as possible. On an ongoing basis, there are several potentials and innovations that can be implemented later at Syamsudin Noor Airport, such as green roofs, vertical gardens, solid waste processing with the TPS3R concept. So that the implementation of the green building concept will not only be enjoyed by workers but all visitors at Syamsudin Noor Airport.

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