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Green Architecture Sustainable on the House Building

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Abstract:

Sustainable green development is the construction of homes and buildings that meet the needs of future generations, Sustainable development must pay attention to the use of the environment and environmental sustainability so that environmental quality is maintained. Environment that is not maintained, will cause the environmental carrying capacity is reduced, or even will be lost. Sustainable development implies the achievement of social justice from generation to generation. In view of other meanings, sustainable development as a national development that preserves the function and ability of ecosystems, Green architecture is a scheme process in lessening unfavourable environmental impact, increase comfort of man by increasing efficiency, and reduction of usage of resource, energy, usage of farm, and management of effective garbage in architecture level (Kwok Allison dalam Ming Kok, Cheah, 2008). This research result, that is found some element in houses building which are evidence green architecture. (1) vegetation optimisation which form out of two yard at house buildings; (2) The many building side which diekspos and mass configuraton in site; (3) Design fasade building, possible to maximize natural atmosphere and illumination; (4) Terrace; core and teritis. Terrace amounting to multiple and teritis the in all heat Create building side to depend and don't coming into house; (5) Draught with crossed ventilation, presentation of from aperture in the form of door, window, roster and other aperture at part of building wall.

Keyword: Buldings, Construction, ecosystems, Green architecture, house building

1. Preliminary

1.1. Background

Environmentally friendly technology has been crowded campaigned, the public was introduced to the concept of environmentally friendly, eg the principle of separation of organic and inorganic waste, and the use of plastics and soaps that can be degraded. In addition, companies are also beginning to be obliged to use environmentally friendly technology and waste treatment handling in accordance with the standards set by related bodies, for example in the presence of ISO 4001 on the environment. The scarcity of BBM & BGG as well as global warming phenomenon caused every field of science to compete to innovate the use of alternative energy besides oil and gas, and compete to create and use Green Technology's environmentally friendly technology. Alternative energy that many experts explored to be used as a substitute for BBM and BGG is solar energy, wind, biofuel, biogas, and bioetanol. Rumah is the closest and smallest element that is a stopover from the subject (main actors) of BBM & BGG energy users as well as producers of waste either directly or indirectly. The experts are both architects and technocrats are and have made various innovations to create a home that is energy efficient and environmentally friendly. Indonesia is a tropical country that is passed by the catuliswa line so that the abundant sunshine throughout the year, as well as a fairly stable temperature. By considering the geographical conditions, the alternative solar energy is very suitable to be applied in Indonesia. Construction of the house should also consider the elements of the use of materials / materials and forms of buildings that can reduce the use of lights for lighting, air conditioning for cooling, a good exhaust system.

1.2. Problem Formulation

Based on the background of the above problem, the author formulates the formulation of the problem as follows

What is green building?

How to use solar energy as an alternative to electrical energy?

How environmentally friendly construction and home materials?

How are houses and energy needs in Indonesia? How is the concept of energy-saving or energy conscious?

1.3. Purpose of Paper

The purpose of this paper is to provide an idea of environmentally friendly and energy-efficient home construction in accordance with Indonesia's geographical conditions.

1.4. Usefulness of Papers

The paper is structured in the hope of providing both theoretical and practical utility. Theoretically this paper is useful as the development of environmental management concept of green building construction (green building concept). Practically this paper is expected to be useful for: The author, as a vehicle to increase knowledge and scientific concepts, especially about the concept of research on environmental friendly construction (green building concept); Readers, as a medium of information about the concept of classroom action research both theoretically and practically.

1.5. Procedure Paper

This paper is prepared using a qualitative approach. The method used is descriptive method. Through this method the author will describe the issues discussed clearly and comprehensively. The theoretical data in this paper is collected by using literature study technique, meaning the authors take the data through reading activities of various literature relevant to the theme of the paper. The data is processed by content analysis techniques through the activities of exposing the data and applying the data in the context of the theme of the paper

2. Discussion

2.1. Literature Review

2.1.1. Definition of Green Building

Green building (also known as green construction or sustainable building) refers to structures and uses environmentally responsible and resource-efficient processes throughout the life-cycle of buildings: from siting to design, construction, operation, maintenance, renovation the incentive will be given to the implementation of projects that apply the concept of green construction. Arrangement of the city to realize the concept of green building Green Building must make an area in its place become a beautiful and environmentally friendly. Therefore the necessary proper urban planning if we want to make a Green demolition, and. This requires close collaboration of the design team, architects, engineers, and clients at all stages of the project. The Green Building practice extends and complements the classic building design of economic concerns, utility, durability, and comfort. Green construction is a sustainable movement that aspires to the creation of construction from the planning, implementation and use of construction products that are environmentally friendly, efficient in usage energy and resources, and low cost. This green construction movement is also synonymous with sustainability that puts the balance between short-term gains against long-term risks, with current business forms that do not harm the health, security and future prosperity.

2.1.2. Green Building Concept

The concept of sustainable development can be traced to energy (especially fossil oil) crises and environmental pollution in 1970. The green building movement in the United States comes from the need and desire for more energy-efficient and environmentally-friendly construction practices. There are a number of motives to build green, including environmental, economic, and social benefits. However, modern sustainability initiatives call for integrated and synergistic designs for both new construction and in retrofitting existing structures. Also known as sustainable design, this approach integrates life-cycle building with every green practice used with design goals-to create synergies between practices used.

Green building brings together a vast array of practices, techniques, and skills to reduce and ultimately eliminate the impact of buildings on the environment and human health. It often emphasizes taking advantage of renewable resources, for example, using sunlight through passive solar, active solar, and photovoltaic techniques and using plants and trees through green roofs, rain gardens, and run-off rainwater reduction. Many other techniques are used, such as using wood as a building material, or using gravel or permeable concrete packaged instead of conventional concrete or asphalt to increase groundwater filling. On the aesthetic side of green architecture or sustainable design is a philosophy of designing a harmonious building with natural features and resources around the site. There are several key steps in designing sustainable buildings: determining 'green' building materials from local sources, reducing expenses, optimizing systems, and generating in-place renewable energy. Applications of green construction at the planning stage are seen in several construction designs that are awarded as energy-efficient building designs, in which building systems designed to reduce electricity consumption for lighting and air conditioning. In addition, new breakthroughs in the construction world also introduce various structural materials which currently uses waste as one of its components, such as the use of flyash, silica fume on ready-mix concrete and pre-cast concrete. In addition, the breakthrough of the implementation system also introduces construction materials that reduce the dependence of the construction world on the use of wood materials as scaffolding. The use of widely used materials such as glass, concrete, wood, asphalt, steel and other types of metals can cause significant global warming effects and cause climate change in the world. Remember the use of dark glass / glass yag can reflect sunlight that is usually used in high-rise buildings commonly referred to as ribben window film. Obviously it is very detrimental because it sends sunlight back into the earth's and there is a buildup so that the temperature of the earth gets hotter. Four main aspects to consider in building green building are:

2.1.2.1. Material

Materials used to build must be derived from nature, a sustainably managed renewable energy source, or locally-acquired building materials to reduce transportation costs. The durability of suitable building materials should still be tested, but still contain elements of recyclable materials, reduce waste production, and can be reused or recycled.

2.1.2.2. Energy

Application of solar panels is believed to reduce the cost of building electricity. In addition, the building should also be equipped with windows to save energy use (especially for lights and air conditioning). For daytime, windows should be opened to reduce electricity consumption. Window of course also can improve health and productivity of its inhabitants. Green building must also use energy saving lamps, other energy-efficient electrical equipment, as well as renewable energy technologies such as wind turbines and solar panels.

2.1.2.3. Water

Water use can be saved by installing a rainwater catchment system. This will recycle water that can be used for watering plants or flush toilets. Also use water-saving appliances, such as low-water fountains, do not use bathtubs in the bathroom, use water-efficient flush toilets or compost toilets without water, and install an electric water heating system. atmosphere and there is a buildup so that the temperature of the earth gets hotter. Four main aspects to consider in building green building are:

2.1.2.4. Health

Use non-toxic furniture and building materials and products can improve indoor air quality, to reduce the risk of asthma, allergies, and other diseases. The materials in question are emission-free, low or non-VOC, and waterproof to prevent the arrival of germs and other microbes. Indoor air quality can also be enhanced through ventilation systems and air humidity regulators.

2.2. Discussion

2.2.1. Use of Solar Energy

The rays from the sun can be converted into electrical energy using a component called solar cells. Solar cells convert sunlight into DC electric current. The resulting current is proportional to the intensity of sunlight received and is also proportional to the surface area of solar cells exposed to sunlight.

Experts have successfully leveraged the principle of solar cells by creating solar panels that can be used as roofs. With the rapid advancement of technology, scientists have also created solar panels that are capable of spinning to adjust its position to find the highest solar intensity. Professor Michael Gratzel from Lausanne Federal Technology Institute has also managed to find cheap solar cells that can be used to build windows that generate electricity with high efficiency.

Supporting equipment to utilize solar energy as a substitute for electricity from PLN, among others is the controller (power discharge from solar cells), inverters to convert DC current into AC currents because most household electronic appliances use AC current sources, and useful batteries to store the energy produced solar cells during the day to be utilized by the residents of the house at night. Constraints faced in order to utilize solar energy using solar panels is in terms of installation costs / installation is still expensive when compared to using electrical energy from PLN. The cost of installing solar panels is US \$ 8-10 / Watt. If a person wants to buy solar cells for household lighting purposes that are around 900 Watt, then roughly $900 \text{ Watt} \times \text{US } \$ 8 = \text{US } \$ 7200$ is required. This price includes the cost of installation and some supporting components for mounted on the roof of a house. While the installation of electricity with power of 900 Watt PLN about Rp. 1.500.000, -. This is why people still rarely use solar panels as a source of electricity. In addition to the benefits of long-term cost (investment), there are still more benefits gained when using solar panels. Among other things the use of solar panels will reduce the impact of pollution on the environment, we know that many power plants use the combustion process from BBM, BBG, coal, and even nuclear. Burning any material will surely produce a gas that will pollute the air. Another advantage of the use of electricity from solar panels is not to be affected by the rotating blackouts of PLN, imagine if the place of economic transactions, such as malls or offices experienced power outages from PLN in one hour how much loss to bear.

2.2.2. Construction and Green House Materials

Green technology campaign has also made the architecture and technocrats in the field of construction to make various innovations to design the construction of buildings and choose building materials in accordance with environmentally friendly principles. For example, various agencies have held many home design competitions beautiful, simple, efficient, and environmentally friendly.

There are many aspects to consider when designing a house. Here are some examples that have been offered / exemplified by the architecture who care about the environment. First, we can imitate the concept of a pangung house. With the distance between the ground and the floor, then the ground area below the floor can still function for water absorption. This can be useful for reducing flooding. Secondly, care must be taken of lighting problems. If the house has enough light entry points, it will reduce the use of the light during the day. Then the third is the ventilation problem, if the air exchange in the house is enough, it will reduce the use of air conditioning and fan, plus if the house has green open space then the air coming in and out of the house will be cleaner as the air temperature will be lower. Sanitation issues should also be considered, such as drainage disposal design and placement of organic or inorganic waste .

Selection of materials to build a house will also affect the effects of environmental friendliness that is being intensively aggressively campaigned. First, use a renewable resource. Renewable resources such as wooden building materials, rocks and the like are generally natural materials that are widely available in the surrounding environment and are easy to renew. Furthermore, we can reuse the building materials that are still feasible to use, and process waste or residual building materials to be reused.

The following are examples of various materials that can be selected to produce an environmentally friendly home. Low E-Glass, which can be used for window glass that will absorb heat so the room will not be too hot and means the use of air conditioning can also be saved. Rain Harvesting which utilizes rain water by way of accommodating and reused for daily needs such as watering plants up to the toilet. Storage Heating is a storage of heat sources that will be used to warm the room when cold temperatures arrive, so the use of a heater can be reduced. The use of Photocatalytic materials on the surface of the outer wall which will convert harmful organic into harmless. In the implementation of green construction of course many challenges that must be passed, namely:

2.3. Capital or Cost

It is undeniable the use of green design is costly. For the Green Building concept would not be the same as the other buildings. Many factors that make Green Construction 'take a considerable capital, as for example in pegguna expert or experts in building a Green Building concept of course spend a lot of money.

2.4. Making a Strategic Design

Each building or a construction is sure to have a different design, of course, in the principle of Green Building design should improve the efficiency of the use of resource execution and use of construction products that berkonsepkan environmentally. Of course it becomes a major challenge Green Building experts to create a suitable design on the internal external conditions of the surrounding environment.

2.5. The Selection of Materials / Building Materials are Environmentally Friendly

The majority of homes today are built using wooden frames, traditional Building Materials and materials of choice for many people. However building a framed wooden house requires a very carefully designed plan and a construction crew with plenty of experience and skills. Building a house with wooden frames will generally produce a reliable and safe structure, but also vulnerable to premature failure when small details are left or made with poor quality wood products. Today homeowners have the opportunity to choose from Green Building alternatives. However, with the illegal logging problem that is still a lot of use of wood as a material began to be left for environmental sustainability. The use of natural smell, brick, gypsum, and aluminum and mild steel also be the right choice. Because in addition to environmentally friendly but also able to support the resilience of the building and of course healthy conditional. Pembuatan legitimate regulations in the application of green construction In Indonesia today, the discourse of green construction began to appear on the implementation of several projects such as airport toll road projects undertaken by PT. Housing Development and Rusunami project by PT Perumnas. But unfortunately until now there is no legal umbrella that overshadow the implementation of green construction in Indonesia what else sejum Building in Indonesia. The location of urban planning in accordance with the environmental ecosystem balance, not to make the Green Building instead of damaging the green area, or air cycle and hydrology that is affected by the loss of water catchment area. For in Indonesia itself, if we take the example of Jakarta may be the construction of Green Building is difficult to be implemented, because the layout of the city of Jakarta which is already solid for buildings are kepentingan commercial or residential buildings residence. and improve the health of green building Financing and care Not easy to care for a building or building let alone building with the concept of Green Building, which must maintain the benefits to the surrounding environment.

2.6. Health Factors

Using non-toxic materials & products will improve indoor air quality, and reduce levels of asthma, allergies and sick building syndrome. Materials that are emission-free, and resistant to prevent moisture generating spores and other microbes. Indoor air quality should also be supported using an effective ventilation system and moisture control materials that allow the building to breathe. Natural or natural ingredients are known to be quite vulnerable to environmental disturbances themselves such as the presence of microorganisms, as well as the humidity of the air and the temperature outside or inside the room that must be balanced to minimize damage to the building.

2.7. Building Public Awareness of the Importance of Green Building

This challenge is also quite important to solve, Many Indonesian people who certainly do not know the meaning of Green Building. Starting from the concept, its benefits in the long run as well as its application. Counseling on Green Building should also be given to the people of Indonesia to better know the role of Green Building in the world of development in Indonesia. What's more with the poor Indonesian economy making this plan only limited to building developers with large capital and upper middle class. Green Building is more of a concept for sustainable living, but it can build hope for the future. Therefore, the awareness of Indonesian society must be improved to know the importance of making the building with Green Construction concept. Whatever humans do to conserve the environment and environmental improvements, no matter how small it really means like throwing garbage in place, it is still not achieved perfect. With age dwindling due to climate change, increasing energy shortages and health problems, it does make sense to build long-lasting buildings, save energy, reduce waste and pollution, and prosper.

2.7.1. Efforts to realize Green Construction

- 1) Building public awareness of the importance of Green Construction for the development world in Indonesia.
- 2) Make buildings that are environmentally friendly.
- 3) Set the city layout in accordance with the concept of Green Construction that is environmentally sound.
- 4) Building an efficient building system for energy use.
- 5) Building Green Construction by using materials that can be updated, recycled, and reused and support the energy efficiency concept.
- 6) Process waste that is useful to be used as material of basic material.
- 7) Building Green Construction in accordance with natural conditions, and the climate of Indonesia.
- 8) Innovation to develop green building continues to be done in an effort to save energy and reduce environmental problems.
- 9) The selection of materials that fit for Green Building can last longer.
- 10) The use of appropriate technologies and environmentally friendly so as not to damage the surrounding ecosystem

3. Residential and Energy Needs

Indonesia is a country whose entire territory is in the equator area, is an advantage but also becomes a huge loss. As an advantage, tropical climates make natural resources more abundant, but a disadvantage due to the tropical climate makes the sun's irradiance high, ie, an average of 200-250 W / m² over a year or 850-1100 W / m² during the irradiation. This causes the surface temperature to rise higher than other regions of the world. This enormous Irradiance can be utilized to be an extraordinary energy source or can also be a very big constraint because with the high temperature permukaandi area of Indonesia, will require a great energy also to cool the house. (Daryono, 2008) In reality tropical climate conditions in Indonesia are often regarded as a problem.

Not achieving comfort in homelessness, making despair in finding the cause. And generally immediately found solution or said as a shortcut, with the use of air conditioning or air conditioner (AC). The working principle of air conditioning is indeed lowering the air temperature for refresh space. This recognized working principle ensures room comfort. But if carefully considered the actual use of air conditioning is the waste of energy derived from non-renewable resources (non-renewable resources). And the AC work process will produce carbon emission substances CFC (chlorofluorocarbon), which will form the greenhouse effect and damage the ozone layer. (Frick, 2006) The entire surface of the building must be protected from direct sunlight. The walls can be overshadowed by trees. The roof needs to be given a heat insulator or a heat detector. The common ceilings are used to prevent heat from roaming directly downward (Satwiko, 2005). Energy conscious design (energy conscious design) is one of the architectural paradigms that emphasize the conservation of global natural environment, especially the preservation of energy derived from non renewable fuels (non renewable energy) and which encourage the utilization of renewable energy (renewable energy). In energy conscious design it is absolutely necessary to understand the conditions and potential of the local climate to consider design decisions that will impact on energy consumption both at the development stage and at the operational stage of the building. At the scale of the microenvironment, this phenomenon of solar radiation affects the rate of increase in ambient temperature. Such conditions affect human activity outdoors, to overcome this phenomenon there are three things that can be controlled namely the duration of solar irradiance, the intensity of the sun, and the angle of the sun (Satwiko, 2003).

4. Energy Saving Concepts or Conscious Energy

Distribution of energy use in the home stay more on the aspect of airborne function or air refreshment and lighting function aspects, so these two things are important to be the focus in the discussion of the concept of energy saving. The discussion on energy saving is emphasized on ecological steps, namely by creating continuity between the house and its environment or the interaction with nature.

In addition to these two other important aspects of housing, water use as a source of quality of life support, with the system reduce, reuse, recycle. Passive solar system is a technique of utilizing solar energy directly in buildings without or minimally using mechanical equipment, through the design of elements of architectural elements (floors, walls, roofs, sky ceilings, building accessories) for human comfort purposes natural air circulation, temperature and humidity regulation, solar radiation control, use of thermal insulation).

The natural air exchange of rising indoor temperatures causes heat and this is closely related to the microclimate conditions of the house scale and the surrounding area. To lower the temperature while providing comfort air required adequate air flow. Air flow principle is the difference in temperature and pressure between two or more space, both space between space and between space in and outer space. Therefore it is necessary to create areas of the building that can make the difference in temperature and air pressure.

4.1. Some Air Refreshing Concept Applications Are

4.1.1. Roof Ventilation

The wind will flow from low temperatures to higher temperatures. The rooftop space is the part that receives the greatest radiation, so it has a hot temperature. We recommend that the space under the roof is equipped with ventilation holes, so that will draw air from the room to be flowed out the building.

Through ventilation holes located on the roof, then the hot air pressure inside the room will be attracted and wasted out through the roof. To get the stack effect (stack effect), then the wind tower is made with the shape of the cover facing the wind coming direction, and better yet the void. The chimney effect will be optimal if the house / building has a high ceiling or at least two floors. The higher the ceiling, the better the ventilation (wind flow).

4.1.2. Terrace and Eaves

The terrace serves as a transitional space between the outer and inner spaces. In hot climates, such as in Indonesia, the presence of terraces can create a microclimate that provides comfort in the building and its surroundings. This is due to the air pressure in the yard to expand due to the hot temperature, while the terrace is a higher pressure air suction and cooler temperatures. Differences in temperature and pressure cause air to flow, from cold to warmer temperatures, or from high pressure to lower pressure. The air inside the room will be attracted to the outside and immediately change. As well as terraces, the eaves will cool the air temperature first, before entering into space. The width of the eaves, the room temperature will be cooler.

4.1.3. Environmental Vegetation

Vegetation serves as a climate regulator or climate regulator (temperature, humidity and wind rate), both for the residential tread scope and for the area scale. The provision of real vegetation (opening of tread for vegetation) means also the provision of green open space (RTH), which also means as a water controller. The availability of open space and vegetation will supply oxygen and will drain it into the house, plus the presence of water (alternatively pool-shaped) that will reduce the temperature of hot air. Oxygen and cold temperatures flow into the home and will provide comfort. Vegetation on the roof of the house (greenroof) can withstand the sun's radiation, thus conditioning the space beneath it at cooler temperatures. The green element identified with vegetation is indicated by adding green elements not only to the landscape but also to the building, such as the provision of roof garden, the provision of vine vegetation on the walls of the building and so forth.

4.1.4. Natural Lighting

The purpose of lighting is in addition to getting sufficient quantity of light so that the visual task is easy to do, also to get a pleasant visual environment or have a good quality cah aya. In natural lighting, which greatly affects the quality of the pencil ayaan is the occurrence of glare. Natural daytime lighting can be said to be good if: during the day between 08.00 and 16.00 hours local time, there is quite a lot of light coming into the room. The distribution of light in the room is quite evenly distributed and or does not cause any disturbing contrast. Shine is a vision condition where there is discomfort or a reduction in the ability to see an object, because of the luminance of an object that is too large, uneven distribution of luminance or excessive contrast.

There are two types of glittering:

- 1) the glare that causes the inability to see an object (disability glare),
- 2) the glare that causes the discomfort of seeing an object without the need to cause discomfort to see (discomfort glare). The principle of natural lighting is to utilize sunlight as much as possible and reduce the heat of the sun as much as possible. Utilization of natural light will obviously save electricity

4.1.5. Building Orientation

The orientation of the building aims to get a pocket of sun (sun pocket), a condition in which sunlight is at the lowest radiation intensity, according to the rising and sinking cycles, and the sun has a small falling angle of light. Thus the lit area will be bigger and the sunlight is not hot.

The best building orientation is to have a 20 ° incline angle to the east-west axis with the widest faceted surface area on the north-south axis. If the ideal condition of building orientation is not possible, it can be done by expanding the opening for light entry or reducing space restrictions, so that light can enter the inner spaces. If necessary, use transparent material Use local materials The building envelope that gets the greatest solar radiation is the roof and then the wall. In order for energy savings can be done, it should be avoided optimal solar radiation during the day, because it will increase the temperature of the room.

Utilization of natural materials from vegetation can be designed to blend with the construction of building envelope. Learning from Ngibikan hamlet trying to exploit local potential by utilizing wood from coconut trunks, and bamboo.

3. Conclusions and Suggestions

3.1. Conclusion

Based on the discussion above, the following conclusions are taken:

Green building (also known as green construction or sustainable building) refers to structures and uses environmentally responsible and resource-efficient processes throughout the life-cycle of buildings: from siting to design, construction, operation, maintenance, renovation disassembly, and. This requires close collaboration of the design team, architects, engineers, and clients at all stages of the project.

Solar energy as an alternative energy other than fuel and oil and gas can be applied in building energy-efficient homes in the hinge of solar panels for the roof or in the form of gratzel cells that can be used as windows.

The high cost of installation of solar panels can be overcome if there is a willingness of the government for example by providing subsidies, massive socialization of the benefits of using solar cells, and the willingness of the industry with technocrats to create solar cells are cheap and efficient.

At the scale of the microenvironment, this phenomenon of solar radiation affects the rate of increase in ambient temperature. Such conditions affect human activity outdoors, to overcome this phenomenon there are three things that can be controlled namely the duration of solar irradiance, the intensity of the sun, and the angle of the sun.

Selection of materials to build a house will also affect the effects of environmental friendliness that is being intensively aggressively campaigned. use upgraded resources. Renewable resources such as wooden building materials, rocks and the like are generally natural materials that are widely available in the surrounding environment and are easy to renew. Furthermore, it can reuse the building materials that are still feasible to use, and treat waste or residual building materials to be reused.

The design of houses that are energy efficient and environmentally friendly should consider the aspect of light, ventilation and sanitation.

Distribution of energy use in the home stay more on the aspect of airborne function or air refreshment and lighting function aspects, so these two things are important to be the focus in the discussion of the concept of energy saving. The discussion on energy saving is emphasized on ecological steps, namely by creating continuity between the house and its environment or the interaction with nature.

The selection of materials for the building should also pay attention to aspects of sustainability and environmentally friendly.

3.2. Suggestions

Some suggestions that can be given to can be done next as follows:

The need for awareness from all parties to jointly develop and implement the use of alternative energy besides BBM & MIGAS.

The need for awareness from every family and developer / contractor to pay attention to energy-saving and environmentally friendly aspects when designing a house.

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