



## ENERGY SAVING HOUSE DESIGN THROUGH A TROPICAL ARCHITECTURAL APPROACH

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### ABSTRACT

Housing is one of the basic needs of human beings. Today, many homes are built without environmental considerations and do not consider the tropical climate of Indonesia, especially Medan. When designing a home, you need a solution that takes tropical climate into account. One of them is the design of houses by a tropical architectural approach with the concept of energy saving. The study entitled Two Story House, an energy-saving concept with a tropical building approach, aims to design a two-story house with an energy-saving concept with a tropical building approach, taking into account the current state of the building, wind direction, natural lighting, and natural ventilation. Will be considered. The study identifies the site, collects article data from national journals from the Internet to obtain variables used in design guidelines, and analyzes through visits to land sites that produce photographic documents and work drawings. Use a qualitative description method. The design of this house is intended to be an example or recommendation for an energy efficient life with a tropical architectural approach.

**Keyword:** Living House, Energy Saving, Tropical Architecture

### 1. INTRODUCTION.

The house can be interpreted as a building, where people live, and is formed by several rooms that accept wall dividers and roof coverings (Rulli, 2014). In Indonesia, especially Medan, housing demand is increasing due to population growth, and this is also continuing (Fisika et al., 2016). Therefore, a solution is needed to meet housing needs, namely through the development of the housing sector to the fullest. However, in many cases, this development is designed without considering the energy saving factor, resulting in a much higher electrical operating load and the effect of wasting energy (Karyono, 2011). In addition, because it can affect global warming and environmental damage, it is necessary to take energy saving measures for housing,

In addition, the architectural concepts used in the design must be considered in order to adapt to the prevailing climatic conditions in Indonesia, namely the tropical climate (Bu'ulolo et al., 2020). Tropical architecture is an architectural concept that adapts to the tropical climate and applies to buildings (Edyas et al., 2017). Finding the definition of energy-efficient tropical architecture, applying the concept of energy-efficient tropical building approach to residential design, and when and what aspects of energy-efficient housing design with a tropical building approach There are several issues that need to be considered. Residential design that applies the concept of energy saving with a tropical architectural approach. The research entitled "Designing Energy-Efficient Houses with Tropical Building Approaches" aims to clarify how the concept of energy conservation with a tropical building approach can be applied to home design. The results are intended to be examples or recommendations for housing. Using an energy-efficient tropical building approach, can contribute to the effects of global warming, energy wastage and environmental damage.



## **2. LITERATURE REVIEW**

### **2.1. Residential home**

A residence is a building that can be used as a place to live for a certain period of time (Rulli, 2014). Currently, the use of electrical energy in residential homes is consumed excessively which results in energy wastage, so a strategy is needed in designing residential homes with energy-saving concepts (Rahanra et al., nd).

Several strategies that need to be emphasized in designing a residential house with an energy-efficient concept are prevention of the greenhouse effect, prevention of heat in the roof area of the building, placement of heat-retaining rooms on the east and west sides of the building, prevention of the fall of solar heat on the pavement surface and utilization air flow at night (Heryanto, 2004). Medan city is one of the cities in Indonesia which has a tropical climate that has rainfall and temperature so that in designing a building, especially with a residential function, it must be able to answer tropical climate problems (Simbolon & Nasution, 2017).

The solution is to design a house with a tropical architectural approach that is energy efficient. Understanding residential energy saving is an effort to reduce the amount of electricity consumed to achieve comfort or to support the activities of its residents (Prianto, 2007).

### **2.2. Tropical Architecture**

Tropical architecture is an architectural work that solves problems related to the local climate, namely the tropical climate (Karyono, 2000). Several previous researchers have discussed the concept of tropical architecture in buildings. Factors that influence the design of a building is the concept of tropical architecture in green buildings as a low cost solution using qualitative descriptive methods such as thermal comfort, air flow inside the building, and heat radiation. al., 2017).

The second research paper, entitled "Energy-efficient forms of tropical housing for global warming", is a design of an energy-efficient tropical house, including lighting system design strategies, orientation considerations, existing site conditions, and creativity. An approach that requires a design strategy for building facade care, regional climate research, use of materials and structures, shade and green elements (Prianto, 2007).

The third study entitled "Green Concepts for Housing Considering Tropical Climate Factors" includes sun exposure, building orientation, sun protection, greenery, lighting, and air circulation (Mufliha et al., 2015). The three previous similar studies were used as a reference for the research entitled "Designing an Energy Efficient House with a Tropical Building Approach" and can later be applied to the location or project recommendations. This residential building material uses an energy-efficient concept with a tropical architectural approach. The design of Jalan Sei Padang applies the concept of energy saving with a tropical architectural approach.

## **3. RESEARCH METHODS**

The research entitled "Designing Energy-Efficient Residential Houses Through Tropical Architecture Approaches" uses a descriptive qualitative method with several stages including:

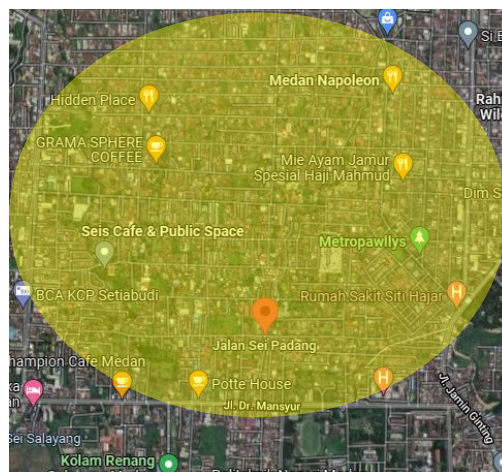
#### a. Location Determination Method

The location determination is determined based on the availability of vacant land so that the residential house can be built after being planned and designed. The location is on Jalan Sei Padang, Medan Selayang.



**Figure 1.** Site Map

Source: Author, 2022



**Figure 2.** Site Location in 500 . Radius

Source: Author, 2022



**Figure 3.** Site location selection

*Source: Author, 2022*

From the picture above, it is explained that the selection of the site location with a radius of 500m<sup>2</sup> and the boundaries of the area, the site is located on Jalan Sei Padang next to a transportation alley adjacent to residential areas. There are several public facilities around the site, namely churches, mosques, elementary schools (SD) and the USU campus.

b. Data Collection and Analysis Method

- National journal articles, thesis or student final projects related to the design of residential houses with energy-saving concepts with a tropical architectural approach.
- Then from the data collection then analyzed then taken several variables that are used in designing a residential house with an energy-efficient concept with a tropical architectural approach. This data collection is accessed via the internet.

## 4. RESULT.

### 4.1. Heat Radiation

Heat radiation is caused by sunlight entering the house from outside making the room air hot. The solution to overcome heat radiation is to provide openings in the form of window or door canopies to prevent heat radiation from entering the dwelling.





**Figure 4.** 3D Residential House

*Source: Researcher, 2022*

Seen in the picture above, in the view of the residential house, concrete canopies are given to the windows and doors so that solar radiation does not enter the whole house. The result after being built and occupied can be seen in Figure 3.



**Figure 5.** Front view of the house after it was built and occupied

*Source: Personal Data 2022*

#### 4.2. Green Element

Provide an element of vegetation in the form of an inner court as an alternative to green open space on land used for housing development. Also provides vegetation in the form of grass and trees in the area defined by the green basic coefficient (KDH).



**Figure 6. Innercourt and Trees Planted in Front of Residential Houses**

*Source: Author 2022*

The function of the green element in the form of trees is placed in front of the site as a buffer so that heat from outside does not fully enter the house, it becomes cooler and there is no need to install air conditioning, especially during the day to be more energy efficient. In addition, there is green space in the form of grass and yards that can add to the freshness of the house.

#### 4.3. Building Orientation

The orientation of the building must be in a direction that is protected from the heat of the sun, namely facing North or South. If the direction of the building is facing west or east, shading must be provided and there is no need for many openings in the form of windows and doors. The orientation of this house faces west because in the north and south the land is a residential area. If the house is still facing north or south, it is not receiving too much natural light. Therefore, the solution is to make the direction of the house facing west, but with awnings on the doors and windows to reduce heat from the sun that enters the residence. Store at a comfortable room temperature and do not need to use air conditioning, especially during the day, so it is more energy efficient.



**Figure 7.** Concrete canopy placed on every window and door facing north  
*source : Author 2022*

#### 4.4. Good Lighting and Circulation

Good lighting can be applied by providing ventilation in the form of windows that are large enough and adding skylights to the roof of the building and placing it in the middle of the dwelling so that the light entering the dwelling is more optimal. lights during the day to save more energy. . The type of lamp used is an energy-saving LED lamp, only used at night. Good circulation can also be achieved by placing ventilation openings in the form of windows and doors with even ventilation so that outside air can enter and enter the residential space.



**Figure 8.** Use of Skylights in Residential Houses  
*Source: Author 2022*



## 5. Conclusion

Residential design on Jalan Sei Padang applies the concept of energy saving with a tropical architectural approach with several strategies including providing shade in the form of a canopy at each opening in the form of windows and doors, providing green elements in the form of trees, grass, and inercourts that serve as buffers for residential buildings against heat. the sun that penetrates the building and can also add to the coolness, the building facing west is covered by a concrete canopy that covers the windows and the main door of the house, good and good light circulation with cross ventilation and skylights for optimized natural light and air so that it does not require artificial lighting in the form of daytime running lights and artificial ventilation in the form of air conditioning. Residential design with energy-saving concepts through a tropical architectural approach should be an example or recommendation in residential design, especially in the city of Medan and can contribute to the effects of global warming, wasted energy and environmental damage.

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