THE CONCEPT OF HOUSING WITH ARCHITECTURE BIOCLIMATIC APPROACH THAT CONSIDER HUMAN PERSPECTIVE TO OBTAIN A BETTER SETTLEMENT AND CONSERVATION ENERGY

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ABSTRACT

Global warming is an issue that trend today. Awareness needed to perform its main energy efficiency is the energy cooling operations. Its because energy is related to the operational life of the thermal comfort of occupants to perform daily activities. This paper identifies residential design typology of house type 60 as a building envelope design and configuration space. The research determines the thermal performance and explore a simple house type 60 for its energy efficiency. In general, this paper aims to identify the typology of house type 60 that is associated with the operational cooling energy savings, as well as opportunities for what can be done to conserve energy by using architecture bioclimatic approach. The main benefits expected is to provide guidance on design concepts (via the model) based energy efficient cooling for modest residential type 60 in the humid tropics in order to conserve energy and create a healthy neighborhood. It need the dweller to adopt what they want to be in their own house. The fourth dimension in housing is a strenght that enable people to materialise their house to what they envisioned and using it to achieved what they intended to be.

Keywords: *a simple house type 60, architecture bioclimatic, conservation energy*

ABSTRAK

Pemanasan global adalah masalah yang penting pada masa kini. Kesadaran untuk melakukan efisiensi energi utamanya adalah operasi energi pendinginan. Karena energi yang berkaitan dengan operasional kebutuhan kenyamanan termal dari penghuni untuk melakukan aktivitas sehari-hari. Penelitian ini mengidentifikasi tipologi desain rumah tinggal tipe 60 rumah sebagai desain selubung bangunan dan konfigurasi ruang. Hal ini dilakukan untuk menentukan kinerja termal dan mengeksplorasi jenis rumah sederhana tipe 60 untuk penghematan energi. Secara umum, makalah ini bertujuan untuk mengidentifikasi tipologi rumah tipe 60 yang berkaitan dengan penghematan energi pendinginan operasional, serta peluang untuk apa yang dapat dilakukan untuk konservasi energi dengan menggunakan pendekatan

arsitektur bioklimatik. Manfaat utama yang diharapkan adalah memberikan panduan mengenai konsep desain (melalui model) berbasis hemat energi untuk pendinginan pada perumahan sederhana tipe 60 di daerah tropis lembab dalam rangka untuk menghemat energi dan menciptakan lingkungan yang sehat. Hal ini diperlukan oleh penghuni untuk mengadopsi apa yang mereka inginkan pada rumahnya sendiri. Dimensi keempat di perumahan adalah kekuatan yang memungkinkan orang untuk mewujudkan rumah mereka dengan apa yang mereka bayangkan dan menggunakannya sesuai dengan apa yang mereka inginkan.

Kata kunci: *rumah sederhana tipe 60, arsitektur bioklimatik, konservasi energi*

INTRODUCTION

Global warming efforts to save the source of natural energy reserves and how steps by steps that can be done for energy management. It is an issue most frequently discussed of late. Occupants in residences can act to reduce global warming by conserving energy consumption to save energy in the form of operational (end-use energy) for their activity and needed. Data from PLN also showed from 23.231 million subscribers in Java and Bali electricity system, only 12,116 or 0.1% of household customers energy-efficient. Criteria for energy efficient according to the PLN based on the load limit of the amount of usage (kWh) according to the type of load (http://www.pln.co.id, Feb. 2008).

Occupants have a role in shaping the comfort of the environment (environmental comfort) include thermal comfort requirements. The expansion of thermal comfort is one form of adaptation to the residents of their home, because it is individual consumption of energy used to meet those needs fluctuate. To make an efficient homes to the needs of energy is needed to guide residents in conserving energy consumption (Wigginton and Harris, 2002).

In the humid tropical climate, energy conservation can be done through the use of passive cooling design. Passive design suitable for the climate is a natural ventilation system (Szokolay, 1980.2004; Santamouris, 1997; Moore, 1973; Givoni, 1991; Roaf, 2001; Feriadi, 2004; Kodama, 2006). Natural ventilation system is expected to expand thermal comfort by providing sufficient wind flow to provide occupant comfort. Design that relied on local climatic conditions and involve resi-dents in it is called as the architecture bioclimatic design approach (Hyde and Sunaga, 2008).

Thus research is needed regarding the design of a simple residential type 60 which minimizes the consumption of electrical energy through the design envelope and configuration space in order to achieve operational efficiency through architectural bioclimatic approach.

The Site Condition

Surabaya is located at 7.21° south latitude with altitudes from sea level ± 6 meters, including in the humid tropics. Humid tropical region has two seasons, rainy and summer seasons. The differences of temperature in the two seasons is not very large. Wind speed in July (winter months) is higher compared to November (summer months). The highest wind speed for a period of 24 hours occur between 12:00 to 14:00 o'clock, while the lowest occurred in the period 24.00 - 03.00 and started to increase again until 06.00 am. In the period in which the occupant occupants began to close the window, starting at 17.00, the wind speed outside the building is still quite large (3.96 m/s) has the potential to remove the heat load from the chamber to the outside of the building with the process of convection, especially at 17:00 to 22:00 o'clock. In this period the internal heat load peaks occur, due to time delay the building envelope material, the use of electronic and lighting in the room.

Research Methods

The design of this study begins with a phenomenon that exists in the field. Among them is the tendency of an increasing number of air conditioning use in residences. With the use of AC is the amount of operational energy consumption will increase. Increasing the amount of energy is regarded as one of the causes of global warming. From the condition that the problems discussed is how the typology casing design and configuration of space in residential type 60, and efforts to what can be done to minimize the operational energy cooling in residences are 60 types of architectural bioclimatic approach.

To be able to answer the problem basically divided in 3 stages. The first stage is used as a reference to address issues that have been described previously. In the literature of climate analysis is also performed. Climate analysis serves to determine the time or the measurement of operational energy data in residences are listed as data kWh PLN.

Before conducting a field study required the selection of sample locations and number of objects. Environmental criteria for the sample object environment of the existing building is still in the existing condition and modifications to the same area in order to be compared. It aims to determine the effect of building envelope design and spatial configuration of the operational energy consumption of cooling, determine the orientation of the building contained location. After building orientation criteria are met the next step is to determine the number of sample objects. The number of objects to be observed using several criteria.

The second stage is to conduct field studies. Stages of field studies were used to determine the typology of the building envelope design and simple configuration of type 60 room house in Surabaya. On these objects will be recording the building facade design drawings including counting the percentage of wide aperture, aperture

type, aperture and extensive schedule of each room in each dwelling unit that relies on good natural ventilation, mechanical or hybrid.

The third phase of this research is to conduct simulation modeling. Before performing the simulation model required simplifications and assumptions. Ecotect 5.5 program was used to predict the air temperature inside the chamber for 24 hours.

The fourth stage is the conclusion of all research results. The conclusion that the expected results in this study is the concept and model building envelope design and configuration of space-based energy-efficiency cooling in a simple house type 60 in Surabaya which is humid tropical with bioclimatic architectural approach.

RESULTS AND DISCUSSION

Housing Design Criteria

At the very hot summer conditions it is necessary to prevent heat gain and maximize heat expenditure. The goal is to reach thermal equilibrium. Solar radiation and long irradiation becomes an important factor. The existence of sun shading will greatly help to reduce this external heat gains. Direction and wind speed are the factors most help to overcome the problems of heat due to radiation in the design of passive cooling system.

In hot humid areas, typically a warm evening and daily temperature variation is very small (often less than 5°C). High humidity causes evaporation of the surface of the skin become blocked. The designer must ensure that the temperature within does not become higher than the outside temperature. Adequate ventilation is required to divert excess heat. Keeping the temperature increases the ceiling by the use of reflective roofing surfaces, has a separate ceilings, adequate ventilation in the ceiling space, the use of reflective surface to below the roof and above the ceiling, and use insulation material on the ceiling.

Generally winds blowing from the East-West or vice versa in the humid tropics. On the use of natural ventilation, wind direction is contrary to the orientation of the sun, it takes precisely the arrangement of the layout of buildings, mainly to avoid the acquisition of excessive solar radiation. Structuring the compact layout of the building but should not be spread out so that the spaces are formed evenly can obtain the wind flow. We recommend using an open-plan design plan to reduce cooling energy requirements. The bedroom should be in place on the South side.

For the humid tropics need to provide a space that serves as a transitional space that also functions as a buffering space. These spaces are used to reduce heat radiation in spaces that have high occupancy, is expected to reduce energy demand on space enough space to have such high occupancy. Cooling with ventilation to rely entirely on natural air movement to cool the occupants. Factors affecting the movement of

air around the building and opening of which is the position, type, area of inlet and outlet, the orientation of openings and air condition outer space. The maximum depth of space for cross-ventilation is five times the height of the ceiling space (Liddament, 1996). In conditions of wind direction perpendicular outlet area larger than the inlet area will provide greater wind speeds than if a larger inlet area. This is different if the wind direction makes an angle of 45° (oblique), the wind speed in space will be greater if the inlet area equal to area outlets (Allard, 1998).

The movement of the wind should be about the occupant's body (Givoni, 1976). Although the physiological cooling needed to expand convenience, should not be done in a long time or not to meet 80% of the time staying in the room (Zhao, Sun and Ding, 2004). Application of full-day ventilation with window to wall ratio (WWR) 40%-50% provide better comfort. In addition to extensive use of type louvre opening and schedules to suit the needs of residents can form a thermal comfort.

Based on the simulation results showed the bedroom and living room on one floor lower temperature compared to the second floor. The second space is at a comfort-table period begins at 20:00 to 06:00 (28°C), where the period the spaces are not receiving solar radiation. Bedroom and living room began to feel discomfort at 07.00. The second period of overheating in the chamber began at 12:00 to 16:00. Where in the period the spaces are at a temperature of 30-31°C. This shows that the period of overheating necessary arrangements and providing schedule openings sufficient imagery. Opening schedule required for the daytime necessary precautions incoming solar radiation into the room through convection

CONCLUSIONS

The concept of housing with architecture bioclimatic approach that consider with human perspective to get a better settlement and conservation energy in this paper show that the design criteria do to optimize the penetration into the design for daylight but minimum solar heat received directly, the design can cooled a structure or mass of the building, especially at night and early morning and plan to optimize the exchange of air from outside to inside the building and vice versa.

Strategy design includes building orientation, building configuration, use of materials on the building and opening in the building.

The passive design principles in this approach to the minimization of the energy needs of daily operations (energy conservation) for the fulfillment of the air temperature is comfortable throughout the day and the strong sunlight of a healthy and comfortable. Energy requirement is only required for artificial lighting at night and the occupants of electronic equipment.

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