



Concept of Environmentally Friendly Residential Buildings By Considering Room Lighting System

Taufik Dwi Laksono¹, Dody Wahyudi²

Civil Engineering, Wijayakusuma University Purwokerto¹,

Electrical Engineering, Wijayakusuma University Purwokerto²

taufikdwilaksono@yahoo.com¹, dodywahjudi@yahoo.com²

Keywords :

Building; Environment;
Lighting

ABSTRACT

Environmentally friendly building is a building which should have considered to implemented in the construction industry. Implementation of environmentally friendly building can give a benefit for the community because if it is implemented can reduce the cost to be incurred for daily life such as for pay electrician, or reduce environmental damage which is caused by the development of facilities and infrastructures of the construction. Review about concept of this environmentally friendly residents building considering two aspects that are design of building and lighting system in the building rooms.

INTRODUCTION

An increase in the number of people in a region caused needs of residential building increase too. More and more residential buildings like apartment, housing, hotel and others can affect the occurrence of environmental changes around the development of residential buildings, such as the narrowness of agricultural land, the emergence of environmental waste, complaints of lighting facilities which is increasingly and many more.

According to Otto Soemarwoto, 2015, development will always bring change hence to achieve sustainable development so then development must be environmentally sound. The role of construction industry practitioners to anticipate the more severe the environmental damage is needed. Every party should be role according to the field of knowledge to create a building which is keep pay attention of the environment where the building held. Departure between parties is needed. So there is an agreement in doing building construction design. Samsudin Amin, Nurul Jmala and Jacklyn Luizjaya, 2016 state that in doing a design process a building thorough consideration absolutely must be done to produce a building which in addition to environmentally friendly is also convenient to used and have an identity and strong character.

In designing building, besides strength structure which must be calculated, utility system of a building should to be considered too. As for the utility of the building such as concerned to building equipment which is related with healthy, comfort, safety or circulation and communication. One of the thing that must pay attention to support comfort, safety of the activity in the building is lighting system. Generally, in a building in Indonesia to second higher energy consumption after air conditioner system

is lighting system (guidance of the use of the green building in Jakarta, 2012). Lighting in a building can be obtained such as by using natural lighting which is utilized can reduce or negate artificial lighting so it can decrease electricity use.

There has been a lot of research to know lighting level on a building. Some of the research is a research which is done by Samsudin Amin, Nur Jamala and Jacklyn Luizjaya (2016) produce that course's room has illumination level which has not met the recommendation illumination standard which recommended by SNI 03-6575-2001 that is 250lux, however the user of the room still can do activity well. Next illumination level affects to building orientation and area in building sheath. While the research which is done by Evi Puspita Dewi (2011), produce a conclusion that by doing rearrange interior element and apply controlling system which made adjustment to the time and teaching media in the course's room, so the lighting system will more effective and efficient by saving energy of 36,4%.

Based on the research then it can be seen that in designing a building that lighting system which is needed for rooms in a building become a must considered factor in designing a building in order to provide comfort for its users. On the basis of it, then in this review will discuss about design a residential building which environmental friendly by calculate lighting in every room so it can have obtained a residential building design which is environmental friendly and fulfill condition about lighting.

METHOD

In Indonesia Green Building or environmental friendly building regulated in the Regulation of State Minister of Environment No. 08 Year of 2010 about Criteria and Certification the Environmental Friendly Building. In the article 1 paragraph 1 explained that environmental friendly building or green building is a building which is apply environmental principal in the design, development, operational, and the management and important aspect handling climate change impacts.

A building can be categorized as an environmental friendly building if it is fulfilling the criteria such as:

1. Use the building material which is environmental friendly.
2. There are facilities, infrastructures for conservation of water resources inside the building.
3. There are facilities, infrastructure of conservation and diversification energy including using lighting system and artificial saving energy air conditioning.
4. There is facility of waste sorting.
5. Pay attention to aspect of healthy for the residence of the building such as maximize the utilization of sun light.
6. There are facilities, infrastructures of sustainable site management.
7. There are facilities, infrastructure to anticipate disaster.

According to Ahadi (2014), condition of environmentally friendly homes is not damaging the nature when planning and building, material which is used not damaging the environment, there is area as where plants grow, utilized energy of the nature, good air circulation, not covering page with concrete, there is a biopore hole in the yard of the house and there is a plant in the home page. Whereas according to Riri Nouriansyah in the Jujuk Ernawati and Rintan Puspitasari (2016), condition of environmental friendly house is having nature lighting, have a garden in the roof, planter and hollow bricks. The nature lighting which is meant that all of the house could have access to get a light from outside, the garden in the roof function to cooling the room below, planter will make the wall green colored so it can give cool and mild effect, whereas the hollow bricks can make the air circulation in the house flow

well so it is no conditioner room needed.

Green building is a practical of making structure and using process which responsible to the environment and resources as efficient as possible in the whole of a building life cycle, start from design activity, doing construction, building maintenance, and building renovation. The concepts of the Green Building emphasize on efficiency in using energy, water or building material. Green Design building will pay attention in the numbers of open spaces to maximize air circulation and natural lighting so the use of lamp lighting and air conditioner in the afternoon as little as possible. (regarzcantona, 2010).

Lighting of a building basically can be fulfilled by using natural lighting if the building is designed accurately. However, if the natural lighting doesn't exist or room doesn't get natural lighting, so the artificial lighting by using electricity can't be voided.

Nurhenu Karuniastuti (2013), in doing interior design, is done n interior using which is environmental friendly and do a reduce of excessive electricity use, for example to illuminate a room should to used a save energy lamp such as using LED lamp that low in electricity consumption.

According to Endy Marlina, 2007, lighting system besides functionalized is lighting facilities also can be used as a forming atmosphere in the building and form the image of building view. In making lighting system as a part from the building, need to considered several things as follows:

1. Level of lighting adjusted with the need of strong light as desired according to the activities performed.
2. Lighting technique which is designed can be used at once to get the building image.
3. Electrical network distribution which support lighting system can putted above room ceiling, under the floor in the floor structure which is rise (rising floor), or planted in the wall.

Those three matters above should to pay attention because it will affect to the building design overall and the cost that must be paid.

In the guidance use of green building Jakarta, 2012 stated that a careful lighting system design, efficient equipment and good control has a potential to reduce total consumption of energy in the building in Jakarta until 10%. Reducing this energy consumption probably to be done if refer to chart of energy consumption details to several kinds of building as below:



Fig 1. Details of Energy Consumption for several kinds of building

In designing a residential building so based on SNI 03-6197-2011, planning of artificial lighting system should not exceeding the maximum installed power of lighting like the table below:

Table 1. Maximum Power Density

Room Function	Lighting Power Maximum (W/M2) including Ballast Loss
Terrace	3
Guest Room	7
Dining Room	7
Office Room	7
Bed Room	7
Bath Room	7
Kitchen	7
Garage	3

The things to watch out for is that the lighting power (watt) for the whole of the building should not exceeding lighting power which is allowed counted by using the table 1 above. Trade-off between the rooms allowed as long as total watt not exceeding the condition that is determined.

As for the minimum lighting level which is recommended in the SNI 03-6575-2001 about Artificial Lighting System Design Procedures in the Building is as below:

Table 2. Minimum Lighting Levels and Color Rendering

Room Function	Lighting Levels (Lux)	Color Renderation Group	Information
Terrace	60	1 or 2	
Guest Room	120 ~ 250	1 or 2	
Dining Room	120 ~ 250	1 or 2	
Office Room	120 ~ 250	1	
Bed Room	120 ~ 250	1 or 2	
Bath Room	250	1 or 2	
Kitchen	250	1 or 2	
Garage	60	3 or 4	

In the SNI 03-2396-2001 about Procedure of Natural Lighting System Design in the Building describing that natural lighting in the afternoon can be said good if in the afternoon between 08.00 am until 16.00 pm local time there is quite a lot of light coming into the room and light distribution in the room quite evenly and or does not create a disturbing contrast.

RESULTS AND DISCUSSIONS

In making concept of this environmental friendly residential building, refer to 2 things that is concerning the design of the building and lighting system in the rooms of building.

Building Design

In this building design based on:

- a. Location of the building which will build
The locations where the building will build affect the concept of the building that will make for example the location is in the mountain or in the town will affect the concept of the building.
- b. Needs for the owner of the building
This needs concerned the use of each room that needed by the owner of the project

c. Available Land Area

Available land area affects the concept of the building which is planned. It is related with calculation supply of those building utility.

d. Situation and Condition Around Environment

This is related with existence of the building which will build, whether there are has already other building around or still in the form of a garbage stretch.

On the basis of it then could make a concept of a building which is will planned. This following is the series of building design that try to make with attention to the concept of green building:

1. Building View

Building view show plan of building view both from the front, back, left side either right side. Building view becomes identity of the building so it is distinguishing with the other building.

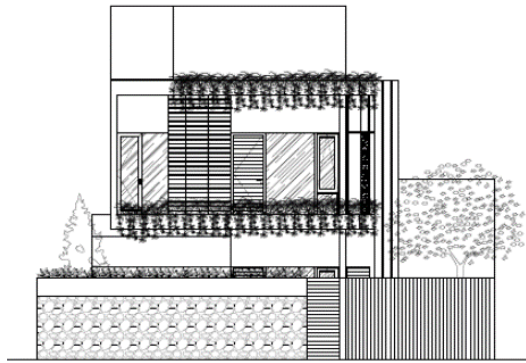


Fig 2. Front View

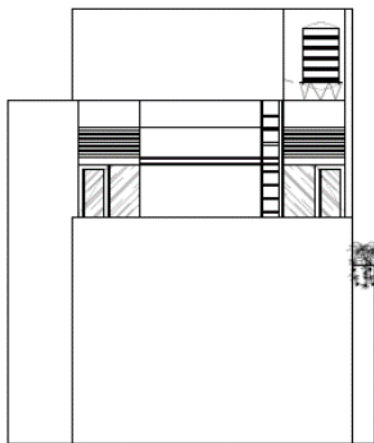


Fig 3. Back View

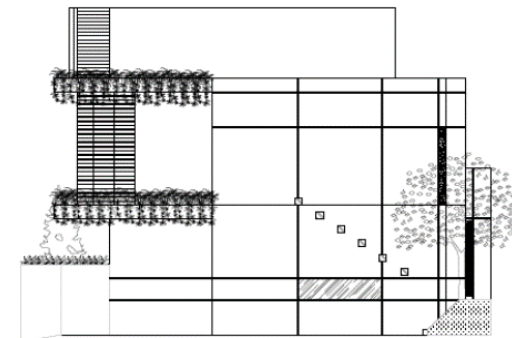


Fig 4. Right Side View

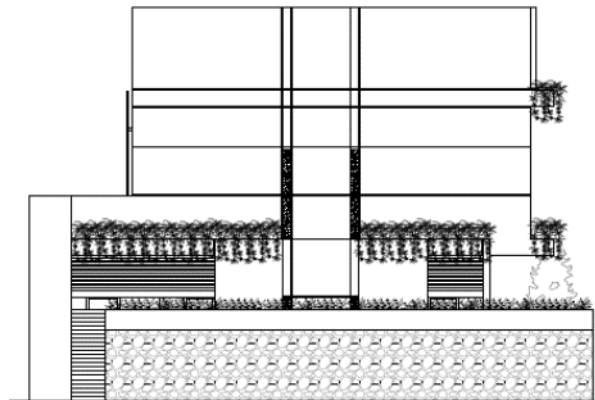


Fig 5. Left Side View

To give more figuring about this building which is planned ten the following is displayed building view in the front view which use coloring so it reflects the condition which will obtained went that building is build.



Fig 6. Building View with Coloring

In this concept of the building trying to create green building with giving plants around the building to give a cool impression on the building overall and can give O₂ supply addition to the residence of the house. To give enough lighting especially in the first floor, so it made a room between with the building which is exist at the side so it is made open carport area thus air circulation and natural lighting can be into the building.

2. Detail of the Building

Detail of the building which shown is to show layout of each floor space and layout of door and window position for each room. This building detail can be the basis for knowing lighting and air circulation which will obtained by each rooms. As for the building detail is as follow:

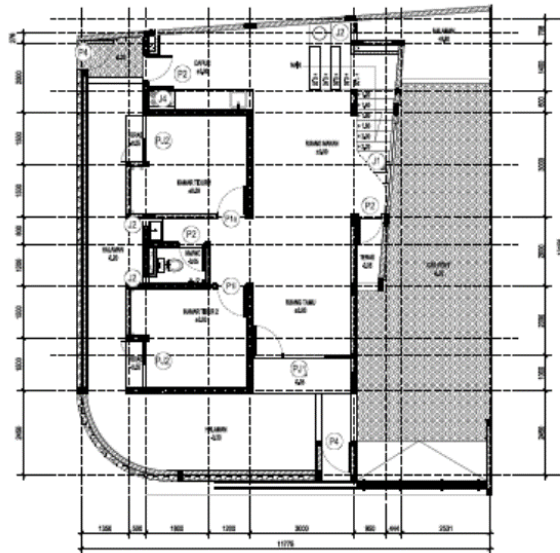


Fig 7. Planning of Doors and Windows Layout on First Floor

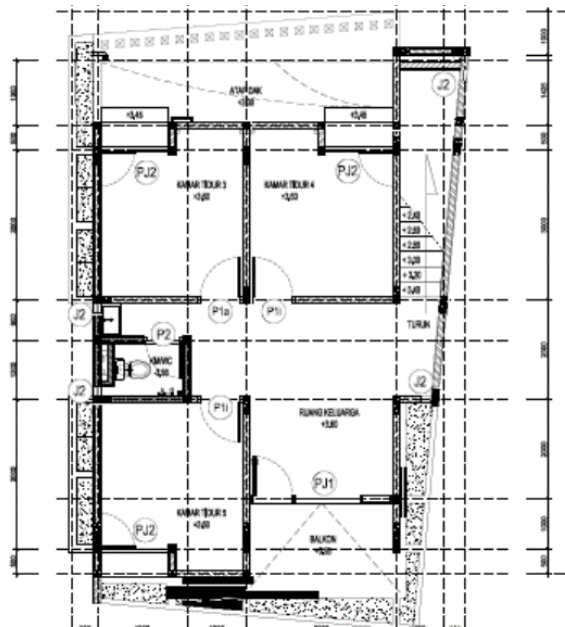


Fig 8. Planning Doors and Windows Layout on Second Floor

Those doors and windows can work for natural lighting so the rooms which have doors and windows to get light so it can give illuminate to those rooms. The laying of doors and windows adjusted with position and function of each room in the building.

Artificial Lighting System for Each Room

After it made room layout which places doors and windows by considering outside lighting, so it made an artificial lighting system to give illumination in the rooms which is still lack natural lighting in the afternoon or to provide lighting for whole the room in the dark condition or in the night. In making this lighting system things that should to pay attention is layout of lamp spots which will placed and the amount of wattage lamp installed in those lamp spots.

This following is the floor plan indicates the artificial lighting system in the rooms of building that planned:

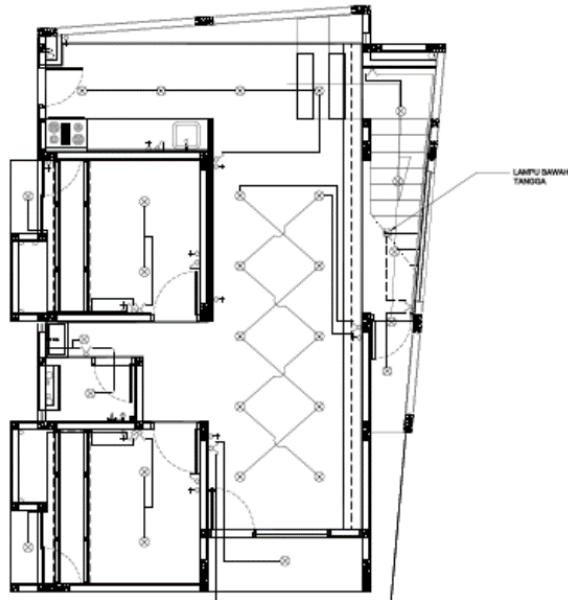


Fig 9. Plan of lamp layout for first floor

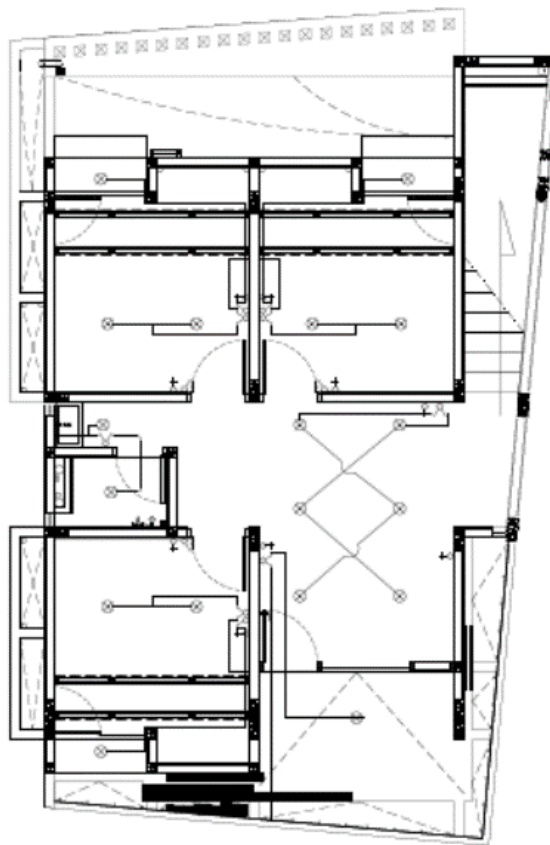


Fig 10. Layout of Lamp Spots for Second floor

In the figure 9 and figure 10 seen that each floor are already placed the lamp spots function to provide lighting for those rooms. The lighting which will provided by installed the lamp is done by considering the conditions that list in table 1 and 2 thus by referring to those tables so will provide comfort for the user and expected it can save the cost that must be paid.

CONCLUSION AND SUGGESTION

Based on the discussion above, so it can be conclude as bellows:

1. Concept of environmental friendly resident can be applied as long there is an awareness from all the parties to be together to create a result of environmental friendly construction.
2. In making environmental friendly residential keep pay attention needs factor of room that desired by the owner of the residential. Mechanism determination of space layout adjusted with environment around the residential will built because it is related with the lighting which will obtained by each rooms especially natural lighting.
3. Determination of artificial lighting referring to conditions which applied so in designing artificial lighting according to the request of the project owner and the regulation that exist.

Concept of environmental friendly building can reduce the occurrence of global warming thus need to be done by construction industry players both for the owner of the project, consultant or the contractor.

REFERENCES

- [1] Ahadi, 2014, Syarat Rumah yang Green atau Ramah Lingkungan, diunduh dari www.ilmurumah.com pada tanggal 1 September 2017
- [2] Endy Marlina, 2007, Panduan Perancangan Bangunan Komersial, Andi, Yogyakarta
- [3] Evi Puspita Dewi, 2011, Optimasi Sistem Pencahayaan Ruang Kuliah Terkait Usaha Konservasi Energi, Dimensi Interior, Vol. 9 No 2, Desember, 80-88, diunduh dari www.dimesiinterior.petra.ac.id pada tanggal 1 September 2017
- [4] Jujuk Ernawati, Rintan Puspitasari, 2016, Syarat Merancang Rumah Ramah Lingkungan, diundh dari www.viva.co.id pada tanggal 1 September 2017
- [5] Layout bangunan rumah tinggal 2(dua) lantai di Yogyakarta, 2017
- [6] Nurhenu Karuniasuti, 2013, Bangunan Ramah Lingkungan, Forum Teknologi Vol. 05 No. 1, diunduh dari www.pusdiklatmigas.esdm.go.id pada tanggal 1 September 2017
- [7] Otto Soemarwoto, 2005, Analisis Mengenai Dampak Lingkungan, Gadjah Mada University Press, Yogyakarta
- [8] Panduan Penggunaan Bangunan Gedung Hijau Jakarta, 2012, Sistem Pencahayaan, Vol.3, diunduh dari www.greenbuilding.jakart.go.id pada tanggal 1 September 2017
- [9] Peraturan Menteri Negara Lingkungan hidup No. 08 Tahun 2010 tentang Kriteria dan Sertifikasi Bangunan Ramah Lingkungan
- [10] Regarzcantona, 2010, Green Building, Bangunan Ramah Lingkungan Syaratkan Efisiensi, www.regarzword.wordpress.com
- [11] Samsuddin Amin, Nurul Jamala, Jacklyn Luizjaya, 2016, Analisis Pencahayaan Alami Pada Ruang Kuliah Fakultas Teknik Univesitas Hasanuddin, Prosiding Temu Ilmiah IPLBI, diunduh dari www.temuilmiah.iplbi.or.id pada tanggal 1 September 2017
- [12] SNI 03-6197-2011 Tentang Konservasi Energi Pada Sistem Pencahayaan
- [13] SNI 03-2396-2001 Tentang Tata Cara Perancangan Sistem Pencahayaan Alami Pada Bangunan Gedung
- [14] SNI 03-6575-2001 tentang Tata Cara Perancangan Sistem Pencahayaan Buatan Pada Bangunan Gedung