Implementation of Energy Efficient Building Concepts In
Design Office of Dinas Pendidikan dan Kebudayan
Kabupaten Merauke

Sari Octavia, Henry Soleman Raubaba And Yosi Valentia Simorangkir
Department of Architecture Universitas Musamus Merauke, Indonesia

sari@unmus.ac.id

Abstract, The building plays an important role in the use of energy in Indonesia. Most of the expenditure of energy in Indonesia is generated by a particular building electricity consumption by households and the commercial sector. electrical energy use in buildings mostly used to create an artificial climate such as air conditioning and lighting. The building was also partially responsible for greenhouse gas emissions and the use of raw materials that are manufactured to material such as sand, gravel and cement. Design Office of Dinas Pendidikan dan Kebudayaan Kabupaten Merauke try to apply the concept of energy-efficient buildings. The purpose of this study is to analyze the application of energy-efficient building concept in the design office Dinas Pendidikan dan Kebudayaan Kabupaten Merauke. This research is qualitative research phases namely direct observation in the field, videotaped, and the study of literature. The results showed Building Design Office of Dinas Pendidikan dan Kebudayaan Kabupaten Merauke try to apply the concept of energy-efficient building on the building design by way of setting the basic building coefficient, the orientation of the building, s / v ratio and wide openings made structures. But the use of materials, the use of concrete with sand brought in from outside the area is not considered environmentally friendly The results showed Building Design Office of Dinas Pendidikan dan Kebudayaan Kabupaten Merauke try to apply the concept of energy-efficient building on the building design by way of setting the basic building coefficient, the orientation of the building, s / v ratio and wide openings made structures. But the use of materials, the use of concrete with sand brought in from outside the area is not considered environmentally friendly. The results showed Building Design Office of Dinas Pendidikan dan Kebudayaan Kabupaten Merauke try to apply the concept of energy-efficient building on the building design by way of setting the basic building coefficient, the orientation of the building, s / v ratio and wide openings made structures. But the use of materials, the use of concrete with sand brought in from outside the area is not considered environmentally friendly. The results showed Building Design Office of Dinas Pendidikan dan Kebudayaan Kabupaten Merauke try to apply the concept of energy-efficient building on the building design by way of setting the basic building coefficient, the orientation of the building, s / v ratio and wide openings made structures. But the use of materials, the use of concrete with sand brought in from outside the area is not considered environmentally friendly.

1. Introduction
Education is a basic requirement today. Every citizen has the right to get an education, wherever located. Therefore, the Merauke district government through the Department of Education and Culture strives to provide the best service to the public so that every citizen in the district of Merauke could get a decent education in accordance with what is hinted at UUD 1945.

Building Planning design review Office of Dinas Pendidikan dan Kebudayaan Kabupaten Merauke prepared with a view to providing a government vessel that can accommodate all the activities of
government administration in order to provide services to the community, starting from early childhood education to upper secondary education level.

Office according to Indonesian dictionary is hall (buildings, houses, rooms) where the care of a job: a place to work. Another notion is office is an organizational unit which consists of places, personnel, and administrative operations to help the leaders of the organization. The place is a room, building, complex, as well as furniture and equipment, such as machinery and other equipment. From the above understanding can be concluded that the office is a place or a place for a group of people doing office governance activities is to provide the communication and recording.

The building plays an important role in the use of energy in Indonesia. Most of the expenditure of energy in Indonesia is generated by a particular building electricity consumption by households and the commercial sector. Electrical energy use in buildings mostly used to create an artificial climate such as air conditioning and lighting. The building was also partially responsible for greenhouse gas emissions and the use of raw materials that are manufactured to material such as sand, gravel and cement.

The concept of green buildings or green building concept is the creation of the construction of the planning, implementation and use of construction products that are environmentally friendly, efficient use of energy and resources, as well as low-cost, pay attention to health, comfort inhabitants who all adhered to the continuous rule.

Definition of energy efficient buildings in the context of this discussion is the building in operation can press (save) the use of derived (mainly) from petroleum. An office building that was built without the use of a lift can be considered energy efficient because it saves electricity consumption for propulsion engine lift [1].

2. Methodology
The purpose of this study is to analyze the application of energy-efficient building concept in the design office of Dinas Pendidikan dan Kebudayaan Kabupaten Merauke.

2.1. Research sites

![Figure 1. Location of research](image)

The research location is at Missi Street Merauke by conduct studies on the design office of Dinas Pendidikan dan Kebudayaan Kabupaten Merauke.

2.2. Data source
The data used in this study are the data obtained from the observation, documents and data from literature studies related to the concept of the building.
2.3. Research design
This research is qualitative research phases namely direct observation in the field, videotaped, and the study of literature,

2.4. Methods and data analysis
The analytical method used is descriptive qualitative, where the results of observation and study of literature is described in detail. Observation data taken directly in the field consists of images are then interpreted in the form of text and image re-recording.

3. Research result
3.1. site plan
In Figure 1 shows the shape of the site and the area of land which is sized 143.5 M x 48 M or an area of 6,888 m² and 1,750 m² building area. From the comparison between the area of the site with the building floor then obtained by comparison to the basic building coefficient is 75%: 25%, or the ratio between the area of land that is not built and built area are 75% not built and 25% were built.

The building boundary is 43.5 M which allows a large parking lot and a park that can function as a reforestation and water catchment area. The position of the building facing the northwest is directly facing the main road, the Missi road.

Figure 2. The site plan
3.2. Building plans

Figure 3 and Figure 4 shows a first floor plan and second floor plan of office building with a total floor area is 2,800 m². The shape of the plan is elongated by raising void in the middle of the building that is used as a park by presenting soft material elements, namely water (fish pond) and hard material, namely plants. As well as the void in the lobby of the building resulting in the lobby ceiling is higher compared to other parts of the building.

3.3. Appearance of the building

Figure 5. building’s fasade

Figure 6. Images of the cross section of the building
Overall appearance of the building characterizes the government building with the use of the large pillars that significantly firmness and authority of the government. Building colours dominated by white and a little black colour display of natural stone is used as a material in building facade (figure 5). Window is made more wider on the building with the use of cladding made of glasses and Alluminum Composite Panel (ACP). Height of each floor of the building is 4M, with 35° degrees roof slope that causes high between the ceiling and the roof ridge is 4 M (figure 6).

3.4. Building materials
The building structure uses concrete with a monolithic structural system. The frame uses an aluminum frame with the use of tempered glass and stopsol glass. The walls use brick walls with ½ brick thickness and finishing plaster on both sides of the walls. Gypsum board is used as insulation material in the room and ceiling material.

The truss frame use mild steel material with a roof cover using a spandek roof with a thickness of 0.45 mm. the floor of the building uses ceramic floor 60 x 60 cm.

3.4.1. Lighting analysis

![Figure 7](image)

*figure 7, 1st Floor lighting analysis using Autodesk ecotect*

From the picture above (figura 7), it appears that the light that enters the building area received the most sunlight is a void area of the building because the area is not covered roof. While most areas in the building receive light at 1,080 lux and the smallest received 500 lux. The average lighting in the building is 1149.36 lux.
From the picture above (figure 8), it appears that the light that enters the building area received the most sunlight is a void area of the building because the area is not covered roof. While most areas in the building receive light at 1,080 lux and the smallest received 500 lux. The average lighting in the building is 1149.36 lux.

4. Discussion

Basic building coefficient behaves differently in each region. For buildings that are government buildings, the space that is built is 30% of the land area and the one that is not built which will become a green open space is 70%. In office buildings of Dinas Pendidikan dan Kebudayaan kabupaten Merauke, the scale of the building and the proportion of open space have met the specified conditions. This non-built space is used as a parking lot, circulation and green open space. In addition to being used as a place for reforestation, this green open space in the building is also used as a rainwater catchment area. The wider the area that is not built and not covered by solid material, the greater the discharge of rainwater that can be stored in the soil as preparation for the dry season.

Building orientation plays an important role in the application of energy-efficient buildings. The position of the building against the orientation of the sun affects the thermal comfort in the building. Buildings facing north and south receive more direct sunlight in the morning and evening and this causes the electric load to increase with the addition of building cooling devices (AC). Building orientation at the education and cultural office faces the northwest so that the surface area of the building exposed to the sun is quite extensive but this is anticipated by planting vegetation and window canopies to form shading.

The plan for the building of the education and cultural office has s / v ratio or the ratio between the volume of the building and the surface of the exposed building is 0.14. The fewer surfaces exposed, the smaller the value of a building. Increasing the s / v ratio causes an increase in air conditioning load[2]. Plan design by utilizing voids in the middle of buildings that function as reforestation can reduce the use of air conditioning (AC) so that it saves use of electricity.

Large window openings with a ratio of the ratio between the area of openings and the surface area of the wall is 777 m2: 1,623 m2 or equal to 0.32% openings in the wall in the form of windows and doors and ventilation. One strategy to obtain energy-efficient designs is to encourage the use of natural ventilation as the main method by maximizing the sun and wind [3].

---

**figure 8.** 2 nd Floor’s lighting analysis using Autodesk ecotect
One of the specific criteria in the aspect of development planning and implementation data, the draft regulation (RAPEREMEN) Public Works On Green Building Technical Code [4], the management of the use of the material. The selection of materials to be used in a building is one of the important aspects in realizing environmentally friendly development. This can be seen from the role of material materialized in three stages of development, namely pre-building, building operation, and post-building [5].

The material used in Dinas Pendidikan dan Kebudayaan Kabupaten Merauke Building office is concrete for building structures. The concrete used cannot be called an energy-saving material considering that the sand used is not locally available sand but imported from outside the city. Aluminum is used as a replacement wood frame material considering that in terms of price, aluminum is more economical. Tempered glass is the choice given the large window openings that do not allow the use of glass.

The use of glass in buildings is expected to maximize sunlight during the day, thereby reducing the use of artificial light that consumes electrical energy. Building envelope became the vanguard of the entry of radiation into the building. With proper design of the building envelope, the use of energy in buildings can be saved as optimal as possible. The building as a building element sheath that covers the walls and roof is translucent or opaque where the majority of the thermal energy and light move through the elements [6].

5. Conclusions and recommendations

Building Design of the Education and Culture Office of Merauke Regency tries to apply the energy-saving building concept in building design by setting the basic coefficient of the building, building orientation, s/v ratio and wide openings of buildings. But on the use of materials, the use of concrete with sand imported from outside the area is considered not environmentally friendly because it can be imported from outside the area to consume fuel. For planning energy-efficient buildings in the future so that material selection can be more considered so that the design of the building with the concept of saving energy is maximally applied.

References

[1] Harso T. Arsitektur Tropis dan Bangunan Hemat Energi. KALANG. 2016;1(1).
[2] Pramita D, Laksmiti E. Kinerja Bentuk Bangunan Perkantoran Ber tingkat Menengah Di Surabaya Ter hadap Efisiensi Energi Pedinginan. :1–12.
[3] Billy G. Energy Efficiency Guidelines for Building Design in Indonesia 3 Case Studies.
[4] Peraturan Menteri Pekerjaan Umum dan Perumahan Rakyat RI Nomor 02/PRT/M/2015 tentang Bangunan Gedung Hijau. 2015.
[5] Syahriyah DR. Penerapan Aspek Green Material Pada Kriteria Bangunan Rumah Lingkungan Di Indonesia. J Lingkung Binaan Indones. 2017;6(2):95–100.
[6] Aseani W, Setyowati E, Sari SR. Pengaruh Material Kaca Sebagai Selubung Bangunan Terhadap Besar Perpindahan Panas Pada Gedung Diklat Pmi Provinsi Jawa Tengah. J Arsit ARCADE. 2019;3(1):80.