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FEASIBILITY STUDY OF FLOATING SOLAR POWER PLANTS IN SITU TUNGGILIS CILEUNGSI BOGOR REGENCY

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Abstract

Currently in Bogor City there are many potential areas that can be used as tourism locations. Tourist locations can also be a source of pride for local residents because they can improve the economy of local residents. By having distinctive cultural heritage characteristics, legendary historical stories to natural potential that has its own appeal, all have an important role in developing the economic welfare of the local community. Supporting factors that cannot be ignored are the infrastructure and comfort offered to support it as a tourist destination. Situ Tunggilis is one of 93 lakes in Bogor Regency, has good tourism potential, but the facilities and infrastructure in Situ Tunggilis are still less than optimal. One of the things that is still an obstacle is access to electrical energy. Therefore, access to electricity must be done immediately to increase the appeal and service to tourists. In meeting the main electricity needs in Situ Tunggilis, one of the efforts put forward is to utilize environmentally friendly New and Renewable Energy (EBT) sources, namely floating Solar Power Plants (PLTS). Based on this feasibility study, it can be concluded that solar energy obtained around Tunggilis can be used as an energy source for floating PLTS. Thus, this study can be applied as an effort to improve sustainable ecotourism facilities and infrastructure in Situ Tunggilis.

Keywords: Tourism, Floating Solar Power Plants, Renewable Energy

INTRODUCTION

Currently, the tourism industry is one of the mainstays of local residents, which is expected to boost the economy in the region. Like in Bogor in particular, there are many potential areas that can be used as tourism locations. By having distinctive cultural heritage characteristics, legendary historical stories to natural potential that has its own appeal, all have an important role in developing the economic welfare of the local community (Mauidzoh, et al., 2023) (Slamet, 2024).

In addition, several other supporting factors such as typical foods and social systems also contribute to the color of a tourist area. Apart from these factors, there is one thing that cannot be ignored, namely the various infrastructure and comfort offered to support it as a

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tourist destination, this is one of the important factors of a tourist area (Nugraha, 2022).

Situ Tunggilis is one of 93 lakes in Bogor Regency and is a local government asset owned by the West Java Provincial Public Works Office. Administratively located in Tungilis Village, Setu Sari Village, Cileungsi District (Susdiyanti, et al., 2017). Having good tourism potential, the facilities and infrastructure in Situ Tunggilis are still less than optimal. One of the things that is still an obstacle is access to electricity. As is known, currently the need for electricity is the main thing in everyday life to support various activities, as well as in a tourist area (Prasetio, 2024) (Hidayat, et al., 2022). Due to the absence of electricity, there is no Public Street Lighting (PJU) in Situ Tunggilis, local people around the lake have difficulty doing business such as the existence of food stalls, souvenir shops, play facilities, difficulty getting internet facilities to support the promotion of tourist areas, and other problems (Soebagia, 2023). In fact, in improving tourism services, good infrastructure is needed such as PJU, local businesses, internet, decorations, and other things that require electricity to make it look more attractive. Therefore, electricity access must be done immediately to increase the attraction and service to tourists.

Figure 1. Situ Tunggilis Tourism Area

In meeting the main electricity needs in Situ Tunggilis, one of the efforts put forward is to utilize environmentally friendly New and Renewable Energy (EBT) sources, namely floating Solar Power Plants (PLTS). As is known, floating PLTS is the most promising alternative energy and will not run out when viewed from its availability (Soebagia, 2023). One innovation that can be applied is the use of floating solar panels on the surface of the lake in Situ Tunggilis. This concept not only provides an alternative for providing environmentally friendly electricity, but also utilizes unused space in the waters for power generation. Floating PLTS has its own advantages, such as higher efficiency due to the natural cooling effect of water and reducing limited land use. Based on the results of the team's survey and several studies, Situ Tunggilis is a natural lake that has an area of almost 35 Ha and has a daily

radiation of 4.5 kWh/m² (Mariya, 2019) (Yuliza, et al., 2022) (Hidayat, et al., 2022). So in this study, a floating PLTS construction design was carried out to provide electrical energy in the Situ Tunggilis tourist area, which can later be realized so that it can optimize infrastructure in the Situ Tunggilis tourist area. In addition, the use of solar energy in the area can reduce dependence on fossil fuels, which have so far been the main source of energy in several remote areas. By considering this potential, this feasibility study aims to evaluate the technical, economic, and environmental feasibility of developing a floating solar panel power plant in Situ Tunggilis Cileungsi, as well as provide recommendations for stakeholders in making decisions related to the implementation of this project. Through the development of a floating PLTS in Situ Tunggilis, it is hoped that a more stable and sustainable energy needs can be met for the community around the lake, as well as support the achievement of government targets in developing renewable energy in Indonesia.

IMPLEMENTATION METHOD

In carrying out this activity, the Unpak Electrical Team collaborated with the Uika Electrical Team. The methods used in the implementation are:

- Preliminary survey stage
  The activity at this stage is to conduct a survey related to Situ Tunggilis. Then coordinate with BUMDes (Village-Owned Enterprises) to determine the identification of problems and solutions.
- Socialization stage
  Activities at the socialization stage were carried out to BUMDes managers at November before the construction of the FLOATING PLTS and after construction was completed.
- Preparation stage
  Activities at this preparation stage were to measure the illumination and dimensions of the road. Measurement activities were carried out in the months of October to December at several points around the lake by involving students.
- Design Stage
  Activities in the design stage are to determine the system, layout, and modeling of the floating PLTS and PJU, where the goal is that before construction is carried out, the layout and system to be implemented can be in accordance with the existing potential in the Situ and minimize unwanted incidents during the construction process.

In the planning, the position and placement of the floating PLTS in the Situ Tunggilis Tourism Area are on the side of the lake as seen in Figures 1 and 2. Then from the results of measuring the illumination parameters and dimensions of the road to Situ Tunggilis, the lighting conditions do not meet the SNI 7391: 2008 standards concerning the provisions for Public Street Lighting where for normal public roads the lighting level is an average of 5 lux (Arirohman, et al., 2021), while on the road at the Situ Tunggilis location it is far below that value because there is no proper PJU.

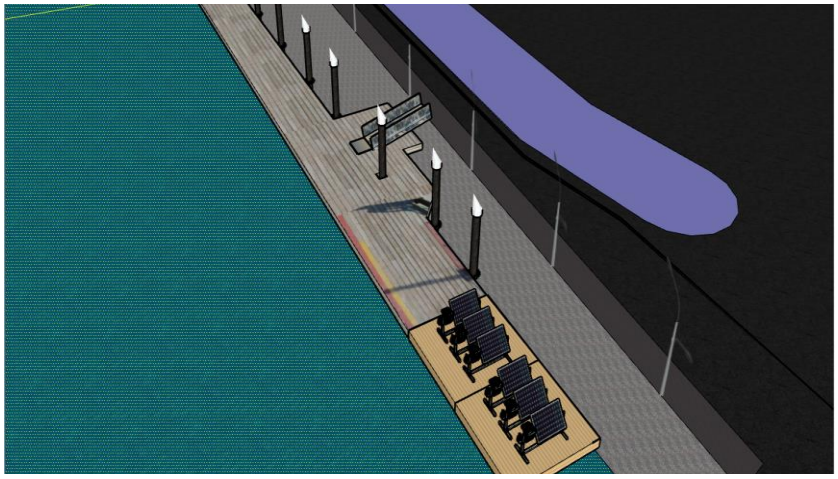

Figure 2. Floating PLTS Design in the Situ Tunggilis Area

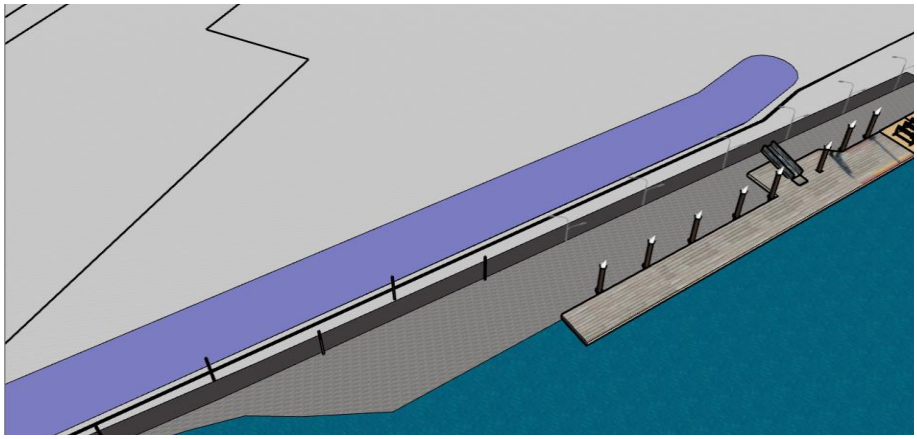

Figure 2. Planning for Determination and Placement of Lights

The basics for determining lighting needs are based on:

- SNI 03-6575-2001 concerning energy conservation in lighting systems
- SNI 7391-2008 concerning provisions on Public Street Lighting
- Permen Pupr no. 3 of 2014 concerning pedestrian guidelines
- Calculation of the number and power of lights based on the lighting area needs.

Based on the existing condition measurement stage before the design, then after that the needs are measured for each parameter, namely land pedestrians, floating, lighting height, and lamp brightness level as stated in Table 1 and the design scheme in Figure 3.

Table 1. Measurement of needs for each parameter

Parameter	Need
Land pedestrian	Need 22 lamp pole LED 15 Watt with distance 10 meter
Floating pedestrian	Need 17 lamp pole LED 15 Watt with distance 10 meter.
High Illumination	4 meter
Light Brightness Level (Lux)	4 Lux

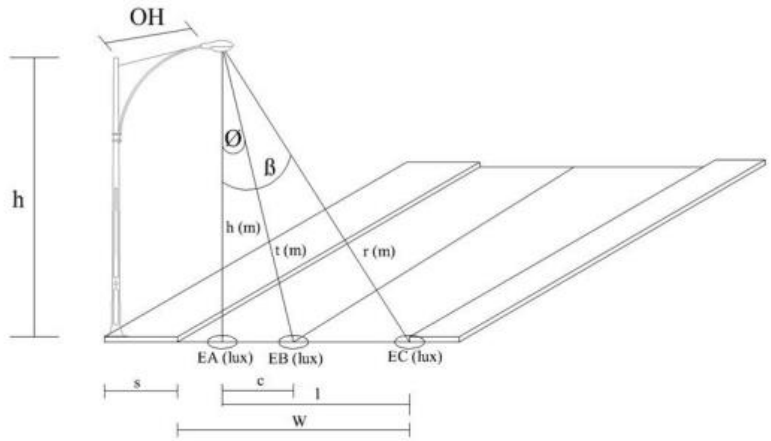

Figure 3. Design Scheme

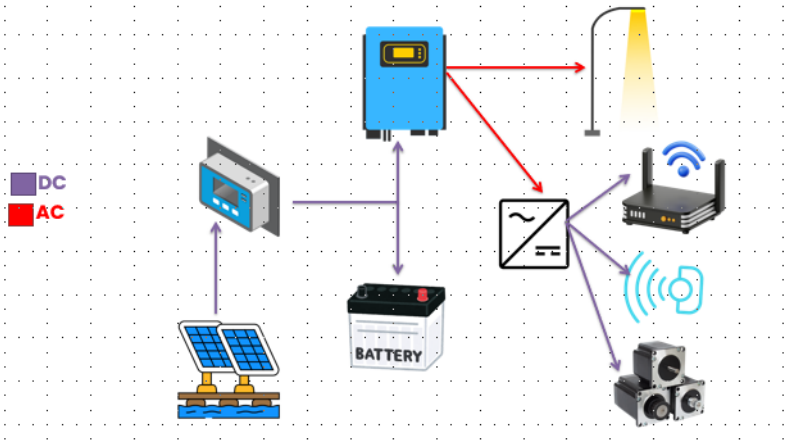

Figure 4. Floating PV System Configuration

Meanwhile, in this study, a configuration plan for the floating PLTS system in the Situ Tunggilis area was also made. In Figure 4, it can be explained that the system will accommodate AC electrical loads including PJU lighting and DC loads in the form of internet resources and the solar panel tracker automation system itself.

RESULTS AND DISCUSSION

The need for electrical power that must be met in the Situ Tunggilis tourist area is calculated based on the needs in terms of lighting alone or PJU. As stated in Table 2, where there are four devices that are the main points for the main PLTS load, namely PJU.

Table 2. Solar power plant load requirements

No.	Equipment	Power (watt)	Total	Operation (jam)	Energy (Wh)
1.	LED lamp (PJU)	15	39	9	5265
2.	Strip Led 10 Meter	10	1	9	90
3.	Motor Steper	45	5	6	1350

4.	Access Point	5	2	24	240
TOTAL					**6945 Wh/Day**
Monthly Energy					**208,4 kWh/Mth**

Based on the data above, the system losses are calculated at 20% of 1389 Watt Hours so that the overall load that must be generated from the PLTS is 8334 Watt Hours for each day. 3.2 Solar Panel Requirements The solar panels needed for the planned Public Street Lighting (PJU) are with a panel specification of 200 Wp 36 Voc. The number of panels needed is calculated based on the following equation:

$$\Sigma \, \mathrm{p} = \frac{\text{Total Energi (TE)}}{\text{Cap. Panel} \, . \, \text{PSH}} = \frac{8334}{200 \, . \, 5} = 8{,}3 \approx 8 \text{ pcs}$$

After the solar panel needs are calculated, the next step is to calculate the battery needs for the PLTS. Batteries are used to store the power generated by the solar panels on the PLTS. The equation that can be used to calculate battery needs is as follows:

$$\Sigma \, \mathrm{B} = \frac{\text{Total Energi (TE)}}{\text{BC} \, . \, \text{DoD}} \cdot \text{Outonomy Day} = \frac{8334}{600} = 13{,}8$$

Based on the results of the analysis and calculations above, the need for batteries with a capacity of 12 Vdc 100 Ah is 14 units per day.

CONCLUSION

Based on the feasibility study of the floating PLTS construction in Situ Tunggilis, it can be concluded that solar energy obtained around Tunggilis can be used as an energy source for the floating PLTS. The Public Street Lighting (PJU) needed for the Situ Tunggilis area is 39 pcs with a total power of 6945 Watt hours per day. To calculate the required solar panels, the total PJU power must be added with a power loss of 20%, which results in 8334 Watt hours per day. As a result, the required solar panels are 8 pcs and assisted by 14 batteries with a specification of 12 Vdc 100 Ah. Thus, this study can be applied as an effort to improve sustainable ecotourism facilities and infrastructure in Situ Tunggilis.

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