Study of Solar Power Plants as the Main Resource of Fish Ponds in Percut Sei Tuan District, Deli Serdang

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Abstract
Percut Sei Tuan is one of the sub-districts that does a lot of fish farming which is quite abundant. However, the cost of using electricity for operations is one of the things that is quite burdensome for fish farmers. To overcome this problem, Solar Power Plants (PLTS) can be one of the alternatives for more economical and environmentally friendly resources. This study aims to calculate the power needs and capacity of solar PV needed to meet the power needs of fish ponds. This research provides benefits in the form of proper solar PV system planning, battery counting, and the use of renewable energy as a sustainable resource in the fish farming sector.

Keywords: *PLTS, Renewable Energy, Fish Farming*

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Introduction

Solar Power Plants (PLTS) are power generation systems that utilize solar energy to generate electrical energy. The system works by converting solar radiation into electrical energy through solar cells or photovoltaic solar panels [1]. With the potential for sunlight in Indonesia to be very abundant, solar power plants can be one of the energy potentials that are sustainable and environmentally friendly. This can be used for one of them fish farming, because in fish farming a very good water system is needed, pumping water is one of the efficient ways to drain water in the pond. With solar power as a resource for water pumping, it can be expected to reduce the need for conventional energy.

In Percut Sei Tuan District, fish farmers use electricity from PLN to irrigate their fish ponds, so the farmers spend a considerable amount of money every month because the water flow carried out by water pumps takes 6-8 hours every day [2]. With the use of solar PV, it is hoped that fish farmers can take advantage of solar energy to reduce considerable expenses every month [3].

In planning the use of solar power for water pumps, there are several things that must be known such as the power needs of the water pump, the capacity of solar panels, and the energy storage system. So that the use of solar power plants can work appropriately to meet energy needs.

Research Methodology

The research began by collecting data on the equipment used in the fish pond. Based on this data, the calculation of daily energy needs is carried out using a formula. Solar radiation data is obtained by calculating using the Lux Meter application.

Time and place

This research was conducted for 30 (thirty) days, starting from 09:00 to 18:00 from June 1 to June 30, 2025. This research was conducted in Dendang Sea Village, Percut Sei Tuan District, Deli Serdang Regency, North Sumatra.

Figure 1. Fish Ponds That Are Research Sites

Tools and Materials

The tools and materials used in this study can be seen from the table below.

Table 1. Tools and Materials Used

NO	Tools and Materials	Information
1	*SolarCell600 WpMonocrystalline Hi-MOX6Guardian MODEL:LR5-72HTHF600M*	*2 pieces*
2	*SolarChargeControllerMaximumPowerPointTracker (MPPT) 40 A*	*1 piece*
3	*Batera i24 V BatteryLifepo4 24V 100 A*	*3 pieces*
4	*Shimizu automatic pump well125 watt*	*1 piece*
5	*Pompa celup air Kyodo 500 watt*	*1 piece*
6	*Lampu LED Philips 15 watt*	*4 pieces*
7	*InverterXD-ESS7000 watt*	*1 piece*

Results

Potential of Solar Energy

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Hasil Interpolasi pada Waktu yang Tidak Terukur:

Waktu: 1.0 Hari, Intensitas: 11723.00 lux
Waktu: 2.0 Hari, Intensitas: 12294.00 lux
Waktu: 3.0 Hari, Intensitas: 10986.00 lux
Waktu: 4.0 Hari, Intensitas: 13767.00 lux
Waktu: 5.0 Hari, Intensitas: 10540.00 lux
Waktu: 6.0 Hari, Intensitas: 11233.00 lux
Waktu: 7.0 Hari, Intensitas: 11302.00 lux
Waktu: 8.0 Hari, Intensitas: 11746.00 lux
Waktu: 9.0 Hari, Intensitas: 10708.00 lux
Waktu: 10.0 Hari, Intensitas: 9534.00 lux
Waktu: 11.0 Hari, Intensitas: 10521.00 lux
Waktu: 12.0 Hari, Intensitas: 11119.00 lux
Waktu: 13.0 Hari, Intensitas: 12993.00 lux
Waktu: 14.0 Hari, Intensitas: 13322.00 lux
Waktu: 15.0 Hari, Intensitas: 11220.00 lux
Waktu: 16.0 Hari, Intensitas: 9109.00 lux
Waktu: 17.0 Hari, Intensitas: 10442.00 lux
Waktu: 18.0 Hari, Intensitas: 11506.00 lux
Waktu: 19.0 Hari, Intensitas: 12094.00 lux
Waktu: 20.0 Hari, Intensitas: 11273.00 lux
Waktu: 21.0 Hari, Intensitas: 12359.00 lux
Waktu: 22.0 Hari, Intensitas: 12232.00 lux
Waktu: 23.0 Hari, Intensitas: 13010.00 lux
Waktu: 24.0 Hari, Intensitas: 11976.00 lux
Waktu: 25.0 Hari, Intensitas: 11099.00 lux
Waktu: 26.0 Hari, Intensitas: 14966.00 lux
Waktu: 27.0 Hari, Intensitas: 13253.00 lux
Waktu: 28.0 Hari, Intensitas: 12957.00 lux
Waktu: 29.0 Hari, Intensitas: 11373.00 lux
Waktu: 30.0 Hari, Intensitas: 12252.00 lux

Total Energi Berdasarkan Data Interpolasi: 352909.00 lux.hari
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Figure 2. Lux Collection Results in June

After 30 (thirty) days of data collection, the total amount of lux in June 2025 was obtained of 352909 lux.

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Total Energi Matahari yang Diterima: 352909.00 lux.hari
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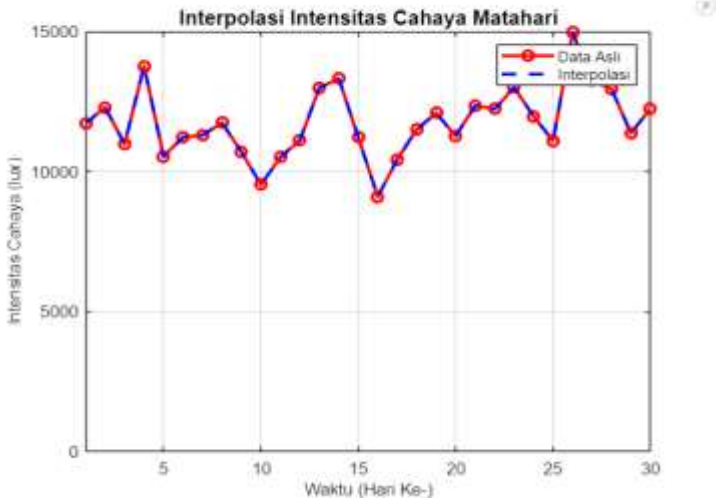

Figure 3. Lux chart in June

Electrical Power Requirements
To calculate the number of watts of power used on the fish pond by the solar panel and the number of hours of use per day. The formula used is

$$Wh = Pxh$$

Wh is the discharge power, P is the load used, and h is the length of use. The power load used for the automatic Well Pump is 125watts, a total usage of 8 hours,
That means the daily load is 1000 watts. 500watt Water Immersion Pump with 8 hours of use, total daily load is 4000 watts. And for 4 15watt LED lights with a total daily usage of 12 hours720 watts. The total daily used in the fish pond is 5720 watts.

Blindness of Solar Panels
In Indonesia, the sun can be absorbed by electrical energy for a maximum of 5 hours (Handani, 2022). So, to calculate the number of solar panels used in fish ponds is as follows

$$Wp = Wh/5$$

It is known that Wp is the capacity of the solar panel, Wh is the load discharging power, 5 is the optimal time, so 5720/5 the result is 1144 Wp.
To obtain 1144 Wp, a solar panel with that capacity is required. Then 2 pieces of 600Wp solar panels are needed. Thus the 2 pieces of solar panels can meet daily power needs.

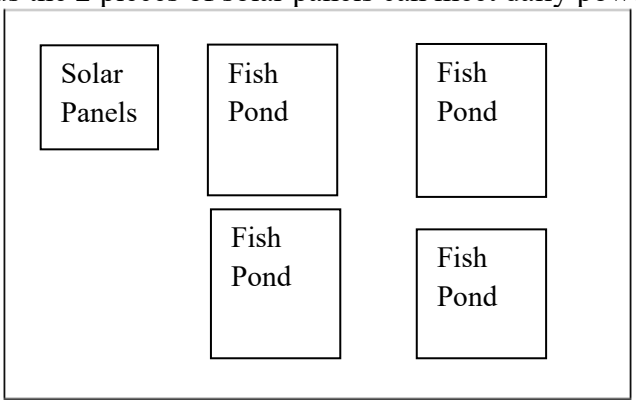

Figure 4. Solar PV Installation Planning Plan

Requirements Battery Capacity
In the available battery market there are various specifications, this study assumes the use of batteries with the following specifications.
Battery Voltage(V) = 24V
Battery Capacity (Ah) = 100 Ah
Then the battery capacity can be calculated
Battery Power = VxAh = 24Vx100Ah = 2400Wh
The number of batteries needed to meet the power can be calculated by the formula
Battery Count = (Electrical Power Required) / (Battery Power)
= 5720⁄2400 = 2,3
Rounded up to 3 battery units

Kebutuhan Inverter
The determination of the inverter is obtained from the total load. In the study, the total load was 5720 watts. Then the output power of the inverter used must be more than 5720 watts. So that the inverter needs 7000 watts, the selection of an inverter with a capacity greater than the total load aims to improve the reliability of the system and guarantee optimal performance during the operation of the system.

Necessity Solar Charge Controller (SCC)
The type of solar panel used is Mono Crystalline with the following specifications:
Power Output (Pmax) = 600 Watt
Open Network Voltage (VOC) = 53V
Maximum Power Voltage (Vmp) = 45V
Maximum Power Current (Imp) = 14 A
Short Relationship (Isc) = 15 A
Physical Dimensions = 2281mm×1134mm×30mm
Then the power of SCC can be calculated as follows:
SCC Power= Isc × TotalPanel=14×2=28A
Based on the calculation of SCC that is allowed to be used, a minimum of 28A and in this study SCC 40A will be used
Solar Panel Design Scheme
Design of solar panel system for fish ponds in Percut Sei Tuan, Deli Serdang. With the following scheme

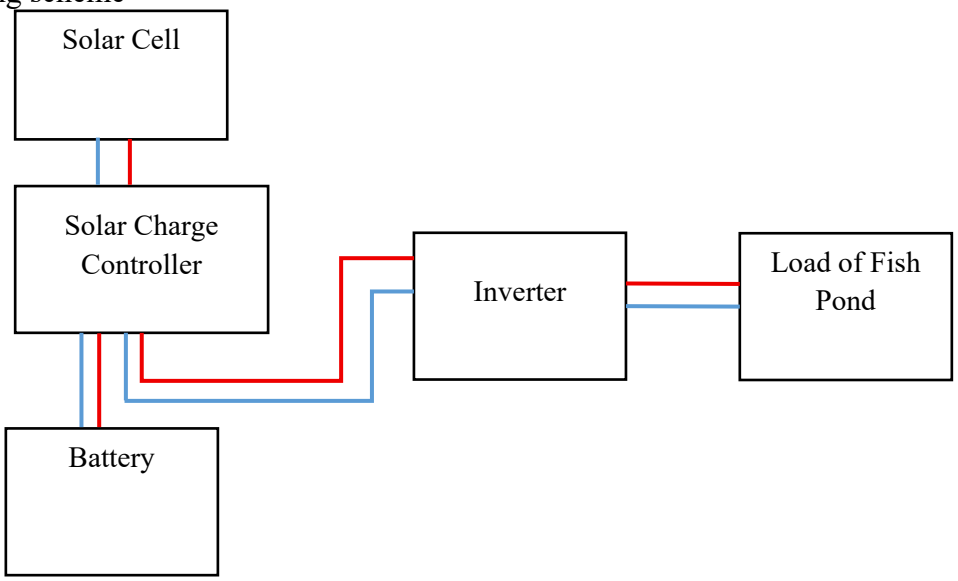

Figure 5. Diagram Rangkaian

Conclusion
Based on the results of the research for the Study of Solar Power Plants as the Main Resource of Fish Ponds in Laut Dendang Village, Percut Sei Tuan District, Deli Serdang Regency, North Sumatra.

1. From the research of collecting solar radiation data during the month of June, it was found that the results were 352909 lux, with the lowest point being 9109 lux and the highest point being 14966 lux. The average absorbable solar energy is about 5 hours.
2. The power load of electrical energy in the fish pond is 5720watts so that 2 pieces of 600 Wp solar panels are needed to meet this power, 3 batteries of 24 V 100A, 7000watt inverter and SCC 40A are also needed.

Suggestion
In the implementation of this final project, of course, there are several suggestions obtained from researchers

1. For further research, it is hoped that it can add various sensor accessories to make it easier to see the output results of voltage, current and power at solar power plants
2. In the next study, it is hoped that the addition of solar sensors will be automatically added to facilitate research.

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