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Performance Analysis of Egg Hatchers with a Manual Drive System Using Solar Cells

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Abstract - The egg incubator machine is a simple tool that uses a 5W incandescent lamp and a 12v heating element, to produce heat which is used by breeders with a small capacity, but along with technological developments this machine was developed to increase the capability and ease of hatching eggs. The egg incubator is made from electricity from PLN and is planned to be sourced from solar thermal energy using solar panels. The process of modifying this solar-powered egg incubator has several stages, namely starting with the stage of making the machine frame, the tool design process, modifying the electrical circuit, and calculating the electrical power used. From the test results of egg incubator machines that use PLN electrical energy, the power used is 26.66 watts and the electrical energy for 24 hours is 501.22wh or and is planned with the installation of PLTS, 2 solar panels with a capacity of 100wp each, 2 batteries with capacity 12V, 48 Ah, with 30watt Inverter and 12 Ampere scc.

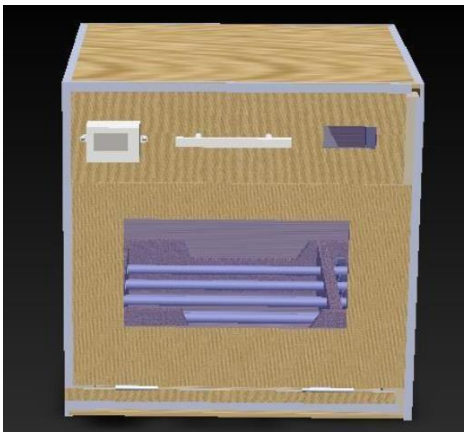
Keywords : Incubator Machine, Solar Energy, Egg Hatching, Electrical Power, Solar Panel Modification.

1. INTRODUCTION

The larger the poultry farm, the more poultry farms require egg incubators to assist in the hatching process of poultry eggs. In terms of hatching poultry eggs, special attention is needed, especially to the temperature in the poultry egg incubator machine and also requires attention to the process of hatching poultry eggs, because when hatched eggs are not immediately removed from the egg incubator machine, the baby birds can die because they have been inside for too long. The egg incubator also experiences dehydration, and can interfere with the hatching process of other eggs. The ideal temperature in the process of incubating poultry eggs is 37.5ºC-38ºC, the temperature should not be lower than 38ºC because if the temperature is lower it will cause the embryo to die on the 2nd to 4th day, causing late hatching of the eggs and also baby birds. hatching will also experience a wet navel that does not close properly, and the temperature is not higher than 38ºC because if the temperature is higher it can result in the embryo dying on the 2nd to 4th day and if the embryo can grow, the beak is often not in the sac. the air and conditions of the hatching birds will be less good, for example, with their eyes closed. In selecting good hatching eggs, the eggs that can be hatched must be fertile (fertile) which come from egg cells fertilized by sperm. Eggs that are not mated by males are not fertile eggs. Therefore, to choose eggs that will be hatched, first make sure they come from parents that have been mated with males and with sufficient nutrition and choose eggs that are oval in shape and have good, thick shells that are not cracked or dirty, let alone broken.

2. METHODOLOGY

In this egg incubator, the egg holder or egg rack measures 32.5 cm and the average egg diameter is around 4 cm. The cylinder rotates every 1×3 hours and the rotation time is 1 minute. This rotation is done so that the eggs get even heat



Picture 1. Automatic Hatching Machine

The initial stage taken was to make observations and then study the literature. This literature study contains writing studies from several references obtained in the form of scientific works, journals, books, or sources from the internet

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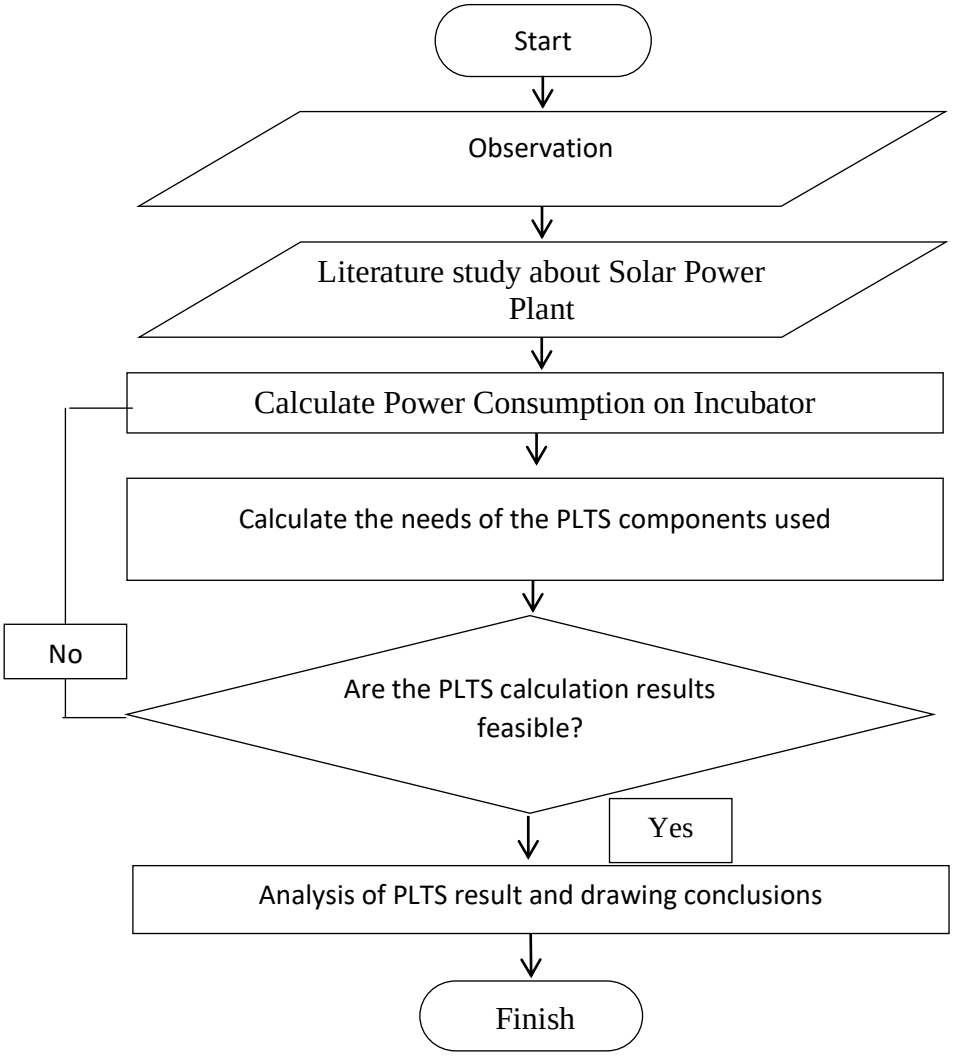
which relate to the research theme which is useful as support and makes it easier for the author to complete this research. The type of research used is design. This type was chosen because it is in accordance with research, namely designing a Solar Power Plant (PLTS) and after it is designed, testing (experiments) and analysis of the PLTS that have been created will be carried out.

3.1 Research Procedure



Picture 2. Research Steps

Flowchart explanation:

1. Start collecting ideas about designing an incubator tool.
2. The author begins to carry out field observations to find the information needed
3. This research was created by collecting data related to EBT, which will later be connected to an incubator as an energy source.
4. After obtaining the necessary data, the author begins to determine the materials and types of tools that will be used to start assembling the incubator.
5. Test the incubator circuit that has been made, and check again whether there is anything that is not appropriate or not.
6. If the circuit is not functioning properly, the circuit must be checked again.
7. If the circuit functions well, then the test can be said to be complete.
8. Create a research report from the results of the data and comparisons obtained.
9. Done.

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3. RESULTS AND DISCUSSION

The load analysis aims to determine the amount of power and electrical energy required for egg hatching incubators supplied through PT. PLN. Through a direct observation process, data analysis of electrical power consumption is obtained

Temperature (^{0}C)	Time (Hour)	Voltage (V)	Current (A)	Power (W)	Electrical Energy (Wh)
37,7	08.00-10.00	20	0,97	19,4	38,8
37,6	10.00-12.00	21,5	1.24	26,6	53.32
37,8	12.00-14.00	19.03	0.7	13,3	26,6
37,2	14.00-16.00	16,07	1,27	20,4	40.8
37,5	16.00-18.00	20.5	1,2	24,6	49.2
37,3	18.00-20.00	18.07	0.9	16.26	32,52
37,9	20.00-22.00	19.07	0,87	16,59	33,18
37,7	22.00-24.00	20.03	1,24	24,83	49,66
37,5	24.00-02.00	21.03	1,27	26,07	52,14
37,7	02.00-04.00	20.04	0,97	19.43	38,86
37.6	04.00-06.00	20.02	0,98	19.61	39,22
37,6	06.00-08.00	19.08	1,23	23,46	46,92
Total					**501,22 Wh**

1. Calculating the needs for PLTS components

The important thing that must be calculated is the need for PLTS components such as the need for solar modules, battery usage, calculating inverter needs and calculating the solar charger controller used in designing power plants.

2. Calculating solar module requirements

That the electrical energy produced by PLTS is not 100% usable. Because during the transmission period from the solar panels to the load (electronic devices), up to 40% of the electrical energy is lost. Therefore, it is necessary to add 40% of the electrical power to the total power used. So, mathematically it can be written as follows:
Total power = Incubator Energy: (100% - 40%) = 501.22 Wh : 60% = 835,36 Wh

Number of Panels = Total Energy : (Wp Panels x Exposure time)
= 835,36 Wh : (100 wp x 4 hours)
= 2,087 rounded up to 2 panels
So, the total number of solar panels needed is 2

3. Calculating of batteries capacity of PLTS

Total Battery= Electrical Energy : Battery Energy
= 501.22Wh : (12V x 48 Ah)
= 501.22Wh :576Wh
= 0,87 rounded up to 1

The battery should not be used until it runs out because it will damage the battery quickly. Use only half or the equivalent of 50%. So, the results of the calculation above are multiplied by 2, to get maximum results. Then 1x2 = 2 pieces.

4. Determine of *Solar Charge Controller*

Determines the SCC (Solar Charger Controller), first understand the specifications on the solar panel. Usually, the code written on the solar panel is as follows:

Pm = 100 WP
Vm = 18 VDC
Voc = 21.25 A

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Imp = 5.8 A
Isc = 6 A

Then, pay attention to Isc (short circuit current). Next, multiply Isc by the number of solar panels.
SCC Power = Isc x Number of Solar Panels
= 6 x 2 pcs
= 12A
So, the minimum SCC power used is Scc 12 A

5. Determine the Inverter Value
An inverter is a tool that is useful for changing DC (direct) current into AC (alternating) current. To determine the inverter, assume the maximum power used when the incubator is on, then from the previous data we have obtained 26.66 Watts. So, choose an inverter whose output is more than 26.66 Watts. For example, you can choose an inverter with an output of 30 Watts.

4. CONCLUSION

Based on the research that has been carried out, it can be concluded that: To determine the value of the components in the PLTS, first carry out an audit of the power and electrical energy consumption. The value of the electrical data used is 26.66 watts and the electrical energy consumption in the incubator circuit is 501.22 Wh. If the power consumption is 26.66 W and the electrical energy consumption is 501.22 Wh, then you need 2 solar panels with a value of 100wp each, 2 battery capacities of 12V, 48Ah, 12A solar charge controller and 30W inverter.

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