# Design of a Power Plant Using Recycled Goods as Alternative Household Electricity

**Haris gunawan, Zuraida Tharo, Dino Erivianto**

**Abstrack**

One way to overcome the current shortage of electrical energy is to develop a good and environmentally friendly alternative power generator for household consumption. This research is to design a power generator by utilizing recycled goods as alternative household electricity. utilization of recycled goods in the form of a dynamo (DC generator) from a toy car and a swing motor that is no longer used which can produce electrical energy by rotating the generator through a toy dynamo. Utilizing the function of the generator is to convert mechanical energy into electrical energy. From the results of the analysis of the difference in load carried out using 2,7,10,12 and 14 Watt lamps, the lowest voltage produced is 103 Volts at a speed of 2872.3 rpm in a 14 Watt lamp, and the highest voltage produced is 186 Volts at a speed of 3654.1 rpm in a 2 Watt lamp load. Based on the analysis of load differences using 2, 7, 10, 12, and 14-watt lamps, the lowest current produced was 0.01 A at 2872.3 rpm for the 14-watt lamp, and the highest current produced was 0.04 A at 3613.4 rpm for the 12-watt lamp. The generator, operated at no load at 4476.6 rpm, produced a voltage of 237.6 volts and a current of 0.05 A.

***Keywords:*** Alternative Electricity, Toy Dynamo, Fan Gear Swing Motor.

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## Introduction

Electrical energy is a basic human need, as 90% of people rely on electronic devices such as cell phones, televisions, and lamps. These devices require power or electricity to operate. The Indonesian government has a target of 23% renewable energy use by 2025, although currently, renewable energy use in Indonesia is still relatively small, at around 12.5%. In addition to the government's target for renewable energy development, alternative power plants are expected to contribute on a small scale in the future. Environmentally friendly renewable energy is a solution to address this ongoing problem. Referring to Law No. 30 of 2007, utilizing alternative energy sources by utilizing discarded materials is an interesting topic for development. Therefore, the use of recycled materials, such as dynamos (DC generators) from toy cars and motors that rotate the swings of discarded fans, can generate electricity by turning the generator through the toy dynamo.

Figure 1. Children's toy dynamo

This electrical energy source requires a low-speed generator without additional excitation to produce electrical energy. Utilizing the generator's function of converting mechanical energy into electrical energy,

Figure 2. Fan swing gear motor

From the literature review outlined above, the problem formulation is how to design an alternative power generator using recycled materials such as toy car dynamos and swing motors from used fans. Therefore, the author aims to answer the above problem

formulation by analyzing, simulating, and calculating the electrical output generated from designing a power generator system using unused materials, such as a car dynamo. toys and used swing motors from unused fans as alternative power generators.

## Research Methodology

Research often displays a research flowchart, commonly used for research methods. The following is a research flowchart: Designing a generator-powered electricity generation system using unused materials. A flowchart represents the work procedures to be carried out. Creating a flowchart is crucial before conducting any testing or data analysis. The flowchart aims to facilitate these processes. Figure 1 shows the flowchart, which begins with data collection through direct literature review and data analysis to produce a specific output.

Where in the picture it is explained that it starts by utilizing a used dynamo from a children's toy and a broken fan gear swing motor, then specifying the tools and materials to be used as an alternative power generator. And then designing the tools and materials into useful tools in the household when the PLN goes out, proceed to the next section to test the tool according to its purpose and according to its working principle, and find out the output of the tool designed earlier, whether it is as expected, namely producing a voltage of 220 volts that can turn on the lights at home as an alternative tool when the electricity goes out from PLN by using a multitester as a measuring tool. Then if it is in accordance with its purpose, namely producing a voltage of 220 volts, then testing the load, in this case using a 220 volt 9 watt lamp, here the ability of the tool will be tested, whether the voltage on the root tool is reduced or still stable in the range of that number.

And will the speed of the dynamo as the driver be slow or is there something else? If there are changes from before using the load, then some of the instruments can be changed and the test repeated. After the experiment is as desired, then proceed to analyze the results of the experiment, by writing the results of the experiment in the form of numbers starting from the voltage, RPM and current flowing and produced by the tool using a tachometer, multi-tester and ampere meter. After that, the research and experiment method is complete.

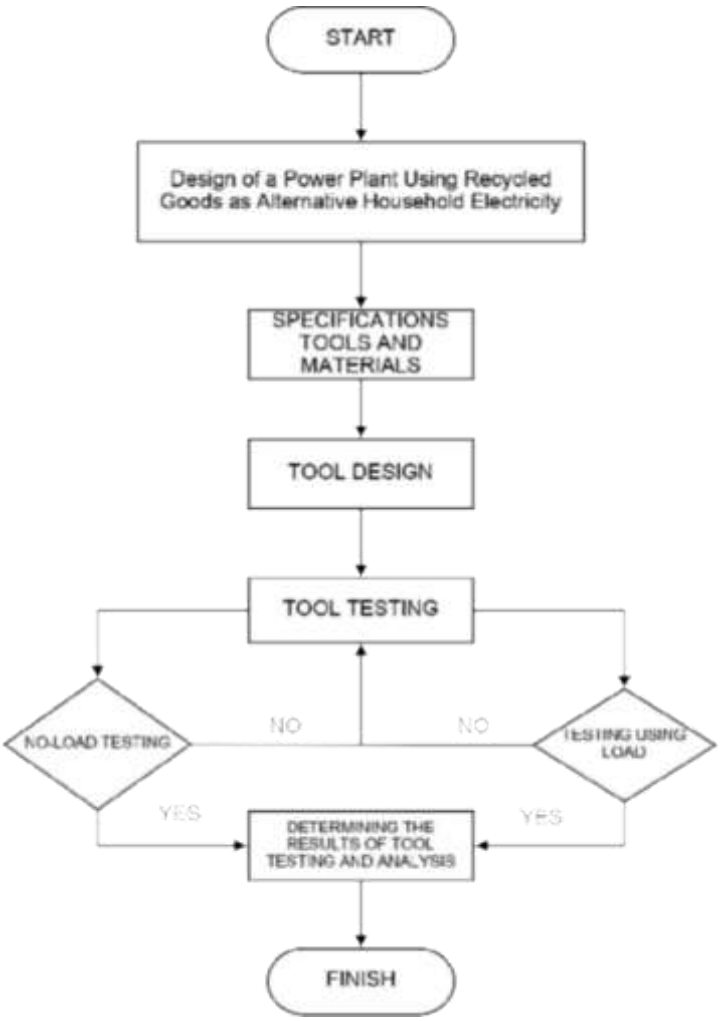


Figure 3. Research flow diagram

Research Results This stage will discuss the overall observation results of this study, presented in the form of data tables and graphs. The data displayed are the voltage (V), current (I), and speed (rpm) values from generator testing with a 12-volt power supply, before and after using loads using 2-watt, 7-watt, 12-watt, 10-watt, and 14-watt lamps, respectively. From this data, a graph is created to show the relationship between the data

and the generator test results. The overall test results from this study are presented in the form of data tables and graphs. The data displayed are the values of the different loads tested, and then a graph is created to show the relationship between the data and the generator's performance under load. This data is presented in Tables 1 through 4 and Figures 1 through 3 as follows:

### 3.1 No-Load Test Results

This test was conducted to determine the generator's voltage, current, and rpm values without a load. The results of the no-load generator test are shown in Table 1:

Table 1. No-Load Generator Test Data

| Number of load | Speed(Rpm) | ltage (V) | Current (I)/Amp |
|---|---|---|---|
| 0 | 4476,6 | 237,6 | 0,05 |

Based on the data in Table 1 above, the generator rotates without a load at a speed of 4476.6 rpm, producing a voltage of 237.6 volts and a current of 0.05 amperes. The following image shows the test results without a load.


Figure 4. Results of rpm/V/A testing without load

3.2 **Test Results Using Load**

**a. Test Results Using a 2-Watt Lamp**

This test was conducted to determine the generator's voltage, current, and rpm values obtained from testing using a 2-Watt lamp. The results of the test using a 2-Watt lamp are shown in Table 2:

Table 2. Generator Test Data Using a 2-Watt Lamp

| Number of load(Watt) | Speed(Rpm) | Voltage(V) | Current(I)/Amp |
|---|---|---|---|
| 2 W | 3654,1 | 186 | 0,03 |

From the data in Table 2 above, the generator rotating with a 2-watt lamp load at a generator speed of 3654.1 rpm produces a voltage of 186 volts and a current of 0.03 amperes. The following image shows the test results using a 2-watt lamp load.


Figure 5. Results of rpm/V/A testing with a 2 Watt lamp load

**b. Test Results Using a 7-Watt Lamp Load**

This test was conducted to determine the generator's voltage, current, and rpm values obtained from testing using a 7-Watt lamp load. The results of the test using the 7-Watt lamp load are shown in Table 3:

Table 3. Generator Test Data Using a 7-Watt Lamp Load

| Number of load(Watt) | Speed(Rpm) | ltage (V) | Current (I)/Amp |
|---|---|---|---|
| 7 W | 3642,2 | 184,2 | 0,03 |

From the data in Table 3 above, the generator rotating with a 7-watt lamp load at a generator speed of 3642.2 rpm produces a voltage of 184.2 volts and a current of 0.03 amperes. The following image shows the test results using a 7-watt lamp load.


Figure 6. Results of rpm/V/A testing with a 7 Watt lamp load

**c. Test Results Using a 10-Watt Lamp Load**

This test was conducted to determine the generator's voltage, current, and rpm values obtained from testing using a 10-Watt lamp load. The results of the test using a 10-Watt lamp load are shown in Table 4:

Table 4: Generator Test Data Without a Load

| Number of load(Watt) | Speed(Rpm) | ltage (V) | Current (I)/Amp |
|---|---|---|---|
| 10 W | 3135,3 | 119,9 | 0,01 |

From the data in Table 4 above, the generator rotating with a 10-watt lamp load at a generator speed of 3135.3 rpm produces a voltage of 119.9 volts and a current of 0.01 amperes. The following image shows the test results using a 10-watt lamp load.

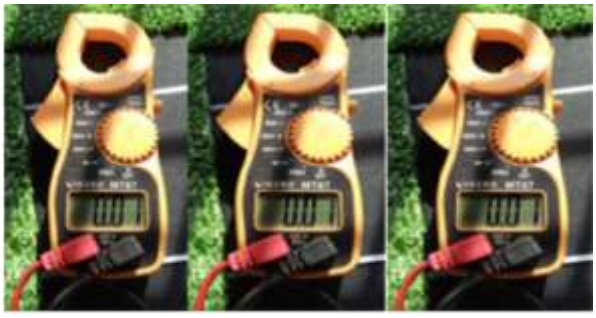

Figure 7. Results of the rpm/V/A test with a 10-Watt lamp load

**d. Test Results Using a 12-Watt Lamp Load**

This test was conducted to determine the generator's voltage, current, and rpm values obtained from testing using a 12-Watt lamp load. The results of the test using a 12-

Watt lamp load are shown in Table 5:

Table 5. Generator Test Data Without a Load

| Number of load(Watt) | Speed(Rpm) | ltage (V) | Current (I)/Amp |
|---|---|---|---|
| 12 W | 3613,4 | 183,6 | 0,04 |

From the data in Table 5 above, the generator rotating with a 12-watt lamp load at a generator speed of 3613.4 rpm produces a voltage of 183.6 volts and a current of 0.04 amperes. The following image shows the test results using a 12-watt lamp load.


Figure 8. Results of the rpm/V/A test with a 12-watt lamp load

**e. Test Results Using a 14-watt Lamp Load**

This test was conducted to determine the generator's voltage, current, and rpm values obtained from testing using a 14-watt lamp load. The results of the test using a 14-watt lamp load are shown in Table 6:

Table 6: Generator Test Data Without a Load

| Number of load(Watt) | Speed(Rpm) | ltage (V) | Current (I)/Amp |
|---|---|---|---|
| 14 W | 2872,3 | 103 | 0,01 |

From the data in Table 6 above, the generator rotating with a 14-watt lamp load at a generator speed of 2872.3 rpm produces a voltage of 103 volts and a current of 0.01 amperes. The following image shows the test results using a 14-watt lamp load.


Figure 9. Results of rpm/V/A testing with a 14 Watt lamp load

**f. Comparison Results of Tests with Load Size**

From the data examined, the comparison results between load size, generator speed, and the resulting voltage and current are shown in Table 7.

Table 7: Comparison Results between Load Size, Speed, Voltage, and Current

| Number of load(Watt) | Speed(Rpm) | oltage (V) | Current (I)/Amp |
|---|---|---|---|
| 0 | 4476,6 | 237,6 | 0,05 |
| 2 W | 3654,1 | 186 | 0,03 |
| 7 W | 3642,2 | 184,2 | 0,03 |
| 10 W | 3135,3 | 119,9 | 0,01 |
| 12 W | 3613,4 | 183,6 | 0,04 |
| 14 W | 2872,3 | 103 | 0,01 |

From the data in Table 7, the relationship between the generator speed values without load and using load is shown in Figure 1:

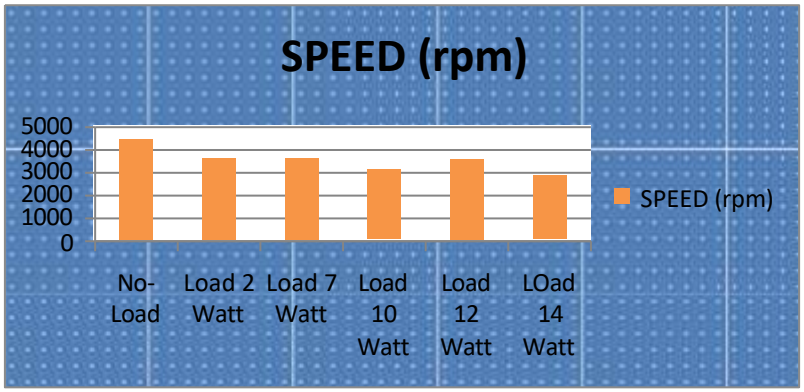


Figure 10. Graph showing the relationship between generator speed values.

Data from Table 7 shows the relationship between generator voltage values at no load and with a load. Figure 2:

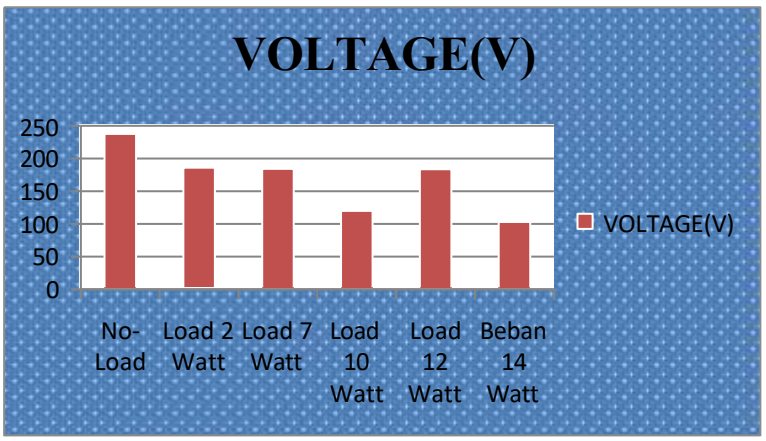


Figure 11. Graph showing the relationship between generator voltage values.

Data from Table 7 shows the relationship between generator voltage values without load and with load. Figure 3:

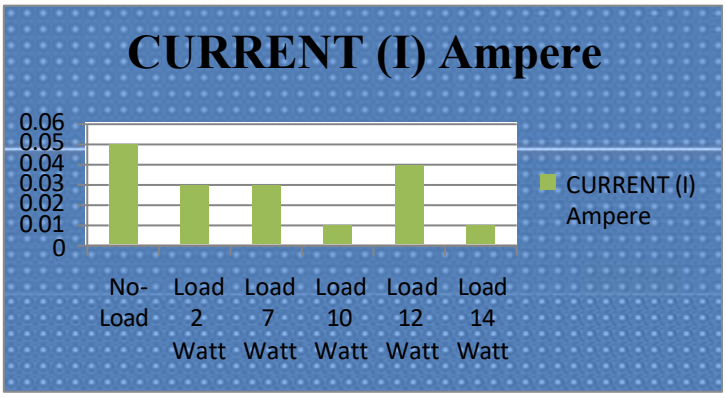


Figure 10. Graph of the relationship between generator current values.

Data from Table 7 on the generator is determined by comparing each load with the maximum generator speed of 4476.6 rpm, a voltage of 237.6 V, and a current of 0.03 A. The lower the load, the higher the generator speed, resulting in optimal generator output.

## Conclusion

From the design of a power generator utilizing recycled materials as an alternative source of electricity for households, along with the research and testing conducted, the following conclusions can be drawn:

1. The design of a power generator utilizing recycled materials as an alternative source of electricity for households can be realized and can generate electricity by synchronizing a used children's toy dynamo with a used fan gear swing motor.
2. Based on the analysis of different loads using 2, 7, 10, 12, and 14-watt lamps, the lowest voltage produced was 103 volts at 2872.3 rpm for the 14-watt lamp, and the

highest voltage produced was 186 volts at 3654.1 rpm for the 2-watt lamp. The lower the load, the higher the generator speed. Increasing the generator speed also increases the voltage produced.

3. From the results of the load difference analysis carried out using 2, 7, 10, 12 and 14 Watt lamps, the lowest current produced is 0.01 A, namely at a speed of 2872.3 rpm on a 14 Watt lamp, and the highest current produced is 0.04 A, namely at a speed of 3613.4 rpm on a 12 Watt lamp load.
4. The generator without load with a generator speed of 4476.6 rpm produces a voltage of 237.6 volts, and a current of 0.05 A.

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