# Design of experiment on energy conservation using solar energy

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**ABSTRACT** – Energy conservation is very important and efforts have been made to consume less energy, by increasing the efficiency of converted energy. In this paper, magnetic energy was used as power transmission method. A DC motor generator was used to test out the efficiency of this method. The recorded results were based on the output of DC motor generator. Different numbers of permanent magnets were used as the drive and driven disk (built to repulsive each other at 90 degrees). The results showed potential energy was needed to work the conversion continuously, thus solar energy was used as eco-energy starting potential.

## 1. INTRODUCTION

The design of experiment was to include solar panel as potential energy in order to supply the electrical energy to DC motor. This construction performed two ways of energy conversion, which was from solar energy to electrical energy and electrical energy to mechanical energy; while another energy conversion was from mechanical energy to mechanical energy which was using the magnetic energy as way of transmitting mechanical energy to electrical energy. The output of electrical energy was stored up in a super capacitor, which for future used (charging USB electronic devices).

Most people are still confused about the reality of perpetual machine concept [1]. In this experiment, the results have proved that the theory of perpetual machine cannot work. Thus, the solar panel was used to collect solar light and convert into electrical energy, while this energy was stored inside a battery for future used. To activate the system, the toggle switch can be selected to change either to store electrical energy from solar panel or to use the stored energy to run the motor.

Tools were installed inside the box. In this system, user can choose several Neodymium magnets to start with an experiment. The main part design was the two rotating disks. Each disk can be installed 1 to 12 magnet holes of Ø13mm or 1 to 3 magnet holes of Ø25mm Neodymium. Both disks were installed on the shaft of motor and generator respectively.

## 2. METHODOLOGY

Figure 2.1 shows the flow chart of the energy conversion in the system. DC generator converts mechanical energy to electrical energy. After the mechanical energy transmitted by magnetic drive from motor to generator, the generator generates electrical energy that can be used to charge electronic devices. To smoothly activate the magnetic drive, the generator output should not connect to any electronic device before the disk rotate stably, or it will affect the torque of generator, and increase the difficulty of magnetic drive.

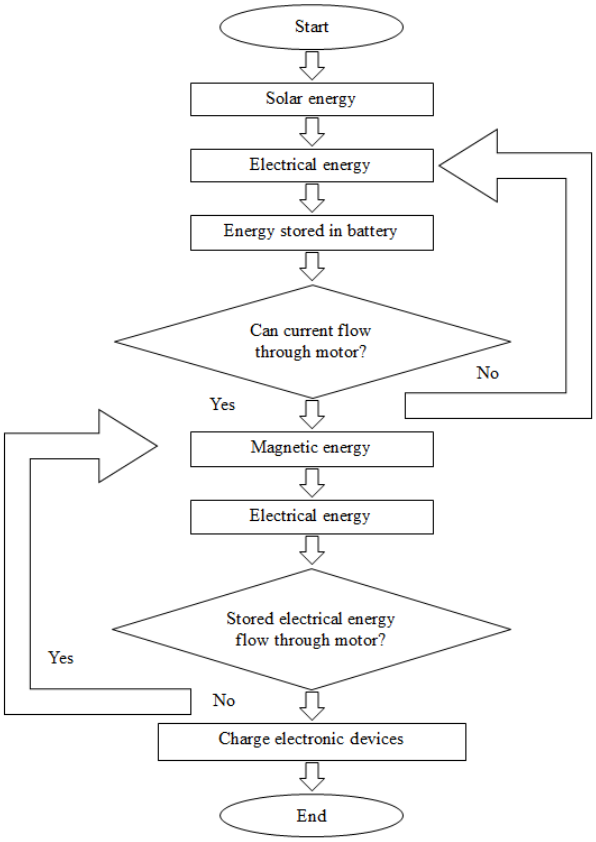



Figure 2.1 Flow chart of the energy conversion in design

## 3. RESULTS AND DISCUSSION

The 3D printed disks were used due to more precise angle was done compared to man-work disk. The angles between each magnet holes were (12 small magnet holes) 30°. The used of different number of magnets can be calculate with the formula to estimate the distance between each magnet at a disk. To calculate the efficiency of the magnetic drive, use the theoretical output and actual output to estimate the efficiency.

*Important: Theory stated DC motor converted to DC generator must lost around 50% efficiency, so the

maximum generated power of generator was half to the motor [2].

$$P_G = \frac{P_M}{2} \quad (1)$$

$$P_G = \frac{2W}{2}$$

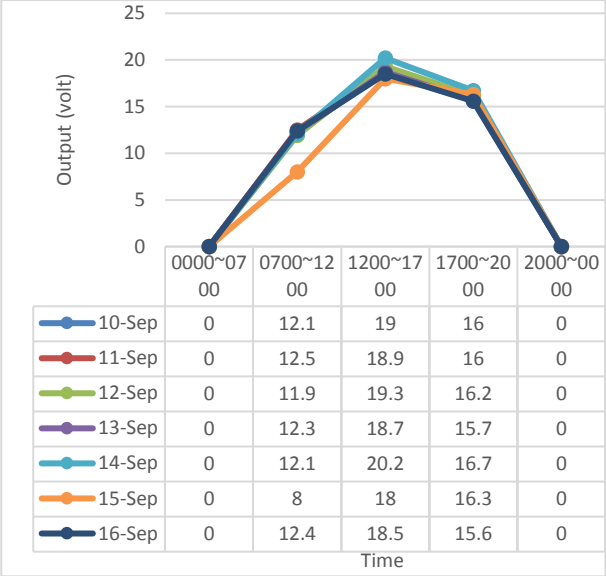
$$P_G = 1W$$

The efficiency of magnetic drive,

$$\text{Efficiency} = 2 * \frac{\text{Actual power}}{\text{Theoretical power}} * 100\% \quad (2)$$

$$\eta_G = 2 * \frac{P_A}{P_G} * 100\%$$

Table 3.1 Average solar panel output voltage at outdoor from 10 Sep ~ 16 Sep 2017




| | 0000~0700 | 0700~1200 | 1200~1700 | 1700~2000 | 2000~0000 |
|---|---|---|---|---|---|
| 10-Sep | 0 | 12.1 | 19 | 16 | 0 |
| 11-Sep | 0 | 12.5 | 18.9 | 16 | 0 |
| 12-Sep | 0 | 11.9 | 19.3 | 16.2 | 0 |
| 13-Sep | 0 | 12.3 | 18.7 | 15.7 | 0 |
| 14-Sep | 0 | 12.1 | 20.2 | 16.7 | 0 |
| 15-Sep | 0 | 8 | 18 | 16.3 | 0 |
| 16-Sep | 0 | 12.4 | 18.5 | 15.6 | 0 |

From the Table 3.1, it showed the output of solar panel within 7 days from 10 to 16 September 2017. The table stated around 8.00pm to 7.00am is 0 volt, which was not suitable to charge the battery. The highest output of solar panel was 12.00pm to 5.00pm, which generate around 18.94 volt. After 5.00pm, the output of solar panel decreased gradually, but still acceptable for charging battery.

Assume solar panel worked with 10W, and maximum operating voltage is 21.67 volt,

Given:

$P = 10W$

$V_{max} = 21.67V$

The average voltage from 1200~1700 was 18.94V, calculate the current of solar panel within the time range.

Efficiency of voltage,

$$\eta_v = \frac{V_{actual}}{V_{max}} * 100\% \quad (3)$$

$$\eta_v = \frac{18.94}{21.67} * 100\%$$

$$\eta_v = 87.4\%$$

Efficiency of wattage,

$$P_{output} = P_{max} * \eta_v \quad (4)$$

$$P_{output} = 10W * 87.4\%$$

$$P_{output} = 8.74W$$

Output current,

$$A_{output} = \frac{P_{output}}{V_{actual}} \quad (5)$$

$$A_{output} = \frac{8.74}{18.94}$$

$$A_{output} = 0.46A$$

With the estimated output 18.94 volt and 0.46 ampere, the IC7812 was used to maintain the battery charging input to 12V. Assume there's no energy loss, calculate the estimated time to fully charge a 12V 1200mAh battery.

Estimated time,

$$t_{chrg} = \frac{mAh}{mA} \quad (6)$$

$$t_{chrg} = \frac{1200}{46}$$

$$t_{chrg} = 26.08\ hours$$

With fully charged battery 1200mAh, the motor consumed 12V, 0.3A. Estimated the motor life by using the fully charged battery,

$$t_{motor} = \frac{mAh}{mA}$$

$$t_{motor} = \frac{1200}{30}$$

$$t_{motor} = 40\ hours$$

The time of motor life equaled to time of system work. As long as the motor was activated, the output from generator can be used to charge electronic devices. When the variable resistor set to minimum resistance, the meters reading stated generator generate 2.5V, 0.6A. The output was step-up by booster to 20V.

## 4. CONCLUSIONS

At the end of this experiment, it is recommended that magnetic energy can be used as a type of mechanical energy transmission. This transmission method provides a very good advantage, with zero friction between two disks. Permanent magnets have its own strength, which replaced the role of teeth on the sprocket, and can increase the efficiency during energy transmission.

## REFERENCES

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