

DESIGN AND DEVELOPMENT OF A PORTABLE HYDROELECTRIC GENERATOR

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ABSTRACT

The design and development of a portable hydroelectric generator is done by using the concept of hydroelectric, or to be more precise, the hydroelectric where the water flow is converted into electrical energy with the use of hydroelectric generator. The prototype is done by using the portable hydroelectric generator to produce electricity from the kinetic energy by water flow. This project also uses green and renewable energy which is water flow to rotate the generator to create electrical energy. The objectives of this research are to design the suitable aerodynamic design that apply to the blade, to apply electromagnetic to produce AC current and to study the circuit to give a charge to the charge battery. This prototype is designed to solve electricity problems that always happen in human daily life. Even though, there are many ways to generate electrical energy but there are many problems that human will face such as the cost, the proper location, the size and other else. Lastly, with the increase popularity and the demand to use renewable energy products, the portable hydroelectric generator has the potential to be marketed locally and globally. It has a special feature where it could literally generate its own electricity to be able to give an electrical supply when there is lack of non-renewable sources such fossil fuels, natural gas and coal.

Keywords: hydroelectric generator, renewable energy, electricity, electromagnetic.

1. Introduction

Hydroelectric generator is a new type of generator and the technology that uses for this product able to overcome the problem "lack of electrical energy" that frequently faced by people. Other than that, hydroelectric generator is designed to increase the portability of generator which means the user can produce electricity at the river anytime (Hydropower Capacity, retrieved from: <http://www.theprojectdefinition.com/hydropower-hydroelectric-power-capacity/>).

Hydroelectricity is electricity produced from hydropower. In 2015 hydropower generated 16.6% of the world's total electricity and 70% of all renewable electricity, and was expected to increase about 3.1% each year for the next 25 years (REN21, 2016).

Hydropower is produced in 150 countries, with the Asia-Pacific region generating 33 percent of global hydropower in 2013. China is the largest hydroelectricity producer, with 920 of production in 2013, representing 16.9 percent of domestic electricity use.

The cost of hydroelectricity is relatively low, making it a competitive source of renewable electricity. The hydro station consumes no water, unlike coal or gas plants. The average cost of electricity from a hydro station larger than 10 megawatts is 3 to 5 U.S. cents per kilowatt-hour (Kumar, 2012).

With a dam and reservoir, it is also a flexible source of electricity since the amount produced by the station can be changed up or down very quickly to adapt to changing energy demands. Once a hydroelectric complex is constructed, the project produces no direct waste, and has a considerably lower output level of greenhouse gases than fossil fuel powered energy plants (REN21, 2011).

Nonetheless, in regards of the concern of the safety of the theoretical study, the whole of the experiment is covered by magnet shield which can prevent the contact of magnetic field inside the project to outsiders. The machine will stop spinning when the pulley of self-made permanent magnet motor is pushed, and the magnet shield will block the magnetic field between bottom and upper magnets.

The aim of this conceptual design is to use green and renewable energy which is water flow to rotate the generator to create electrical energy for small scale user such as for campers or urban domestic purposes. Three objectives that have to be made in order to achieve the aim:

- i) To design the suitable aerodynamic design that can be applied to the blade.
- ii) To develop the prototype of a portable hydroelectric generator.
- iii) To analyze the circuit to give a charge to the charge battery.

Nowadays, the electricity is often uses by the human in the daily life. If one day, the non-renewable energy such as natural gas, coal, fuel and others are run out, this will face a serious problem because the electrical energy is the basic needs in daily life. Even though, there are many ways to generate electrical energy but there are many problems the project will face such as the cost, proper location, the size and other else. So by referring to the problem, this prototype is proposed and designed to overcome electrical energy problems.

2. Methodology

The alternating current generator is an electric generator or dynamo shown in **Figure 1**. It also is a device which converts mechanical energy into electrical energy. The simplest practical generator consists of a rectangular coil rotating in a uniform magnetic field. The magnetic field is usually supplied by a permanent magnet.

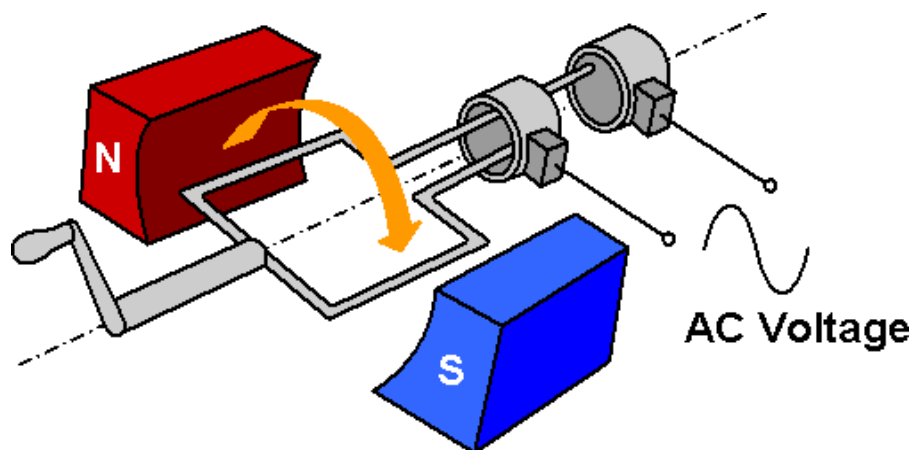


Figure 1. An alternating current generator

The working principle of an AC generator is similar to the basic working principle of a DC generator by referring to Figure 2. Firstly, when the blades are rotated, the generator will automatically rotate on and the magnetic field in the generator will produce electricity. Then, it will produce AC voltage. AC and DC converters were used to supply electricity to battery storage (Fitpatrick, 2007).

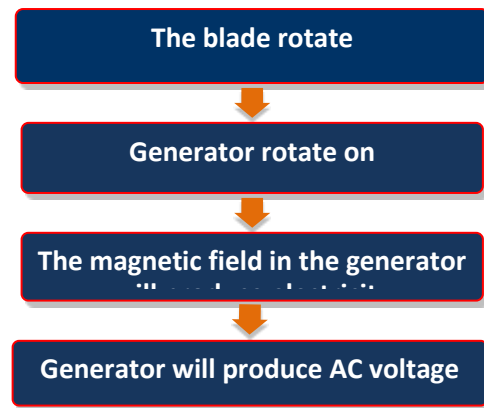


Figure 2. Process flow of hydroelectric generator

After the AC generator generates electricity, the AC will convert to DC by using DC converter. Voltage rectifier is used to rectify the voltage and voltage regulation is used to constant the voltage output. Then, electricity can be supply to the load (refer to Figure 3).

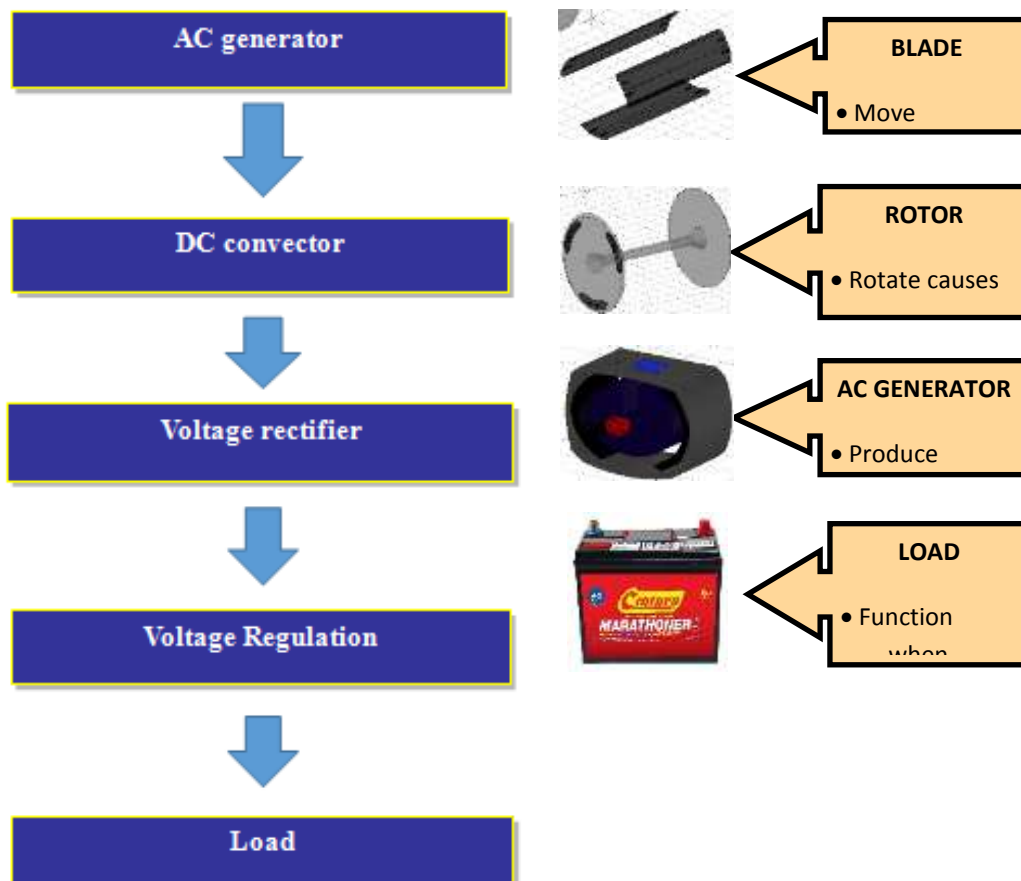


Figure 3. Circuit flow of electricity

3. Proposed Design and Prototype

The magnetic generator consists of coil rotating in a uniform magnetic field. The magnetic field is usually supplied by a permanent magnet to rotate the shaft as shown in the proposed prototype design (with a length of 60 cm and diameter radius of 20 cm) in **Figure 4**.



Figure 4. Proposed design of prototype

4. Expected Result

The idea of a portable hydroelectric generator is a suitable idea to convert the water flow energy to electrical energy which can use in daily life. Furthermore, this renewable energy that come from the portable hydroelectric generator actually can gave economy support to the users and no need to face the higher electricity bills charge with this kind of electric sources.

Other than that, this product also can be potentially commercialized as it has the potential to be marketed in the home-stay business and small business industry in Malaysia. As we all know, it is hard to supply the electricity in upcountry region, So, by this kind of method the entrepreneur of small industry can easily get a new supplies of energy.

5. Conclusion

Even though, there is more models of hydroelectric generator but some of them are specified to some places and the cost also can be the biggest problem to the entrepreneur. Other models of hydroelectric generator have been modernized and to build it need a higher cost so it is hard for the entrepreneur to have it. This product could overcome the problems to supplies the electrical energy such as, lamp nearby the river and could also prolonged the usage of electrical appliances near the business site. Last but not least, the portable hydroelectric generator is an environmental friendly product and it is also plays a very important role in order to supply sustainable energy for future generation needs.

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