Report on water turbine

Environment, Water

1. Abstract

The proposal aims at to giving a solution to the problem of low power output by designing a power generation system that maximizes power output by mounting the turbine on a D. C generator with a suitable coupling. This generator is then connected to the water pipe. The turbine is designed to generate electricity by converting kinetic energy from water flows to electric energy. The use of this technology proves sustainable as it works under minimum maintenance. In this proposal is included the conceptual approach, results ad conclusions arrived at validating the significance of conducting this research. In include but not limited to the advantage of the system as a solution to low power generation.

2. Introduction

At the beginning of the new millennium, the world energy consumption increased rapidly with more than three quarter of this consumption mainly coming from the from the fossils fuel. Among the renewable sources of energy like the solar, biomass, hydroelectric and wind, hydroelectric power is rated very reliable as it is generated from most efficient means that is hydroelectric power plants that that produce electric energy.

Water plays play a critical role by they are used to turn the turbines. To do this, water is harness through collecting it in hydroelectric dam. It is then passed through a turbine through a penstock and then allowed out f the turbine in a tailrace. This turbine consists of a shaft that has some blades attached to it. These blades are rotated when water passes through it creating a rotational force.

Being the back of any hydroelectric power generation plant, the D. C generator converts mechanical energy to electrical energy. The electrical energy can then be transmitted and distributed. An electric generator does this by spinning a rotor that will in term turn the turbine. A typical rotor consists of a shaft with field windings. An excitation voltage is created when the rotor rotates creating current onto a stator. This current is magnetically induced while a stator is ring that is cylindrical in nature and is separated from the rotor by an air gap.

Hydroelectric power generated varies depending on the level of technology used. With today's improved technology, it's possible to generate power from a micro generator by use of low flow and low head parameters. To demonstrate how this technology has revolutionize hydroelectric power generation, this proposal uses a small model designed by used of a 2 Lt water container that acts as a dam, the container is 300 mm tall, while a 1000 mm pipe with a valve and has an internal diameter of 5mm connects the container holding water to the turbine. The model has an electric generator connected.

3. Literature Survey

According to (Edwards, 2008), the system can produce approximately 400 watts at constant rate. This means 9. 6 kilowatts can the produced per day. A example of this the hydropower generation system installed by Counter Lake Guest Ranch that used the low flow and head parameters. The system contains of a turbine with batteries, D. C generator, load controller and

inverter. These are the main components of the system. As proposed in the system the system advantage is the ability to produce more power.

In his extensive research in this field, Bill Kelsey has come up with hydroelectric systems that are small in nature. In the system are turbines feed by unstated flow that is approximately 30 feet with water running through 275 feet and 4 inch diameter pipe. Kelsey system produces 3. 6kW hours daily (Garman, 1986). It is worth noting that the efficiency of the system was enhanced by increasing the diameter of the PVC pipes as done by Kelsey. This doubles the output as the friction between the water and pipe is reduced. Kelsey didn't however encounter problems with his systems. Use alternators with brushes didn't work well as the brushes wore out.

Joseph Hartvigsen according to (Hartvigsen, 2008) managed to build his own micro hydroelectric system. The system has 96' head and 6'' diameter pipe. Burying of the pipe is essential to avoid freezing hence maintaining grade. Hartvigsen has its pipe buried 4' down depending on the terrain. Increased power supply as negative effects as many batteries as destroyed through overcharging. This justifies the need for charge controller to control this. On average, the plant generates 800 watts at the power house.

4. 0 Conceptual Design

For the project to be complete, the proposal has been designed as illustrated in the above diagram. This is basically designed in the above simple way as it also as an educational tool used to educate the general public. It should therefore be made easy and simple to understand. This will also enable the

people to relate it to the real life experiences. To further justify this is a detailed description of proposed conceptual designed.

In the above proposed hydroelectric power, an experimental work is set a long side the project in the project site. The experiment is meant to serve as an educational display to educate the general public on how the project is intended to work. In the experiment, a 2lt container is used to hold the water. This acts as a dam used to harness water. The tank is 300 mm long. Though not drawn to scale, this height represents 30 feet on the actual dam that will be used to store the water.

A pipe 1000 mm long in the experiment acts as the 275 feet long PVC pipe that connects the water tank to the turbine. The pipe has a valve fitted on it that is used as a controller to control the amount of water to be released to the turbine. Pipe is approximately 5 mm in its diameter. This represents 0. 3 m in actual project. The experimental work also contains a D. C generator fitted to the turbine. This motor converts mechanically energy to electrical energy.

Hydro system overview

As intended in its design the purpose of the project is to provide energy that is renewable through use of water to produce electricity. The project will also act as an educational display to be used to inform the public on type of energy produced and how it’s produced. Its effects on the environment will also be enlightened. There is a power output that is produce produced by the generator and is determine by the equation below:

Kw − hr = q (H − Hf) eT

Where q = the discharge of a stream in cubic feet for every second;

H = the gross heat, measured in feet;

Hf = the heat lost in the tailrace and conduit system;

e= the station efficiency, expressed in form of an equation.

T = a period of time in hours;

As the data was collected, the obtained flow was nearly the base flow for the creek. This was found to be approximately 290 GMP. From this data, the lowest power was calculated to be around 400 W, which will allow for the adjustment of the generator and to determine the size of the nozzle and the pipe (Baker, 1991). From energy system s and design, it was founded that the maximum flow from the nozzle of the generator was around 428 GMP [8]. It was therefore, determined that the power from generated from the generator is 1. 2 KW. However, this calculation was calculated using an efficiency of 50 percent for the generator.

In order for this design to be accomplished, there is a need to have a 4'' supply from the generator to the powerhouse, where the generator will be put. The intake of the pipe need to be covered by the filter or a grate to make sure that no debris goes to the supply line (Baker, 1991). The pipe is also required to have a valve that shuts at the intake in order to allow for the generator or pipe maintenance. It is also preferred that the intake be supplied by some kind of a weir.

The generator

It can clearly be concluded that it is possible to use either a AC or DC generator that can changed the hydraulic power into energy. The DC generators are important for changing batteries that would finally be converted to AC, while the AC generators perform better when connected directly to the load. Therefore, for this reason the DC generator is better suited for this location. The main reason for this is because such location is considered a flow low head site. This means that the power that is produced by the generator is not high. By using DC generator, it is quite easy to keep the energy in batteries and then power to the load.

The acquired data at the site can be used to determine the designation of the system using the LV Hydro 48 V generator directly from the solar-catalogue (Garman, 1986). This kind of a generator was preferred because it can function at maximum and minimum flow for the site. Its highest power output is 1. 2wk and efficiently works on a flow 5 to 400GPM. The turbine may also be fitted with four nozzle inputs (Baker, 1991). The sizes of this nozzles ranges from 1/8 to 1 diameter. The number and sizes of the nozzles affects the flow through the turbine. For there to be some more flows, there must be another generator. When choosing the type of a generator that should be used, the user has to consider such factors. There is an advantage when using four nozzles because it allows the flow to be controlled using the valves.

Battery System

There are three batteries for this application in this project research: lead acid (Wet cell), gel cell, and absorbed class mat (AGM). There are some other several criteria that have to be considered when choosing the type of battery to be used for this application. The purpose of the battery is to produce the surge power required to operate the appliances (Garman, 1986). This battery could also be used to discharge a high percentage of their stored energy and also must be ready to recharge again to accomplish another cycle. There is another type of battery called ‘’Deep Cycle’’ battery which is specifically designed for this task. It is said that this battery will be kept in the powerhouse at the proposed site. The powerhouse might be poorly insulated and is not directly heated from any source.

Grid Tie System

The grid tie system shares various major components of the off grid system. With this system, the inverter and the generator from the grid system are preferred (Garman, 1986). Since the grid tie exists, the battery bank is of no any importance. There are some many stipulations that need to be met by this water turbine before the installation of the system (Baker, 1991).

Educational Display

The customer of this project has clearly states that educating the public about alternative energy sources is quite important. The suggested way of educating the public is by using a display screen that shows instantaneous power generated in watts. The information that would be shown via the

display will come from voltage and current sensors linked to a computer that calculate the generated power that finally outputs to the display.

6. Discussion

As expected the overall performance of the project is high due the as a result of increase in the number of duct. Its performance is further expected due to the increase in the size of the blade cord number (Baker, 1991). The water turbines which operate in the same way as the wind turbine generate power from flowing water causing low or no environmental impact. As tested in this experimental work, the power generated from this machine is more efficient it is produced by an efficient system.

There are also several advantages of such as system will include maximum energy converted efficiently by eliminating tip losses on the axial turbine blades. This is because of the shape of the turbines that are ducted hence generating three times more power as compared to the open bare turbine (Garman, 1986). Other advantages included but not limited to, improved safety, increased power output with reduced turbines and gearbox that generate a particular power output. These turbines are also constructed using low cost materials.

These low cost materials are designed to the downstream sides hence reducing the downstream pressure. In so doing it increases the pressure available dropping. This increases the flow hence increasing the power output of a given turbine of a particular size (Baker, 1991). When put in another way by increasing the flow area containing large water energy, concentrated in a small area of a lower cost turbine gives more power

output. This is because the small turbine flow that is faster spins faster. The torque is in this case less and smaller hence low cost gearbox is used. The flow velocities are low hence turbines are low (Garman, 1986). This produce reasonable amount of power output.

Conclusion

As mentioned in the above findings, this design is seen as the most cost-effective and very efficient hydroelectric power generation system (Garman, 1986). The system is good as it uses low flow and head parameters as well as the duct technologies that make it more efficient and effective. The actual project can produce up to 4000 watts as illustrated in the experimental work on model performance testing using the low flow and head parameters (Baker, 1991). Due to the availability of the educational display in the project, the public can be informed on how power can be generated using this hydroelectric generation system.

References

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