CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)

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Project Number

J1017

Project Title

Dam Science: Testing the Energy Efficiency of Varying Reservoir Dimensions behind a Hydroelectric Dam

Abstract

Objectives/Goals

The objective of my Science Fair experiment was to discover how the depth and length of a reservoir behind a dam impacts the force on a turbine, and ultimatley the amount of generated electricity.

Methods/Materials

First, I constructed a wooden box to simulate the conditions of a hydroelectric dam. The dam simulation had three different adjustable widths, which was made possible by a wooden partition. Next, I built a micro-hydroelectric generator. To conduct the experiment, I placed the micro-hydroelectric generator adjacent to the hole where water would flow out of the "dam". The water force would spin the turbine and generate electricity. The varied range in electrical output occurred because of the varied shape and water pressure of the reservoirs behind the dam.

Results

The reservoir with large horizontal and vertical water pressure (reservoir 9) produced the most electricity. A reservoir with large horizontal force and medium vertical force (reservoir 6) produced less electrical output than the reservoir with medium horizontal force and large vertical force (reservoir 8). The reservoir with small vertical and medium horizontal force (reservoir 2) produced no electricity. A small vertical force and large horizontal force (reservoir 3) produced an average of five mili-volts. The reservoir with small horizontal and vertical pressure (reservoir 1) produced the least amount of electricity.

Conclusions/Discussion

Horizontal and vertical water pressure are very important to the efficiency of a hydroelectric dam. However, vertical water pressure appears to be more crucial as long as there is at leat a medium horizontal force. This is particularly demonstrated in reservoirs 8 and 6. Reservoir 8 yields significantly more electricity compared to reservoir 6 with its large horizontal force and medium force. These results make me question the efficiency of some of todays hydroelectric dams. For example, Buchanan Dam has a reservoir length of 31 miles, while its height is only 1025 feet. The height is disproportionably small, and its long length is unneeded. This dam would be more effective if its length was cut down and the dam was made deeper.

Summary Statement

This project explores the impact of depth and length of the reservoir behind a hydroelectric dam on the the water flow exiting the dam, the force on the turbine, and the electricity generated by the hydroelectric generator.

Help Received

My mother and father helped during the construction and testing processes, which required several sets of hands.