CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

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Project Number

J1021

Project Title

Can a Low Head Hydroelectric Turbine Be Placed in Weirs to Create a Substantial Amount of Electricity?

Abstract

Objectives

The purpose of this project is to create enough usable energy from my hydroelectric weir design to be used throughout our California stream and canal systems as a viable alternative source of clean energy. This project was very close to reality in California but was pulled due to rising oil prices. I decided to prove that through minimal head of 3.5 feet and 5 feet one can create enough electricity through a small scale model and numerous trials. After researching and meeting with Jim Wegley from Keller/Engineering, I showed how this could theoretically be put to place in the Kings River at different weir types. With the flow rates of the Kings River and using my three hydroelectric turbine designs, the project could potentially save homeowners and the state of California hundreds of thousands of dollars annually.

Methods

Created a small scale model that shows elevation drops of 3.5 feet and 5 feet. Measured voltage, amperage, slope, and flow rates through numerous trials. Met with Keller/Wegley Engineering on designs and theoretical outcomes for the Kings River. Proved that a low-head hydro-electrical turbine could produce energy at 3.5 feet head and 5 feet head. Designed three low-head hydroelectric turbine models that could be used at different existing weirs in the state of California, all simulating a drop of elevation of 3.5 feet or 5 feet. Monitored flow rates of Kings River and visited different types of weirs. Created a theoretical example of potential savings using data from the Kings River.

Results

After numerous trials found that a small scale hydroelectric turbine with head of 3.5 feet and 5 feet will produce electricity with minimal flow rate. Calculated amperage, voltage, slope, and flow rate. Proved that energy can be produced at a small scale with minimal head and flow rate. When converting data taken from the Kings River, my theoretical example shows substantial savings of 2040 kWh per day, which is enough hydro power to serve approximately 70 homes per day. Typical rivers in California have numerous weirs and could use several turbines at each weir depending on the existing design. Designs are created for all different types of weirs at low-head ranges.

Conclusions

This project idea came close to happening in California but was stopped due to design, money issues, and increased oil prices. I've proven that my 3 designs could work at all types of different weirs in California. My small scale design was efficient enough to produce electricity, proving that there is enough head at 3.5 feet and 5 feet in canals and at a stream's weir to produce substantial amounts of clean energy.

Summary Statement

The purpose of this project is to create enough usable energy from my hydroelectric weir design to be used throughout our California stream and canal systems, where there is a drop in elevation, as a viable source of clean energy.

Help Received

Jim Wegley Engineer for Keller/Wegley Engineering