CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
J1012

Project Title
When It Rains, It Shines: Optimizing the Efficiency of Home Hydropower

Abstract

Objectives/Goals
The purpose of this experiment was to see how much electricity could be generated by connecting rain gutters to a Pelton wheel generator. This could complement home solar power which is popular but doesn't work when it is raining.

Methods/Materials
I made a Pelton wheel generator and tested this system with the water at two different heights, using four different water nozzles with different flow rates. For each of these conditions, I calculated the potential energy, kinetic energy, and electrical energy. Based on these numbers I then calculated the efficiency of the system. Finally, I calculated how much energy could be generated from rainfall on an average American home roof in a rainy area.

Results
I had a maximum of 1.08% overall efficiency. The highest generator efficiency was only 2.22%.

Conclusions/Discussion
I learned that each element of this system needs to be optimized and matched to the others to achieve high overall efficiency. I also calculated that even an efficient system would only generate a dime of electricity in an entire year, which is not a great investment.

Summary Statement
I studied whether it would be possible or practical to generate electricity from rainwater falling on the roof of a house.

Help Received
My dad helped me make the wheel and nozzles in his machine shop. He also helped me with my testing and calculations, as you have to take many measurements at the same time. My mom helped me with my display board.