CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
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Project Number
J0813

Project Title
Surf Power

Abstract

Objectives/Goals
Purpose: To prove that when looking at the power available in a wave, the height of the wave has a greater contribution than the period of the wave.

Methods/Materials
MATERIALS: Plexiglass wave tank + Specialized wave power generator.
MEASUREMENTS: Using a voltmeter, led light, and oscilloscope.
PROCEDURE/METHOD: A wave generator produces electricity from the up and down motion of a wave. My experiment uses a pair of gear reduction motors, mounted inside a waterproof cylinder, that are attached to a floating "U" device, which causes the shaft of the motors to turn with wave action. A bridge rectifier is used to convert the positive and negative voltages produced (AC) into positive only voltages (DC), and a capacitor is used to even out the voltage drop that occurs when the shaft slows down to reverse directions. By varying the load resistance of the measuring device, the current and voltage can be measured to calculate the generated power.

Results
TESTING RESULTS: From the results of my dry runs, the small waves are approximately 1.5 inches from crest to trough, and 10 inches apart, and the large waves are approximately 3 inches from crest to trough, and 20 inches apart. The larger waves produced 4.5 times more power than the small waves.

Conclusions/Discussion
My hypothesis of larger amplitude waves generating more electricity than lower amplitude waves that appear more frequently is supported by the results of my testing. The larger waves produced four times more energy than the smaller waves, even though they were only two times larger in height. This also supports the power wave density formula that the power of the wave is proportional to the square of the height (i.e., P in kW/m^2 = 1.2h^2/T).

Summary Statement
Capturing power from waves to demonstrate that larger amplitude waves generate more electricity than lower amplitude waves that appear more frequently.

Help Received
My father helped me select the motors used in my floating device to capture energy, he generated waves during testing while I took measurements, and he helped find a mathematical formula that can calculate potential energy from waves. My mother reviewed my draft report.