# CALIFORNIA STATE SCIENCE FAIR
## 2013 PROJECT SUMMARY

**Name(s)**

Annie C. Benedict

**Project Number**

**J0104**

**Project Title**

# Effect of Interior Cavern Angle & Spout Diameter on Water Ejection & Power Collection from a Simulated Oceanic Blowhole

**Abstract**

**Objectives/Goals**

In Year I of my project, I tested how changing the depth of a blowhole assembly in a wave generation tank affected the amount of water ejected from the blowhole spout, which is a measure of how much energy was collected. In this year's project, I tested two independent variables, angle of board inside the blowhole cavern and blowhole spout diameter, to find an optimum configuration for maximum power collection in a simulated oceanic blowhole. I hypothesized the most water would be ejected and most power would be collected when the board was at its greatest angle and the spout had a medium-sized diameter.

**Methods/Materials**

I used the simulated blowhole wave tank I built previously, along with a new water collection system that I designed and built. In addition, I modified my blowhole cavern by adding slant boards to create the internal angle and by developing a system to change spout sizes while still achieving an airtight seal between the spout and cavern. The waves entered the cavern and ejected water through the spout, which was then collected at different heights for a given time. I weighed the lifted water and then calculated its potential energy and power. Using five different board levels and eight different spout diameters, testing each combination for a minimum of five trials, I completed more than 200 total tests.

**Results**

My hypotheses were rejected. The cavern angle did not have much effect on the amount of water output and power collected because the wave motion is primarily at the water's surface, not the tank's bottom. In addition, the largest blowhole spout allowed the most power collection; smaller tubes did not allow for sufficient air flow. The maximum amount of power collected by my setup was 63 milliwatts.

**Conclusions/Discussion**

In this year's project, I was able to increase power collection by more than 21 times that collected previously. The finding that interior angle does not affect its output is actually beneficial to real world application since sand and other debris collected in the blowhole would not affect performance. Based upon my research, I believe blowholes, natural or artificial, could potentially be used as a novel renewable energy source in the future.

**Summary Statement**

In Year II of my project, I tested two independent variables, angle of board inside the blowhole cavern and blowhole spout diameter, to find an optimum configuration for maximum power collection in a simulated oceanic blowhole.

**Help Received**

My father assisted me with the construction/set-up of my wave generation tank and taught me how to use different tools and functions on Microsoft Excel.