



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Isabel Sperandio	Project Number S1020
Project Title Harnessing the Power of the Ocean: Designing an Efficient and Portable Wave Energy Converter Prototype	
<p style="text-align: center;">Abstract</p> <p>Objectives My goal is to design and build a small-scale device that generates electricity from the force of ocean waves. My purpose is to help people who do not have access to electricity, for reasons such as natural disasters, rural locations, and poverty. Criteria: (1) Efficient: able to supply power to basic needs such as light and radio, cost-effective (2) Durable: impact and ocean water resistant (3) Practical: simple, transportable, and safe to use</p> <p>Methods After working on an unsuccessful design based on river hydropower last year, I was inspired by the algae being tossed around in the ocean and a shake-to-light-up toy to change my design to a shaking magnet and coil system. First, the device is thrown into the ocean. As it tumbles around and hits rocks, the magnet slides through a coil, inducing a current. I used thin plastic tubes wrapped in magnet wire nested inside of PVC pipes. I used 12 coils assembled in a cube formation to capture energy in all 3 directions - X, Y, and Z. I built a circuit with rectifiers and added sails to the cube to improve efficiency. I built 4 different prototypes with many iterations in between. I tested them in the ocean measuring voltage & current 20 times per second using a Vernier Energy Sensor and calculated power & energy.</p> <p>Results Prototype 3 produced 1.7 Joules in 10 minutes, with a peak of 11 Volts and 35 mA. On average, it can produce 2.8 milliwatts. It weighs about 1 kg and is under 30x30x30 cm. It withstood 15 minutes in high surf and was waterproof. To use the cube, I tied the extension cord/rope to part of a rock, threw it into the ocean, and waited.</p> <p>Conclusions Prototype 3.1 of the "Wave Power Cube" has met my engineering goal. It successfully converted the chaotic and powerful ocean waves into enough usable electricity to power LED lights. It is durable, safe, and easy to use. It can easily be scaled up and mass produced because of its simplicity. If developed further, it has the potential to be much more efficient and cost-effective through improved circuit design, coil configuration, sail panel improvement, and more testing. This is impactful because it is a new way of using the ocean's power that could give an extra boost of</p>	
Summary Statement I designed and built a small-scale and practical device that generates electricity from the power of ocean waves.	
Help Received I did the designing, building, and testing myself. Mr. Dunbar, my physics teacher, answered my questions about electricity and magnetism. Ms. Wilson helped me with writing. My dad made sure I was safe while testing at the beach.	