



**CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY**

<b>Name(s)</b> <b>Max A. Freedman</b>	<b>Project Number</b> <b>J0211</b>
<b>Project Title</b> <b>Power from Ocean Waves</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Can ocean wave power be used generate electricity? Oceans have tremendous potential, but ocean energy is not widely used. Wave energy, from tides and ocean currents can be used to drive an Oscillating Water Column (OWC). This project builds a small scale OWC using a Wells turbine apparatus, to generate energy with ocean waves.</p> <p><b>Methods/Materials</b> Methods: Prototype, test and refine systems and integrate systems into working OWC. Pipe System (Pneumatic): Task: Convert wave energy to pneumatic energy. Action: When waves ascend, air pushes out and when waves descend, air is pulled in. Turbine System (Mechanical): Task: Convert pneumatic to mechanical energy Action: Moving air spins turbine and turns the motor. Electrical System (Electrical): Task Convert mechanical energy to electrical energy Action: Electricity is generated by spinning motor and conducted to voltmeter. Integrated System (Wave, Pneumatic, Mechanical, Electrical): Task: Convert wave energy to pneumatic energy to mechanical energy to electrical energy Action Integrate all systems using waves to spin the turbine generating electricity. Materials: 4# diameter 3D printed PVC Wells turbine and assembly, 2v DC motor with bell wires, ABS 4# pipe and fittings, 50 gal plastic garbage can</p> <p><b>Results</b> Individual systems were prototyped tested and refined. Pneumatic System--Air Pressure Test: Is there enough air pressure to spin the turbine? Submerge in ocean waves, test the air pressure coming off the OWC in three trials using a weighted lid. The air pressure generated from the OWC was: 86.59 kPa. Turbine System--Intake vs. Outtake Test: Is the Wells Turbine effectively producing electricity in both directions? Testing the turbine with the blower, the Intake air direction generated higher voltages, however both directions produced voltage. Electrical System--Resistor Test: What is the power potential in the system? Testing the motor with 10k ohm, 1k ohm, 100 ohm resistors demonstrate the power generated by motor, 1.85, 20.16, 14.44 respectively. Integrated System--Integrated Systems Test: Will It Work? Integrating all systems did not generate electricity with ocean waves.</p> <p><b>Conclusions/Discussion</b> This engineering project demonstrates a small-scale model of OWC and Wells turbine. Initial results from the integrated unit fail to generate electricity.</p>	
<b>Summary Statement</b> This engineering project demonstrates a small-scale model of OWC and Wells turbine to generate electricity from ocean waves.	
<b>Help Received</b> My mom helped me with research and board. My dad helped me assemble my model and testing in the ocean	