Harnessing the Energy in Waves To Generate Electricity

Choy, Landon (School: Kamehameha Schools Kapalama Campus)

Ocean waves can generate power 90% of the time, making them the most reliable source of clean energy in the world. Places like Hawaii, which are surrounded by waves, can significantly benefit from the use of wave energy as it is the most petroleum-dependent state in the United States. This project investigates a cheap, small-scale wave energy converter (WEC) that can convert oscillating water levels (associated with waves) into electricity. With the use of a float, oscillating water levels were used to move a magnet in and out of a coil to induce a voltage. The WEC was deployed in a fabricated wave tank with a manual wave generator system to move a board through the water using a handle. Coil diameter, wave amplitude, the number of coil turns, and the number of magnets were the variables tested to observe their effect on the device's energy output. Out of three coil diameters of 14, 16, and 25 mm, the largest produced the most voltage and current. A higher wave amplitude was also discovered to increase the energy produced in a linear trend across 10 observations. Building on the coil diameter experiments, the number of coil turns on the 25 mm diameter coil was increased in increments of 50. To further optimize the device, the number of magnets was changed in increments of 10 on the 25 mm diameter coil with 250 turns. After graphing the averages, a linear relationship was found with both the number of coil turns and the number of magnets increasing the voltage and the amperage. Two mathematical equations were analyzed, Faraday's Law of Induction and magnetic flux. Based on the results, improvements are suggested for future experiments.

Awards Won:
Arizona State University: Arizona State University ISEF Scholarship (valued at up to $52,000 each)
Air Force Research Laboratory on behalf of the United States Air Force: Glass trophy and USAF medal for each recipient
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category