Developing and Analyzing Hydropower Generators in Fishpond Makaha

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Hydropower is the conversion of tidal energy into electricity. Being completely surrounded by ocean water, however, Hawai?i has the potential to rely on hydropower to supply renewable energy. Loko I?a, or Hawaiian fishponds, were developed over a thousand years ago by Native Hawaiians. The openings in the rock walls of these fishponds are called sluice gates, or makaha. The tidal currents which pass through makaha produce a significant amount of energy, which can be harnessed and converted into electricity using a hydropower generator. The first goal of this project was to construct a hydropower generator capable of converting tidal energy in a makaha into electricity. Three submersible water pumps were converted into hydropower generators. Prototype 2 generated an average of 41.2 watts of energy, the most out of the three constructed prototypes. The second goal was to develop a software to analyze hydropower generator production and efficiency in real-time. A program was written in C++ to use raw data from sensors and multimeters to graph hydropower generator electrical production and efficiency charts in real-time. During the three-hour software trial, Prototype 2 harnessed 22-26 watts, 9-18% of the 122-356 watts of available tidal energy. The third goal of this project was to construct a prototype with multiple hydropower generators to maximize the amount of harnessed tidal energy. Eight hydropower generators were connected in parallel on a submersible frame to harness both incoming and outgoing tidal currents. During the two-hour collection period, the multiple hydropower generator prototype was more efficient at harnessing available tidal energy than the single hydropower generator prototype.

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