Micro Closed-Loop, Pumped, Hydro-Power System Turbine Assessment

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Worldwide temperatures are rising due to increased greenhouse gas emissions, and energy production and consumption are the largest contributors. The purpose of this experiment was to assess a green solution. Specifically, this project examined a micro closed-loop, pumped, hydro-power system, and three turbines were scientifically evaluated: Pelton, Cross Flow, and a novel turbine (designed and created by the experimenter). This system can provide clean energy in rural and urban communities by harnessing excess solar power and storing it in a micro closed-loop, pumped, hydro-power system with a low-flow, high-head application. The experimental system was built with two tanks, each holding approximately 1550 liters of water. The primary hypothesis of this experiment was that if a micro closed-loop, pumped, hydro-power system with a novel turbine is charged to maximum capacity, then it will emit the most power over time (Watt hours, Wh). Although there was no statistically significant difference in Watt hours among the three turbines (p-value=0.0906), the novel turbine's average Watt hours was close to two established industry standards for turbines (novel mean=10.24 Wh; Pelton=11.76 Wh; Cross Flow=11.07 Wh), and the novel turbine was a strong competitor to the other two turbines in terms of efficiency (novel mean=12.63% Peloton=14.39%, Cross Flow=13.64%) and longevity (novel mean drain time=90 minutes; Pelton mean=100 minutes; Cross Flow mean=56 minutes). The experiment showed three strong approaches to developing a successful and relevant micro closed-loop, pumped, hydro-power system.

Awards Won: