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Small-Scale Hydroelectric Power for Remote Communities

Robert Kameron Dickey

Edward J. Yesilonis

Cameron K. Kanter

Andrew S. Reedy

Caleb P. Southwick

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Kameron Dickey, Cameron Kanter, Andrew Reedy, Caleb Southwick, Edward Yesilonis

Problem

Currently 1.6 billion people in developing countries live without electricity.

Access to electricity advances economic opportunity, improves socio-economic standing, and increases participation in the information age.

Mission

The Pico-Hydro Energy Project (PHEP) believes that all people deserve economic prosperity to financially support themselves and their families. We believe that small-scale hydro can bring jobs and economic prosperity to underdeveloped communities.

Solution

Provide a water energy device for generating electricity (WEDGE), that uses run-of stream water movement to generate electrical power.

Client

Engineering Ministries International (EMI)

Client Vision:

"...see people restored by God and the world restored through design."

Further Information

Project Manager: Bob Hentz —rbhentz@aim.com

Student Project Manager (2018-2020): Andrew Reedy—ar1403@messiah.edu

https://www.messiah.edu/info/22228/our_projects

Goals

- Produce 300-800 watts of electrical power
- Operate in stream velocities as slow as 2 ft./sec
- Operate continuously for 3-5 years with no major component repairs
- Manufacture models for under $500—USD

Prototype Testing

WEDGE 3.0

Kaplan Turbine that sits on the stream bed and has an adjustable height—WEDGE 3.0 testing produced 49 watts of mechanical power

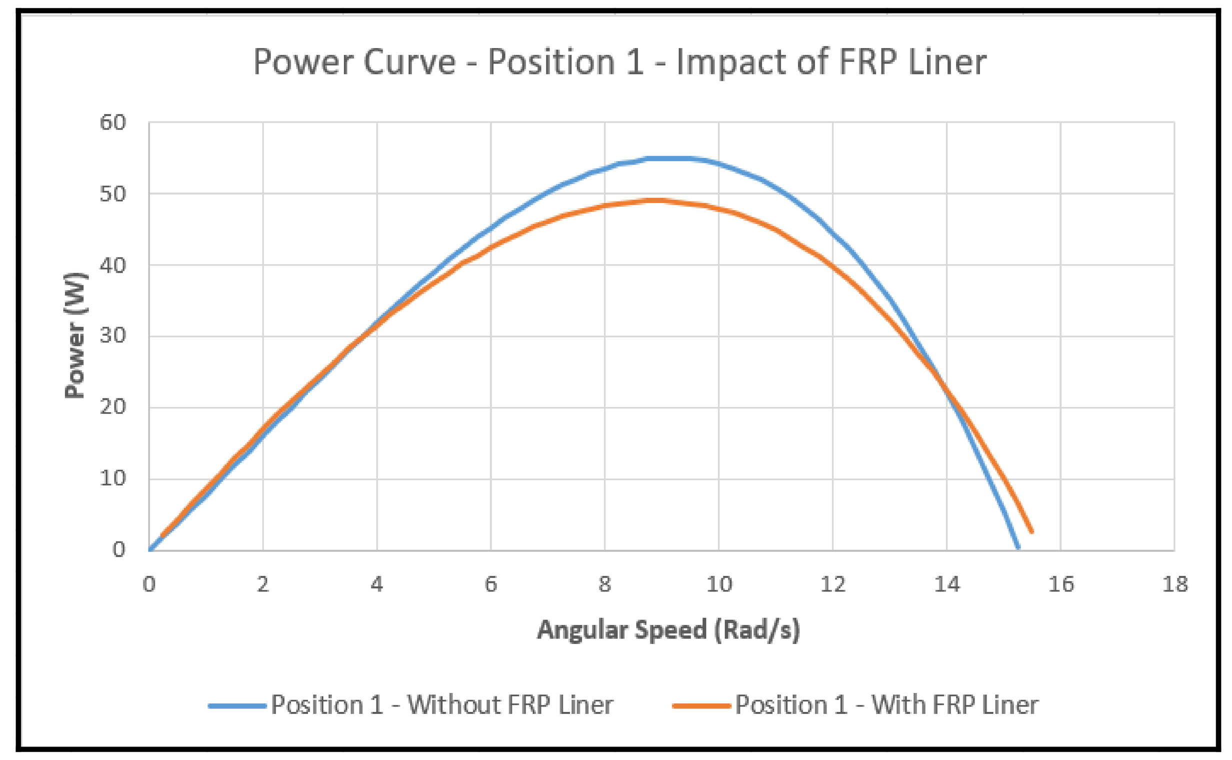
WEDGE 2.0

Kaplan Turbine that sits on the stream bed and features an adjustable device angle —WEDGE 2.0 testing produced 55 watts of mechanical power

WEDGE 2.0 Baseline Testing

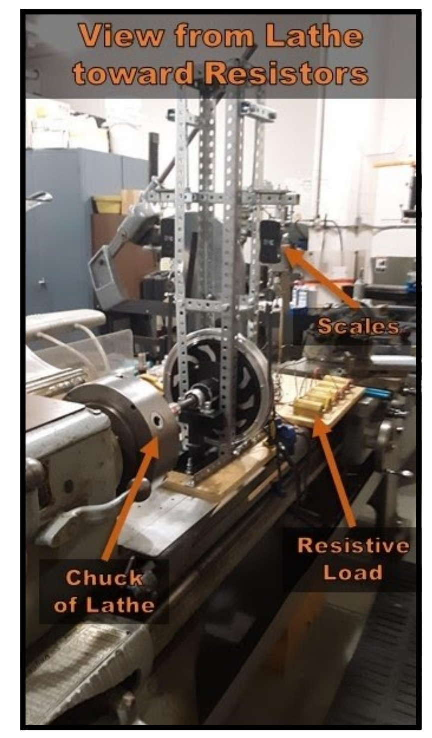
Each device angle was tested. Device angle 1 (the gray curve) produced the most peak power, but device angle 0 (the yellow curve) was better for higher stream speeds.

WEDGE 2.0 Modification Results



The team thought the addition of a liner would increase power output. However, the power curves to the left show that this was not the case.

Electrical Generator Testing Results



Using the testing set-up to the left, the team determined the efficiency of the chosen generator to be approximately 60.7%

Conclusions

The PHEP will progress by testing the effects of the nose and tail cones. This will allow the team to complete design recommendations for the WEDGE 2.0 device. From there, the team will use a generator to turn mechanical motion into electrical power.

Future Plans

- Test modifications, analyze their impact on the WEDGE 2.0
- Compile final research and documentation

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