Rutgers University Marine Energy Collegiate Competition Team

RUTGERS | Smart Systems Laboratory

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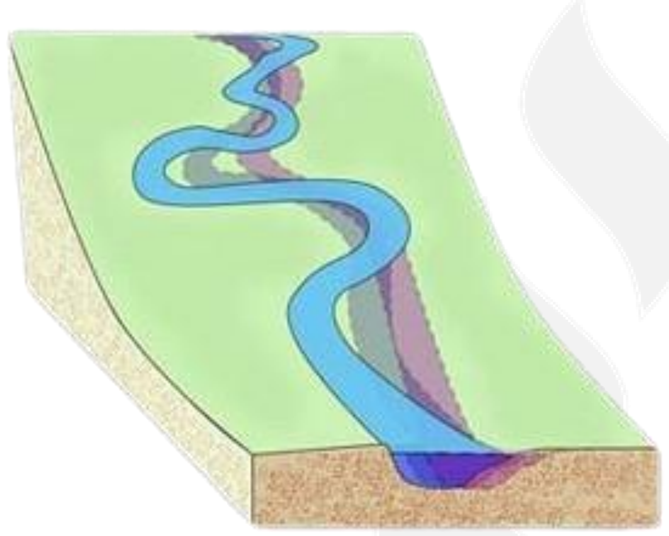
RU POWER

ABSTRACT

The goal of this project by the Rutgers University 2024 Marine Energy Collegiate Competition (MECC) Team, RU POWER, is to engineer a hydrokinetic turbine for river environments. The design of the turbine takes influence from a kinetic turbine. There are two main considerations for the design of the turbine: efficient power output to support isolated power systems and communities at scale, and support for river ecosystems through a design which minimally interferes with the natural movement of the surrounding wildlife. The project is at the prototype stage where a small-scale 3D printed model has been produced and utilized to further design specifications and contribute to improvements.

BACKGROUND – KINETIC TURBINE

- High efficiency at run-of-the-river and no-head applications
- Generates electricity from the available kinetic energy
- Simple design allows for ease in manufacturing
- Efficient use of space, compact
- Also called "Free-Flow Turbine"



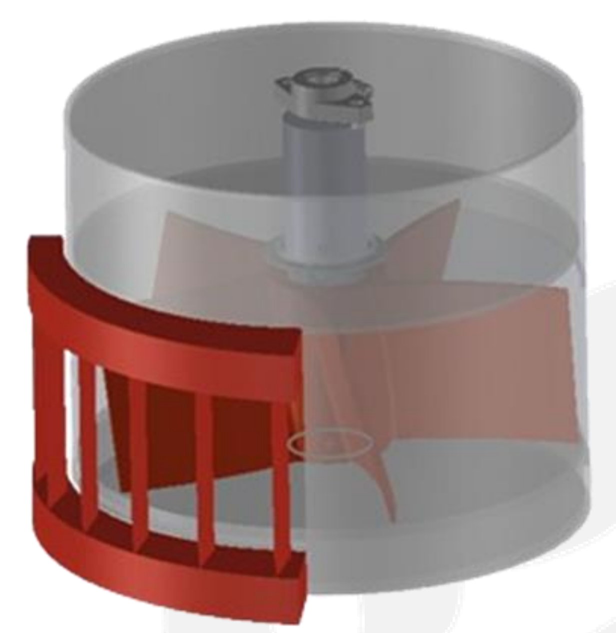
FUTURE DIRECTIONS

- Implementation of pollution monitoring
- Increase scale of experimentation
- Additional specific community-driven enhancements

ACKNOWLEDGMENTS

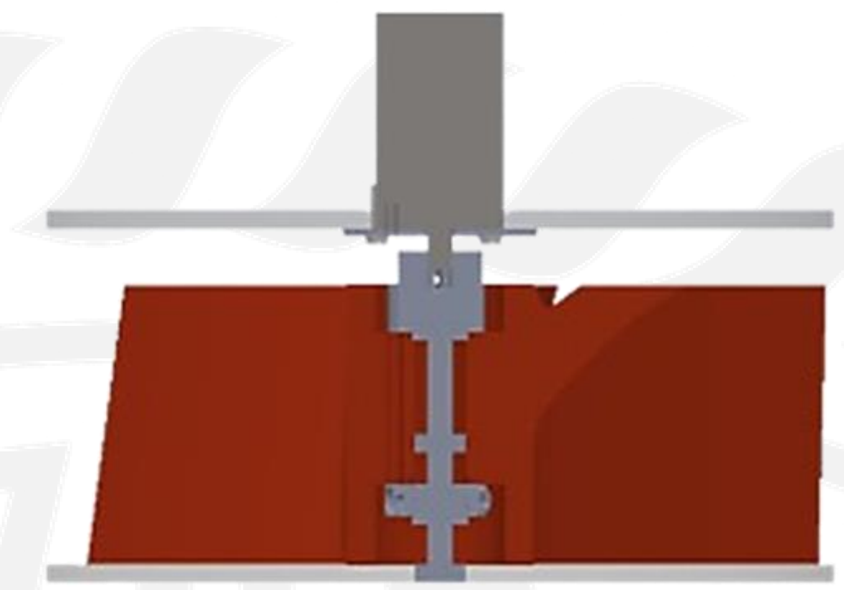
Our team would like to thank Prof. Onur Bilgen and Dr. Gregory Methon for their continuous guidance and support throughout the course of this project. Thanks to the Rutgers Smart Systems Laboratory for providing resources to the RUPower Team. Thanks to the U.S. Department of Energy and the National Renewable Energy Laboratory for the opportunity to compete in this competition, and for sponsoring this project.

SYSTEM DESIGN

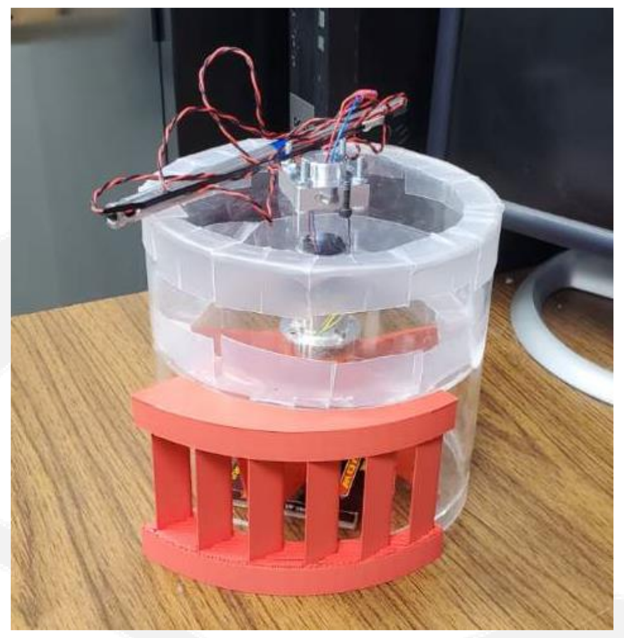


External Turbine Design

Turbine Blades



Turbine Hub



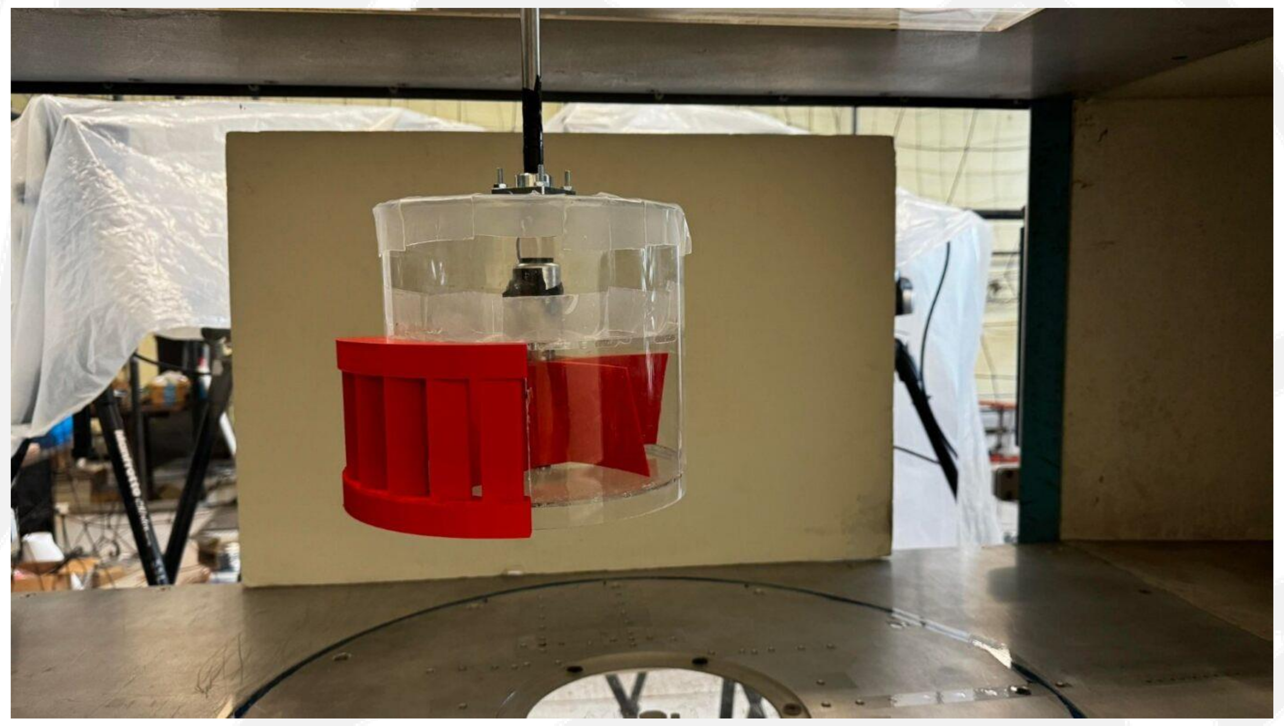
Turbine Assembly

EXPERIMENTATION

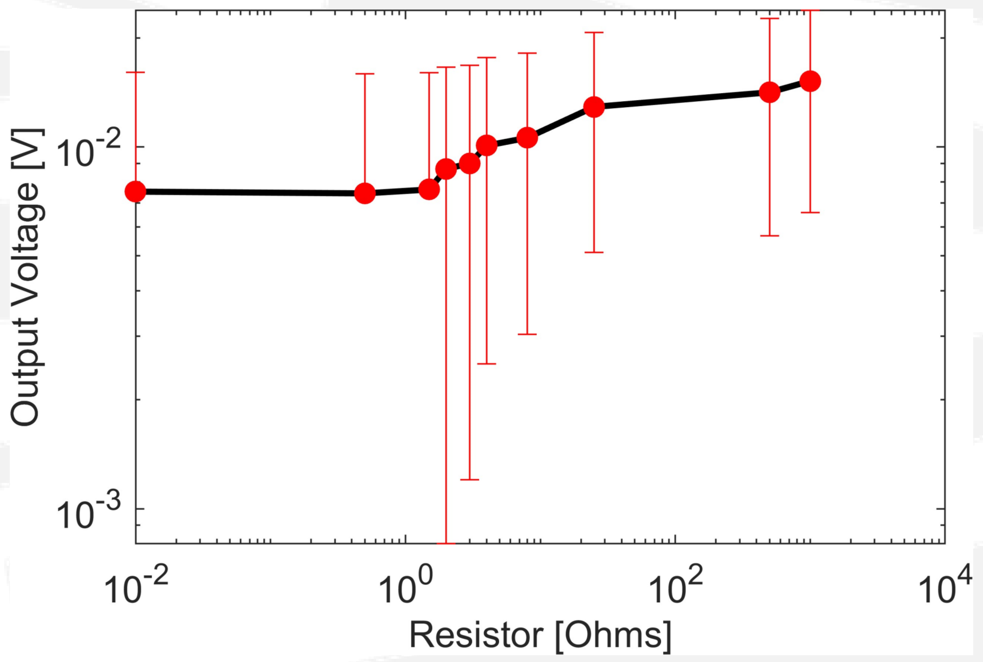
Power Output Setup

Turbulence Setup in Water Flume

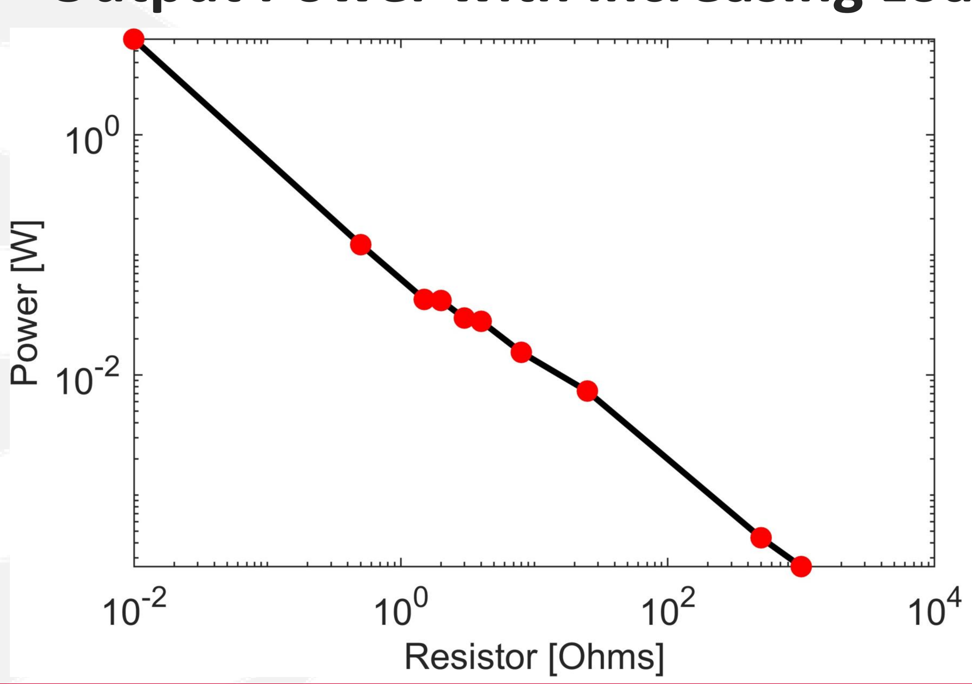
Power Output Setup in Wind Tunnel



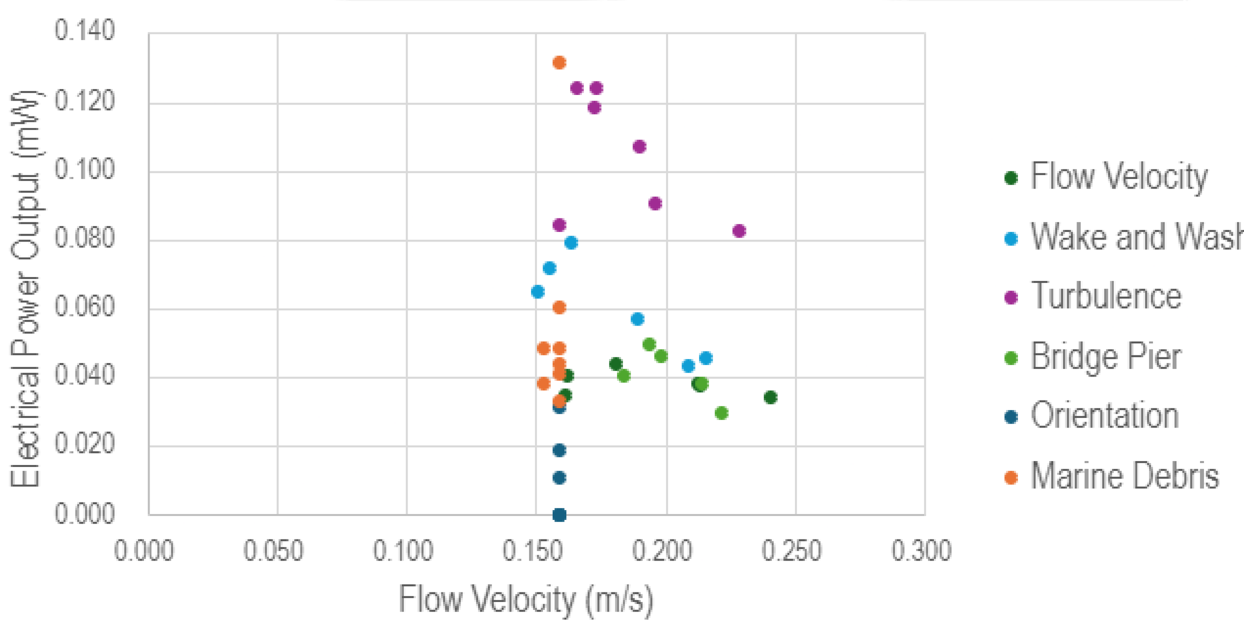
Load Voltage with Input of 12m/s



Output Power with Increasing Load



Power Output vs Flow Velocity



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[1] Water Power Technologies Office (WPTO). "Types of Hydropower Turbines." Department of Energy, www.energy.gov/eere/water/types-hydropower-turbines.[2] Mishra, Gopal. "Kaplan Turbine - Its Components, Working and Application." *The Constructor*, 22 Sept. 2018, theconstructor.org/practical-guide/kaplan-turbine-component-working/2904/.
[2] Nilsson, Hakan. "Numerical Investigations of Turbulent Flow in Water Turbines." CHALMERS UNIVERSITY OF TECHNOLOGY Department of Thermo and Fluid Dynamics , Sept. 2002, citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=22dc6f2ab7ebcc194efc0a15ad5bec0bb2cf54af.