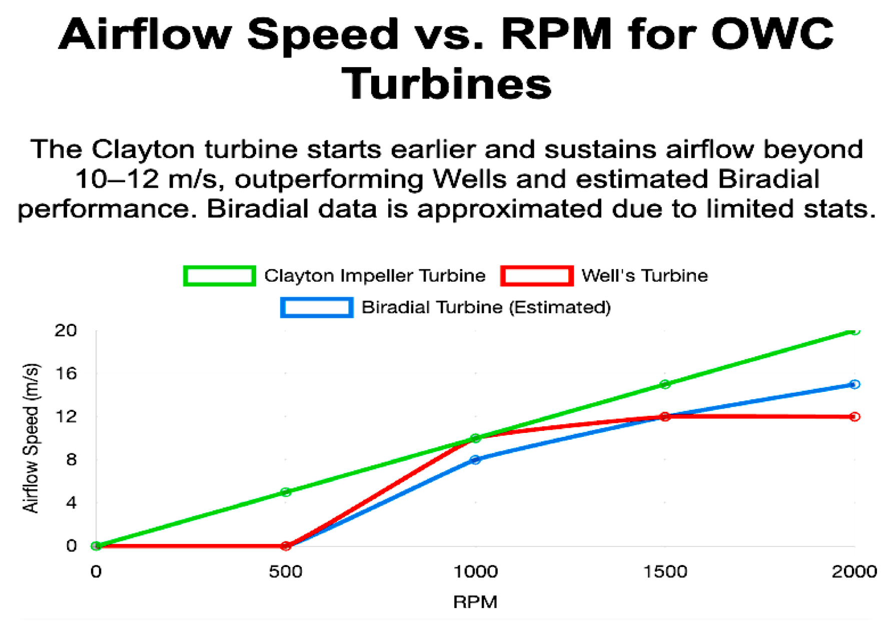
Clayton Axial Bi-Directional Rotary Impeller Turbine. An alternative to Wells and Biradial turbines.

The Clayton Axial Bi-Directional Rotary Impeller Turbine (ABRIT) prevents stalling, ensuring efficient energy capture in air, water, or mixed environments.

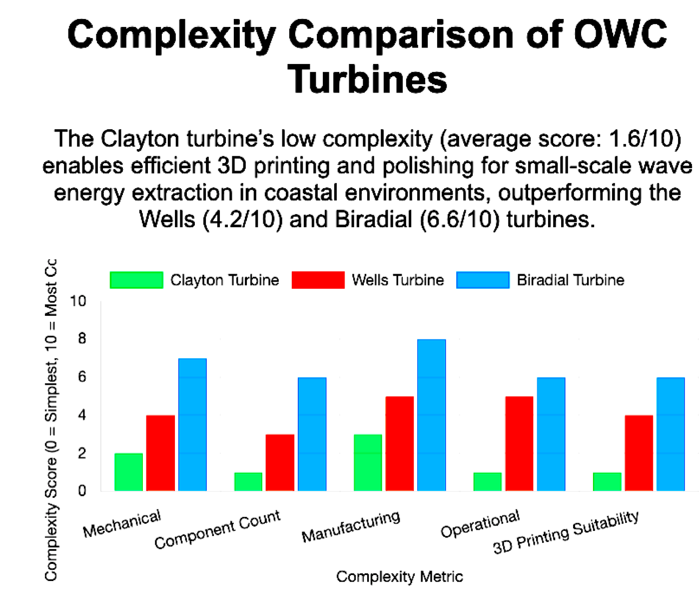
Introduction

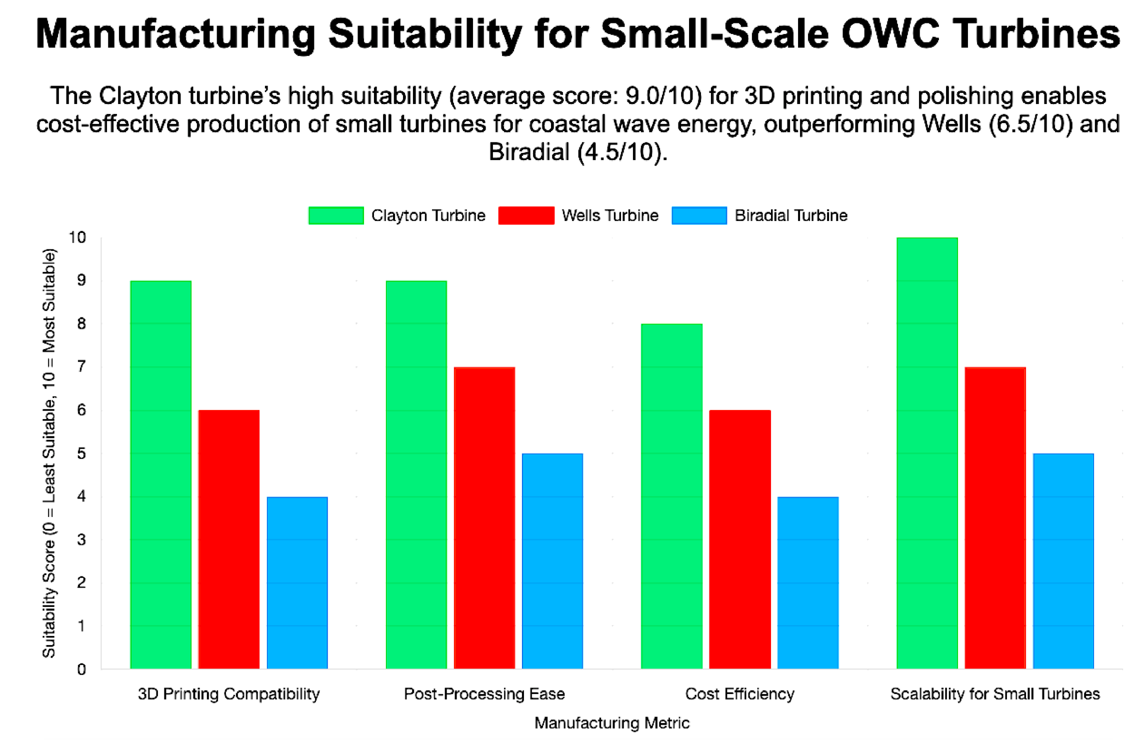
The Wells Turbine, used in (OWC) Oscillating Water Column systems, has limitations: • Efficiency: 40-70% • Stalls below 5 m/s and above 10 m/s • Air-only and subject to Betz Law of efficiency of only 59.3%. Unsuitable for water currents.This limits energy capture in diverse marine environments.

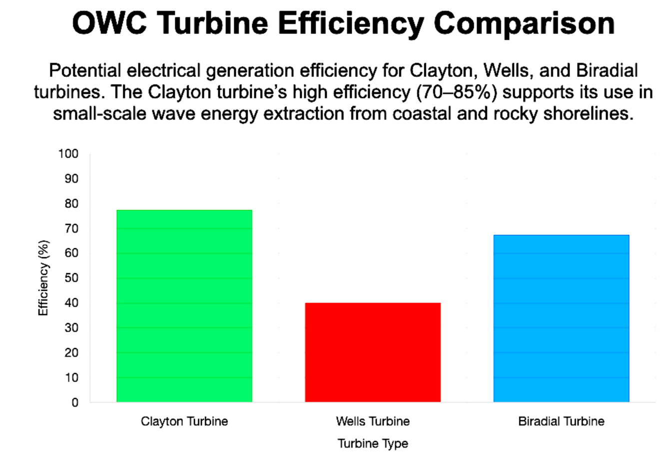
Performance

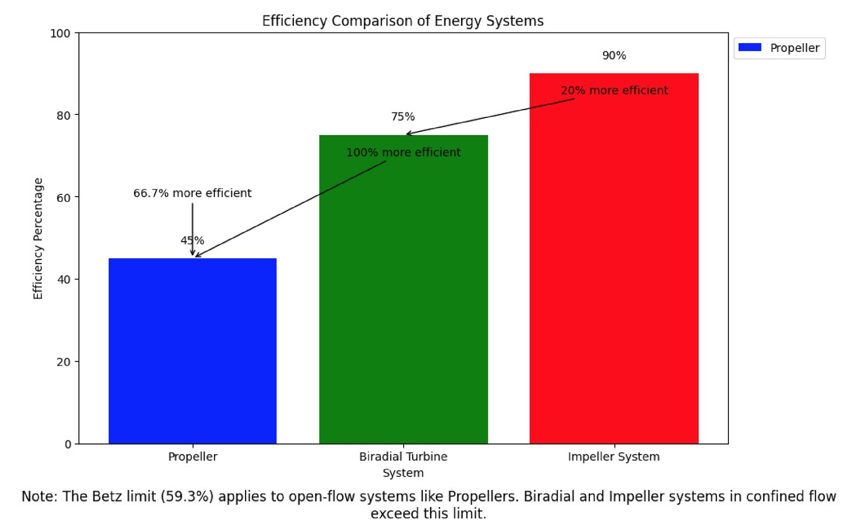


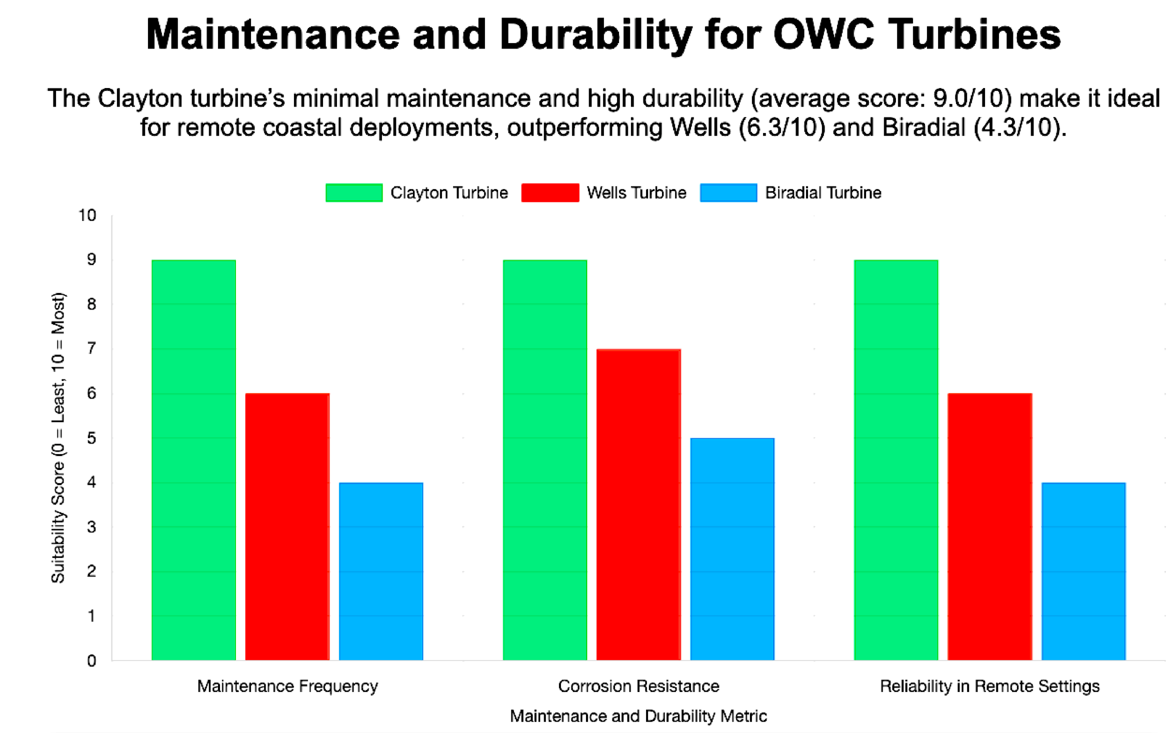
Results are based on the Mutriku Wave Power Plant.











COMPARISON

The chart titled "Airflow Speed vs. RPM for OWC Turbines" compares the performance of the Clayton Impeller Turbine, Well's Turbine, and Biradial Turbine (estimated) in Oscillating Water Column (OWC) systems. The Clayton turbine demonstrates superior performance, starting earlier and sustaining airflow speeds beyond 10-12 m/s, outperforming both the Well's and estimated Biradial turbines. The Well's Turbine shows limited airflow speed, particularly at lower RPMs, while the Biradial Turbine's data is approximated due to limited statistics. The Clayton turbine's ability to operate efficiently across a broader range highlights its advantage in wave energy conversion.

MANUFACTURING

The Clayton Turbine stands out for its manufacturing simplicity, featuring a single moving part—the rotor-shaft—making it ideal for 3D printing with materials like AISI10Mg or Ti-6Al-4V for corrosion resistance. This design minimizes costs and maintenance, outperforming the more complex Wells (4.2/10) and Biradial (6.6/10) turbines, which require multiple components and precision assembly. Its static construction, devoid of hydraulics or valves, allows efficient CNC machining or 3D printing, and the use of conductive metals like aluminum or titanium enables biofouling prevention through electrical surface shocking.

Future Work Next steps

Future work and next steps for the Clayton Turbine involve initiating flume testing with Pedro Lomonaco, PhD, Director of the O.H. Hinsdale Wave Research Laboratory at Oregon State University's School of Civil and Construction Engineering, to assess performance and acquire critical data points. This will be followed by validation through Computational Fluid Dynamics (CFD) modeling and open-water trials at PacWave. Further efforts will concentrate on optimizing efficiency across diverse air and water conditions, scaling the design for larger deployments, and exploring its potential for remote, non-grid locations. Collaborations with OSU and support from TEAMER will propel commercial development and enhance manufacturing processes. Additionally, leveraging its impeller design, the Clayton Turbine can switch between generator and pump modes, offering valuable applications in agriculture and aquaculture.

CONTACT

Steve Clayton
Chief Technology Officer
Clayste Energy Systems, Inc.
541-488-2512
sclayton@clayste.com