

# Feasibility Assessment of an Ocean Wave Energy Converter: The Plug-and-Play 3D Prototype Development

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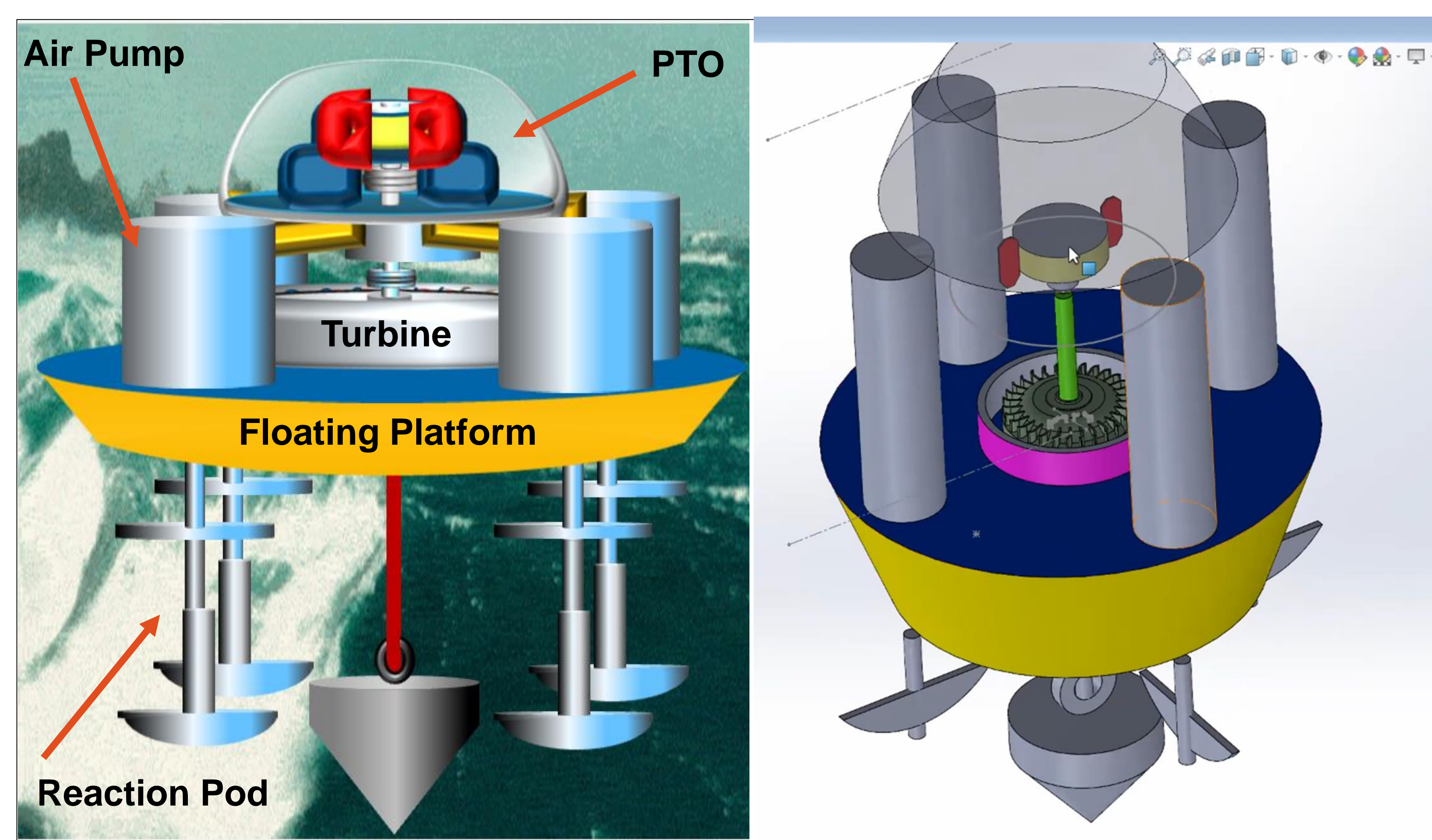
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## Background and Motivations

- Marine renewable power plants are facing the “Grand Challenge” to incorporate substantial demands on the reliability and built-in features such as redundancy, and safe delivery of the generated power.
- The offshore industry has experienced a clear trend for production facilities to be installed in a water depth and seabed.
- This work has studied Ocean Wave Energy Converter, which instantaneously transforms power in a wave surge into pneumatic power and further enables the transfer of energy onto Air-jet Turbine with rotational inertia.
- Power Take-Off Unit processed the extracted mechanical energy to electric form of energy for power delivery to either grid or Off-grid applications.

## System Architecture & Major Features



- ✓ Modular and Scalable with respect to various power levels
- ✓ Easy to manufacture, assemble, transport, deploy, and maintain

## Power Take-Off (PTO) Architecture

All-electric PTO consists of the following components:

- Permanent Magnet Synchronous Machine (PMSM)
- AC-DC Converter (Rectifier)
- DC-AC Converter (Inverter)
- DC-link Capacitor Bank
- Controller

## Design Objectives of this Study

- This project’s aim is to bring Marine Energy, particularly wave energy converter knowledge and industry connections to our university.
- Create an opportunity where students can gain hands-on experience, particularly in emerging marine energy applications.

## Design Concept Principles

- Wave-actuated air pumps with compressed air storage supplying an air-jet turbine
- Higher flexibility on deploying number of reaction pods and air pumps to supply Air-jet turbine.
- The costs associated with a technology for non-grid application are a point of reference in the proposed study.
- Average Capital Expenditure = 3 meter/\$1.5M
- State-of-the-art Average Capital Expenditure is 2m/\$1M

## Empowerment to the Blue Economy Markets

- ✓ Isolated Power Systems: Community Microgrids
- ✓ Coastal Resiliency and Disaster Recovery
- ✓ Ocean Observation and Navigation and Offshore Desalination Plant

## MATLAB/Simulink Simulation Results

- In Steady-state wave condition, the Generator Speed design value is 950 rpm, and the obtained simulation results confirm the design requirements.

