Water Power Technologies Office (WPTO) Marine and Hydrokinetic

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

WAVE ENERGY PRIZE
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Survivability Overview

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Survivability Session Overview

Survivability Overview: The knowledge generated by these projects will improve the survivability characteristics of MHK systems operating in potentially harsh marine conditions, thus extending their lifespans and ultimately leading to a reduction in the cost of MHK-derived energy.

The Challenge: The kinetics of the oceans are complex, random, and harsh. MHK devices need to survive and thrive over the entire range of ocean conditions. However, structural overdesign reduces cost effectiveness. Survivability strategies over a tremendous range of ocean conditions are essential for maximizing survivability, minimizing structural overdesign (CapEx), and reducing Levelized Cost of Energy (LCOE).

2014 Peer review and response: There were no projects in this area in 2012 – 2014.

Survivability projects were launched factoring in feedback from other portfolios. Please let us know if we have taken Survivability projects in the most beneficial direction.

- Three industry lead projects have been undertaken, each with multiple Lab and industry partners to quantify Survivability risks of MHK devices
- Techniques and tools can be applied to multiple device types, impacting the broader industry rather than just a single developer
- Publicly available numerical models, accompanied by test data for validation are in the process of or will be published when the projects complete

The Survivability Portfolio Aligns with Program Strategic Priorities

Technology Maturity

- Test and demonstrate prototypes
- Develop cost effective approaches for installation, grid integration, operations and maintenance
- **Conduct R&D for Innovative MHK systems & components**
- Develop tools to optimize device and array performance and reliability
- Develop and apply quantitative metrics to advance MHK technologies

Deployment Barriers

- Identify potential improvements to regulatory processes and requirements
- Support research focused on retiring or mitigating environmental risks
- Build
- MHK
- Ensure MHK interests are considered in coastal and marine planning processes
- Evaluate deployment infrastructure needs and possible approaches to bridge gaps

Three Industry lead projects

Market Development

- Support project demonstrations to reduce risk and build investor confidence
- Assess and communicate potential MHK market opportunities, including f-grid and non-electric
- form incentives and olicy measures
- Develop, maintain and communicate our national strategy
- Support development of standards
- Expand MHK technical and research community

Crosscutting Approaches

- Enable access to testing facilities that help accelerate the pace of technology development
- Improve resource characterization to optimize technologies, reduce deployment risks and identify promising markets
- Exchange of data information and expertise

Marine and Hydrokinetic Survivability Technologies Phase I/Phase II Projects Timeline

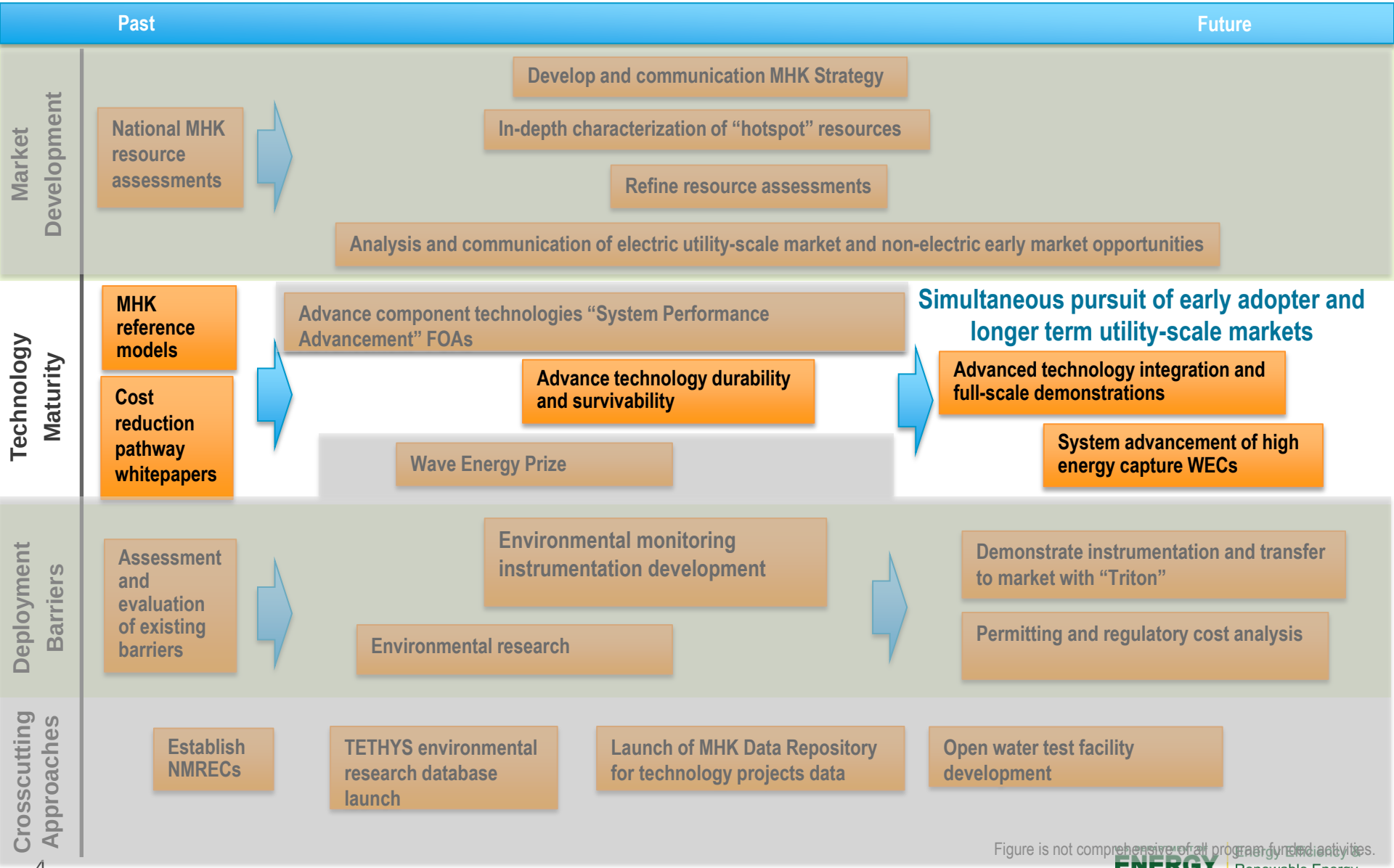


Figure is not comprehensive of all program funded activities.

Marine and Hydrokinetic – Survivability Projects
Cost Reduction Opportunities-Informing Investments

Cost reduction opportunity

- Averaged across wave and tidal
  - Wave: 63¢ per kWh
  - Tidal: 33¢ per kWh

Installed Capital Cost

- Advanced Materials, innovative manufacturing, array layout, design for resource class, efficient installation and permitting

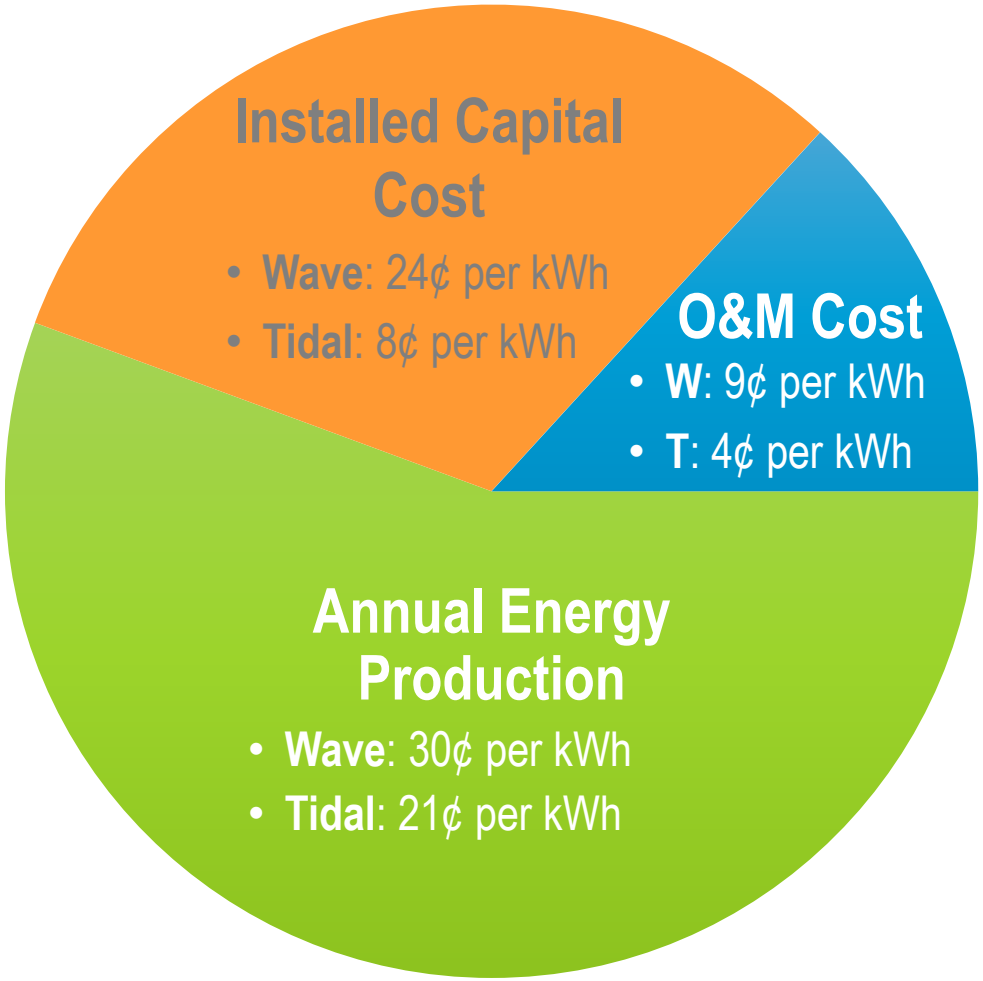
Operations & Maintenance (O&M)

- Prognostic maintenance, **design for service/survivability,** advanced coatings

Annual Energy Production

- Energy Capture/Conversion Efficiency, Resource Characterization, Advanced Controls, **Optimized Structures**

Cost reduction potential between now and 2030

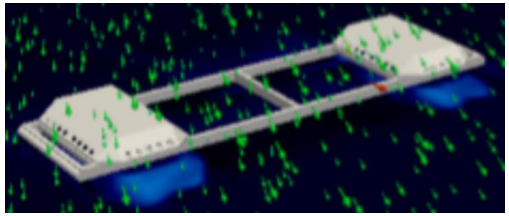


Survivability Project Timeline

Key:
Green: Wave technologies
Blue: Current technologies
Gray: not briefed in this session

M3WAVE.COM

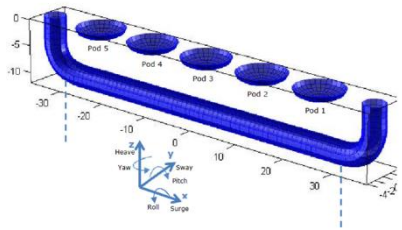
Improved Survivability and Lower Cost in Submerged Wave Energy Device



2013 2014 2015 2016 2017 2018 2019

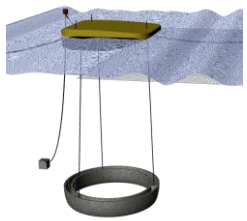
DEHLSEN ASSOCIATES, LLC

Numerical Modeling and Experimental Validation of Extreme Conditions Response for the Centipod WEC

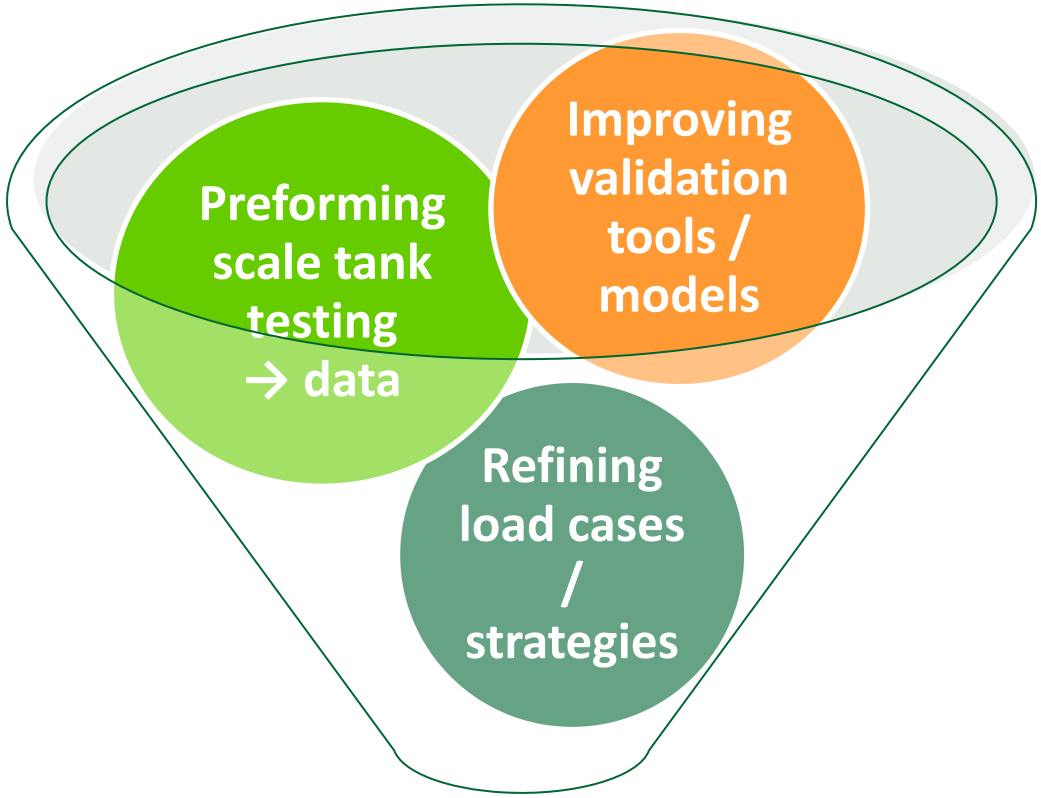


OSCILLA power™

Survivability Enhancement of a Multi-Mode Point Absorber



Survivability Projects' Generalized MHK Benifits



Quantitative knowledge to support a reduction of future MHK device:

- **CapEx (reduced overdesign) and OpEx (improved O&M)**
- **Levelized Cost of Energy (LCOE) (increase commercial viability)**
- **Risk**