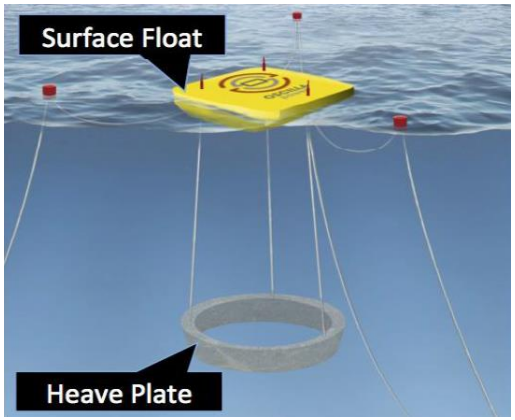

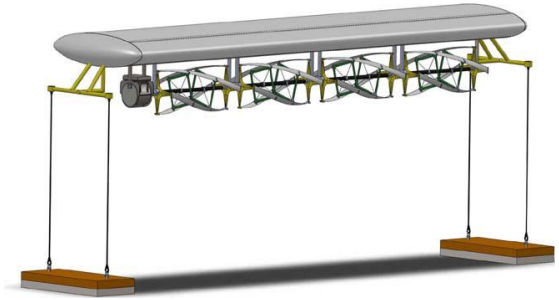

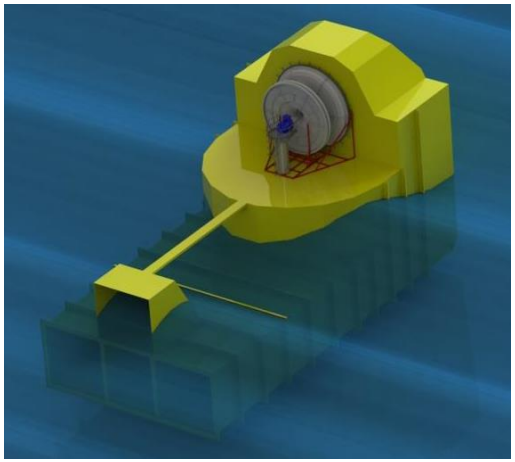

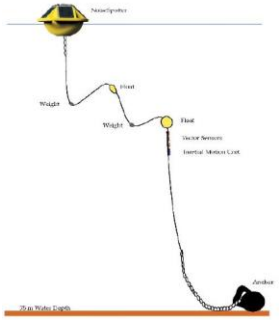

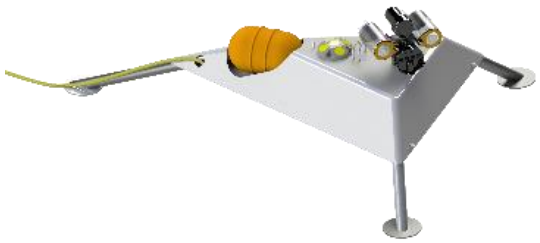

Advanced Technology Integration and Demonstration (FY16 FOA 1418 Topic Area 1 Awards Overview)

Alison LaBonte
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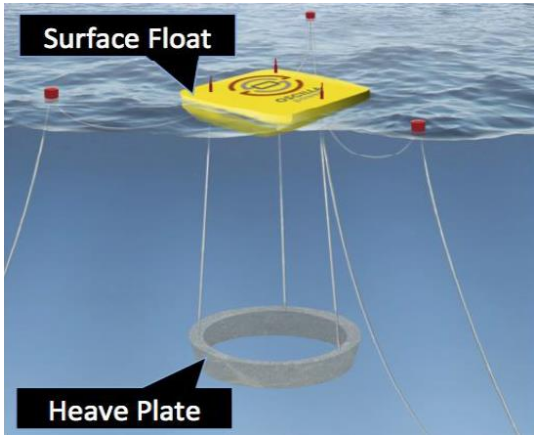
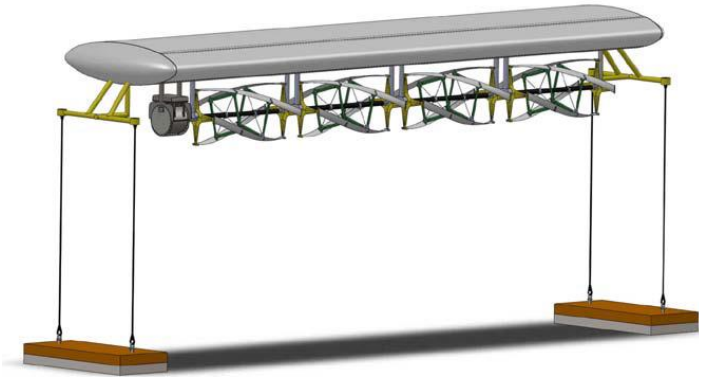
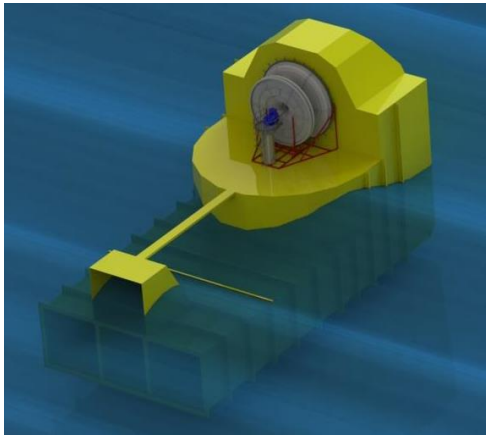
Topic Area 1 – 3 Awards—Advanced Technology Integration and Demonstration: Integration of advanced components or technologies into existing marine and hydrokinetics (MHK) system designs, with the goal of demonstrating the full potential of today's most promising MHK systems



Oscilla Power



Ocean Renewable Power Corporation



Dresser-Rand

Funding overview

FOA funding available

Maximum DOE funding (per application)	Cost share	Maximum duration
$5.35M	Budget Period (BP) 1: 20% BP 2 and 3: 50%	54 months

Award details

Awards made	Total DOE support	Total awardee cost-share	Overall total
3	$15.06 M	$13.02M	$28.08M

Program Strategic Priorities

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

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 and reducing costs
- Build awareness of MHK technologies
- Ensure MHK interests are considered in coastal and marine planning processes
- Evaluate deployment infrastructure needs and possible approaches to bridge gaps

Market Development

- Support project demonstrations to reduce risk and build investor confidence
- Assess and communicate potential MHK market opportunities, including off-grid and non-electric
- Inform incentives and policy 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

TA 1: Project Strategic Alignment

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

Technology Maturity

- Test and demonstrate prototypes
- Develop cost effective approaches for installation, grid integration, operations and maintenance

Market Development

- Support project demonstrations to reduce risk and build investor confidence

Crosscutting Approaches

- Exchange of data information and expertise

The Impact

- Demonstrate the full potential of today's most promising MHK systems, components (e.g. power take off systems), and technologies (e.g. control systems)
- Advance MHK technologies towards commercial viability and demonstrate readiness for early adaptor markets
- Quantify technology performance and costs in order to increase investor, public, and regulator confidence in the potential of the MHK industry
- Prove MHK system performance and reliability through 1-year open-water test campaigns

Award Scope Overview

Advanced Technology Integration and Demonstration

Goal: Support technology demonstration projects that help wave and current energy (i.e. tidal, ocean, and river) electricity generation systems achieve commercially competitive levelized cost of energy (LCOE) by 2030. Projects will improve LCOE and annual energy production (AEP) through the integration of advanced technologies into existing MHK systems, with the goal of demonstrating the full potential of today's most promising systems. Successful projects will:

1. Integrate an MHK hardware and/or software technology into an optimized system
2. Fabricate a full-scale system prototype
3. Install and demonstrate the system during a 1-year open water testing campaign
4. Demonstrate credible improvements in AEP and LCOE

Target Results:

- Advance MHK technologies towards commercial viability and demonstrate readiness for early adaptor markets
- Quantify technology performance and costs in order to increase investor, public, and regulator confidence in the potential of the MHK industry

Award Scope Overview (Continued)

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

Required Project Schedule and Activities::

- Duration up to 54 Months
- Three budget periods (BPs) separated by Go/No-Go decisions
- **BP 1: Design – Up to 18 months, up to $1M DOE funds, 20% cost share:** Integrate a hardware or software technology developed for wave or current energy conversion systems into a system design.
- **BP 2: Build – Up to 18 months, up to $2.75 M DOE funds, 50% cost share:** Fabricate a full-scale system prototype for use in an open water testing campaign and perform necessary pre-deployment testing.
- **BP 3: Deploy, Test, and Decommission – Up to 18 months, up to $2.75 M DOE funds, 50% cost share:** Install and comprehensively test the system performance through a 1-year open water testing campaign. Finally, decommission the system.

Three awards have been made:

- **Oscilla Power**, Seattle, WA - Demonstration of an Advanced Multi-Mode Point Absorber for Wave Energy Conversion
- **Ocean Renewable Power Corporation (ORPC)**, Portland, ME - Advanced TidGen® Power System
- **Dresser-Rand**, Wellsville, NY - Commercial Scale 1MW Power Take Off (PTO) Unit Utilized for Ocean Wave Energy Converters (WEC)

Oscilla Power

Demonstration of an Advanced Multi-Mode Point Absorber for Wave Energy Conversion

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

Device: A two-body multi-mode point absorber wave energy converter (WEC) that consists of a surface float, vertically asymmetric heave-plate, and flexible tethers

Project Summary:

- Oscilla Power will incorporate hydrodynamic, drivetrain, and controls improvements into the Triton-C 80 kW WEC device
- Device will be fabricated and tested for 1-year at the U.S. Navy's Wave Energy Test Site (WETS) 30m test berth in Hawaii

Major Innovations / Strengths:

- Unique WEC design with tethered connections between the float and heave plate allows for energy extraction in multiple degrees of freedom, resulting in a high technology performance level
- Novel design will reduce deployment costs and improve survivability

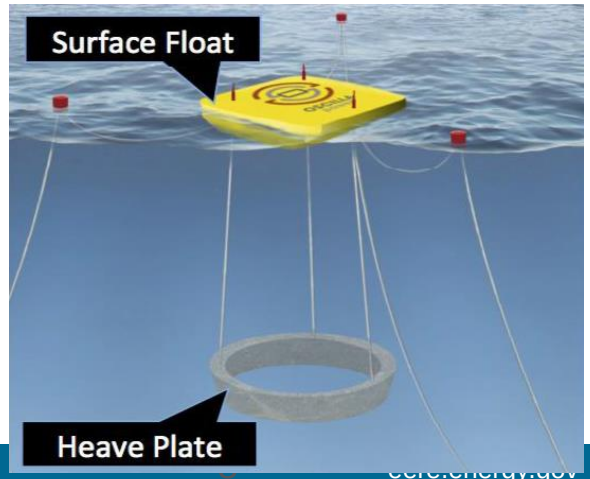
Impact

- Innovative survival strategies, power take-off (PTO) components, and hydrodynamic designs will be tested in the open ocean for the first time, thus advancing the state of the U.S. wave energy industry

Device Type	Deployment location	Power Rating
Point absorber WEC	Hawaii – Navy WETS 30 m test berth	80 kW

DOE Funding	Cost-Share	Total Project Cost
$5.35M	$4.85M	$10.20M

Glostens
Glosten, Sea Engineering, Applied Control Engineering, NREL, U Hawaii, DNV-GL, Janicki, Vigor, GE Power Conversion



ORPC

Advanced TidGen® Power System

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

Device: Cross-flow tidal current turbine deployed in a floating configuration using a tension mooring system

Project Summary:

- ORPC will incorporate hydrodynamic improvements, advanced control schemes, and a tension mooring system into the TideGen turbine
- System components will be tested during a 2-month validation test
- The complete system will be deployed and tested at the Western Passage in Maine for one year

Major Innovations / Strengths:

- Tension mooring system and floating turbine design have the potential to simplify installation procedures and reduce on-water operations costs
- Novel floating turbine design will move the turbine near the surface where flow velocities are high and will also lead to material and weight savings
- Device size (150 kW) is at a "sweet spot" to take advantage of early adopter and high cost markets

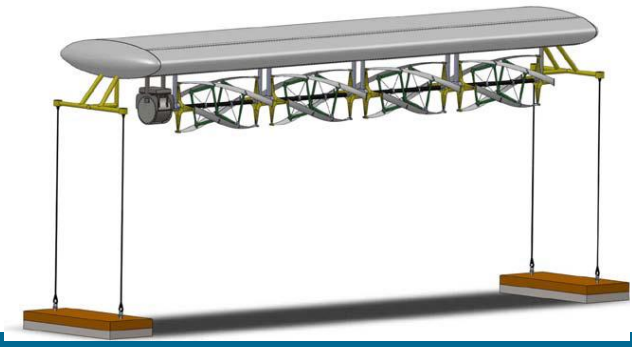
Impact:

- Demonstration of an MHK technology at a Federal Energy Regulatory Commission- permitted site, thus developing the technology and building the workforce needed to support future commercial deployments

Device Type	Deployment location	Power Rating
Floating tidal turbine	Maine – Western Passage	150 kW

DOE Funding	Cost-Share	Total Project Cost
$5.35M	$4.61M	$9.96M

Partners
Maine Marine Composites, Composites Engineering Research Laboratory, Montana State University, University of Maine School of Marine Sciences, DNV GL, BluSource Energy, Aerocraft



Dresser-Rand

Commercial Scale 1MW Power Take Off (PTO) Unit Utilized for Ocean Wave Energy Converters (WEC)

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

Device: Floating oscillating water column wave energy device that uses a high efficiency impulse turbine power take-off system

Project Summary:

- Dresser-Rand will upgrade an existing 500kW oscillating water column device to 1MW by implementing several PTO system innovations.
- The original device, which is currently being tested in Hawaii, will be towed to Oregon and modified to accept the larger PTO system.
- The device will be tested at the Pacific Marine Energy Center (PMEC) for one year.

Major Innovations / Strengths:

- The oscillating water column technology being tested is MW-scale and one of the wave energy converter technologies that is closest to commercial readiness.
- PTO system improvements will enable power production in extreme seas.

Impact:

- The air turbine technology that is being developed has the potential to benefit multiple wave energy converter technologies.

Device Type	Deployment location	Power Rating
Oscillating water column WEC	Oregon	1 MW

DOE Funding	Cost-Share	Total Project Cost
$4.36M	$3.56M	$7.92M

Partners
Ocean Energy, Northwest National Marine Renewable Energy Center, PMEC