Photos: Wedge Global Power Takeoff which this projects builds upon

System-Agnostic Switched Reluctance Linear Generator for WECs

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Project Overview

System Agnostic Switched Reluctance Linear Generator (SRLG) for wave energy converters (WECs):

The scope of work involves definition of power-take-off (PTO) requirements to ensure system-agnostic nature, expansion of MPC control system to hardware implementation, improvement of a SRLG PTO to allow for greater power capture per unit.

The Challenge: Tailor a direct-drive linear generator to be well suited with an advanced control scheme

Partners: Wedge Global – Developer of 'MTLSRM' (Multitranslator Linear Switched Reluctance Machine)SRLG

Oregon State University – Controls development

National Renewable Energy Laboratory (NREL) – Test support, risk management, levelized cost of energy (LCOE) review

Increase MHK deployment in opportune markets

Technology Maturity

- Test and demonstrate prototypes
- Develop cost effective approaches for installation, grid integration, operations and maintenance
- **Conduct R&D for innovative MHK 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

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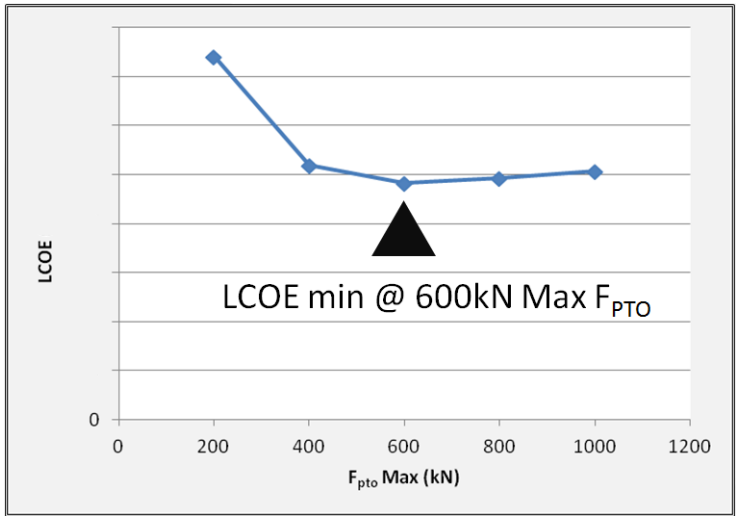
The Impact

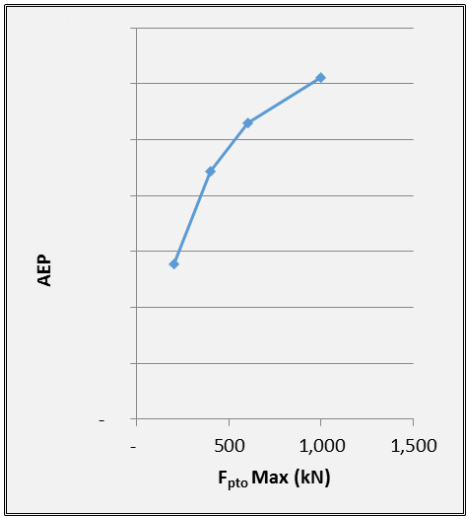
- A PTO capable of capitalizing on advanced control strategies for a wide array of WECs extracting power from linear motion
- This work will lead to a 68% improvement in component rating per unit cost
- At the conclusion of this project, the PTO will be designed, built and tested as a full-scale module

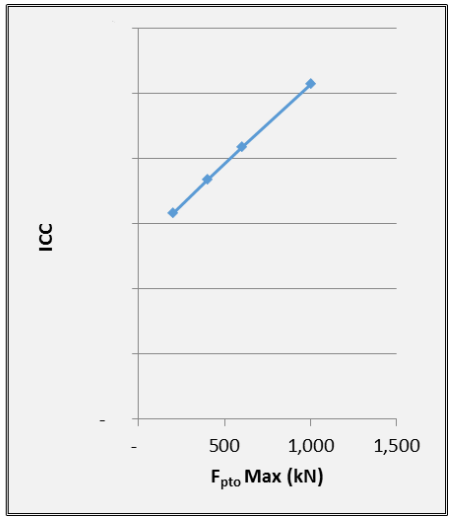
Technical Approach

The approach for this project will follow the process below:

1) Create system requirements for power takeoff by exploring the impact of force and velocity constraints within the MPC controller in numerical models
2) Design PTO system suited for the operating conditions and constraints







Technical Approach

3) Refine controller for usage with power takeoff

4) Create fabrication and testing plans for power take off

5) Fabricate PTO system

6) Test power takeoff system with controller and WEC emulator in laboratory environment

7) Conduct system impact analysis

Accomplishments and Progress

System requirements for PTO have been established following a study of the impact of various constraints on force and velocity

Initial design of the PTO is complete, with final design and fabrication planning underway

Controller development progressing as planned and yielding improvements

Project Plan & Schedule

- Project started in January 2016
- Project to be completed at the end of April 2018
- Progressing at intended rate after a delay of four months in the initial stages of project

Project Budget

Budget History					
FY2014		FY2015		FY2016	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
				$236k	$64k

- No variance from original budget
- $300k spent as of 10/01/16 (DOE and Cost-hare)
- $2,355k total project budget (DOE and Cost-share)

Research Integration & Collaboration

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

Partners, Subcontractors, and Collaborators:

Wedge Global
Oregon State University
McCleer Power
NREL
DNV GL

Communications and Technology Transfer:

No publications to date, though some likely before project end

Next Steps and Future Research

FY17/Current research:

Continuation application to be submitted in Q1 2017
Budget Period 2 to begin Q2 2017
Fabrication and testing of PTO system to take place in 2017

Proposed future research:

Current scope support testing of PTO and controller in a lab setting with PTO driven by a WEC emulator.

Next steps (outside of project scope) will include testing PTO system on WEC system at-sea