U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Potential Maritime Markets for Marine Renewable Energy: Status Update

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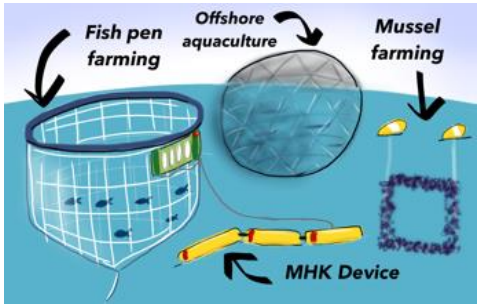
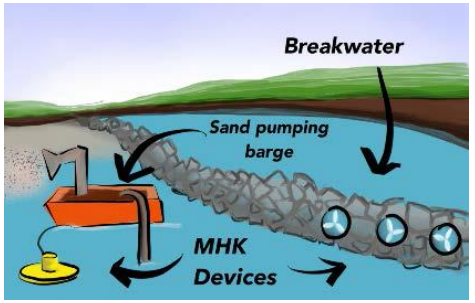
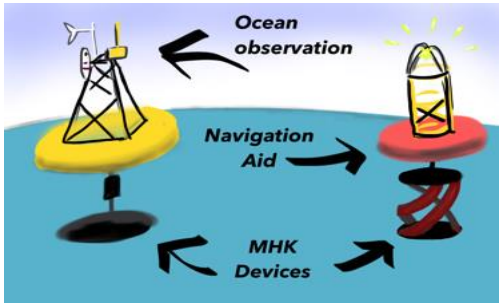
Maritime Markets – What are They?

- Markets that generally require smaller (less than full scale devices)
- Markets where electricity (or freshwater) production are highly valued, and often less price sensitive than utility electricity production
- Markets that are power limited or served by high cost, high risk fuels transported long distances







Potential Benefits of Marine Energy in Maritime Applications

Significant US Wave, Tidal, Current, and River Resource

- Capturing just 5% of the coastal resource would provide power to 6 – 8 million American homes
- Vast offshore MHK resource could generate significant energy
- Island resource potential

Geographically Relevant Local Resource

- Most of US population lives within 50 miles of the coast
- River resources distributed throughout US
- Reduced transmission line costs and losses

Forecastable and Reliable Power Source

- Waves are predictable days in advance
- Tides and currents are predicable over even longer periods of time
- Predictability invaluable for end users, especially if only source of energy

Power Density

- Wave power is concentrated wind power
- Water currents are concentrated wind/solar or gravitational power
- Higher power density allows a smaller footprint

Complement to Solar and Wind Generation Profiles

- Seasonal variations
- Time of day variations
- Potential to offset a portion of grid storage

Room For Growth Without Requiring Land

- US Exclusive Economic Zone (EEZ) is 11.3M km^2;
- US land area is 9.2M km^2

Limited Surface Expression

- Submerged energy capture possible
- Limited exposure to extreme weather
- Minimize visual impact particularly from shore
- Minimal land use

Resilient Power Source Opportunity

- Power source close to load = reduced transmission line failures
- Distributed power generation
- Black Start capability
- Electromagnetic Pulse (EMP) resistance
- Potential for quick disaster response

Uniquely Suited to Serve Maritime and Coastal Markets

- Persistent power for sensors; AUVs / UUVs; algae; aquaculture
- Desalinization of seawater into drinking water without electricity
- Enables new economic growth in maritime sector

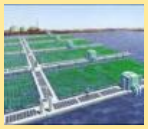
Marine Energy's Value in Maritime Applications and Markets is an Evolving DOE Focus

- **DOE is taking a look at Maritime Markets for several reasons:**
- Not as cost-sensitive as grid power markets.
- Delivers power in locations where marine energy devices can operate
- Near term revenue potential for the marine energy industry.
- Opportunities to learn from research and development at a smaller, more manageable scale.
- Develop technologies, reduce costs, develop supply chain, improve IO&M, increase stakeholder awareness and acceptance for MHK overall.

Opportunities Identified for Marine Renewable Energy in Maritime Markets include:

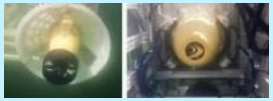
Ocean Observation and Navigation

Marine Algal Biofuels

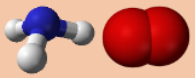


Shoreline Protection and Replenishment

Underwater Vehicle Charging



Seawater Mining



Disaster Resiliency and Recovery

Desalination

Powering Data Centers

Isolated Power Systems: Community Scale

Other Potential Applications:

1. Portable Charging
2. Marine Transportation
3. Ocean Clean-Up

Marine Aquaculture

Constructed Waterways

Isolated Power Systems: Utility Scale

Maritime Market Request for Information Objectives

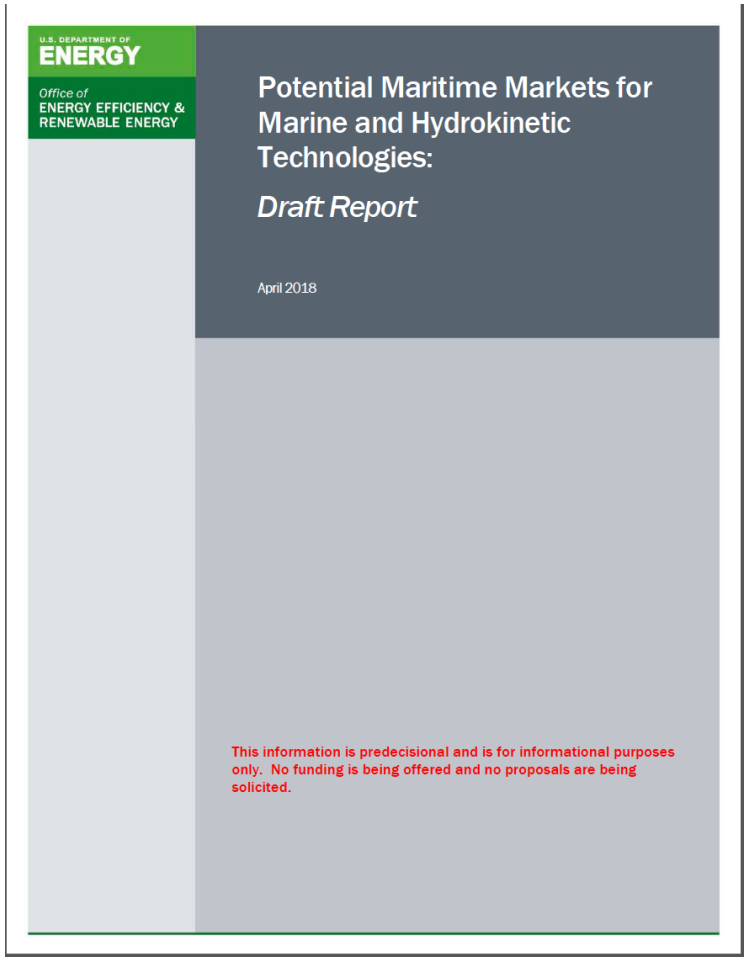
- **Hear directly from** individuals with expertise working in high-priority **potential markets** about the technical needs for or limitations regarding power, and why (or why not) different marine technologies could be useful/applicable to those markets
- **Hear directly from MHK technology developers** about their experiences evaluating, developing, or tailoring their technologies to different potential alternative markets
- Facilitate a **dialogue** between the MHK device development community and experts representing various high-priority potential alternative market areas
- **Capture specific feedback** from both MHK technology developers and experts with knowledge of relevant potential markets

The Final Report Will:

- **Incorporate all relevant feedback and refine and augment identification and analysis of opportunities and challenges for marine energy**

- **Will also look at the portfolio of potential applications and markets:**
  - Clusters of application and market requirements
  - Common R&D challenges and targets
  - Partners with overlapping objectives
  - Areas for further exploration
- **Read only those chapters that interest you most (or all of them!)**

Please Provide Comments



- **Potential Maritime Markets Opportunities for Marine Energy Draft Report open for public comment until July 31st 2018**
  - DE-FOA-0001885: RFI: Marine and Hydrokinetic Technologies: Maritime Markets Report
  - https://go.usa.gov/xQ97q

- **US Department of Energy Water Power Technology Office Website**
  - **water.energy.gov**
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