



## Environmental and Resource Assessment Overview

BOEMRE/OR Task Force—3-31-11

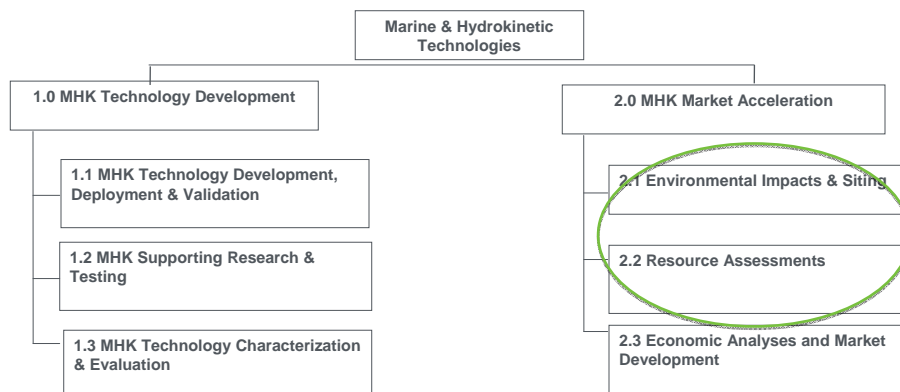
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## Water Power Program Structure

**Water Team Mission:** Develop and employ novel technologies, improved operational procedures, and rigorous analysis to:

- 1) **assess** the potential extractable energy from domestic rivers, estuaries and coastal waters; and
- 2) support industry to harness this renewable, emissions-free resource through **environmentally sustainable** and cost-effective electric generation.

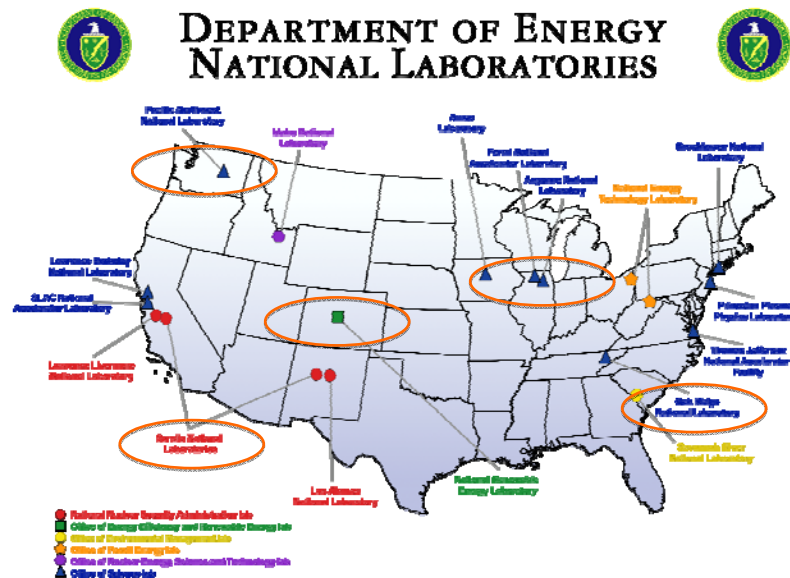


## Defining Terms: Ocean Energy & Marine and Hydrokinetic Power (MHK)

- Hydrokinetic = moving water—tides, currents, rivers, waves
- Ocean Energy also includes offshore wind, Ocean Thermal Energy Conversion (OTEC), and biofuels from algae
- Part of portfolio of renewable energy for future growth
- More consistent and predictable than wind or solar



## National Labs Working on MHK

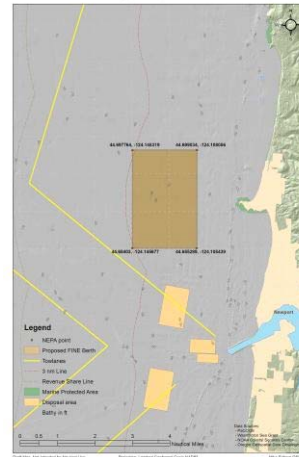


## National Marine Renewable Energy Centers

- Northwest National Marine Renewable Energy Center
  - Partnership Between Oregon State University and the University of Washington
  - OSU—Wave Energy Research, Development and Testing: Mobile ocean test berth and grid-connected ocean test berth.
  - UW—Tidal Power Research, Development, and Testing



FINE Wave Energy Buoy Test Berth Siting Map



- Hawaii National Marine Renewable Energy Center
  - University of Hawaii—Wave Energy and OTEC Research, Development and Testing
- Southeast National Marine Renewable Energy Center
  - Florida Atlantic University—Ocean Current and OTEC Research Development and Testing

## Wave Energy Technologies



Point Absorber



Surface Attenuator



Oscillating Wave Surge



Overtopping



Oscillating Water Column

## DOE Activities to Assist Siting and Permitting MHK Technologies

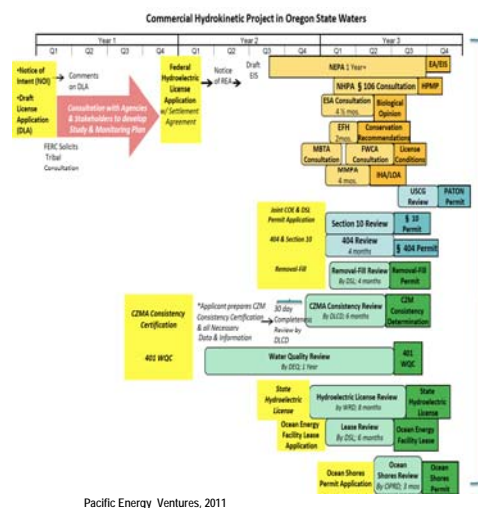
1. Knowledge Management and Environmental Risk Evaluation.

2. Research and Modeling on Potential Environmental and Systems Effects.

3. Energy Resource Assessments

4. Information and Tools to Inform Coastal and Marine Spatial Planning.

5. Regulatory Analysis, Interagency Collaboration, and Environmental Research Protocols



## Knowledge Management

*Environmental and regulatory information management is necessary to organize, search, and share research products and other information needed to inform permitting and siting.*

### DOE Approach - Data and Information Management:

#### • Knowledge Management System (known as "Tethys")

- "Smart" searchable database
- Houses MHK environmental data and information—links to other databases (MMC)
- Functionality created through interviews with users
- IEA-OES Annex 4—International Environmental Database

#### • Pacific Energy Ventures Knowledgebase

- Regulatory analysis and information on environmental permitting issues
- [www.advancedh20power.com](http://www.advancedh20power.com)



Log in (temporary):  
URL: <http://mhk-tethys.pnl.gov/>  
Login: Tethys  
Password:

## Environmental Risk Evaluation System

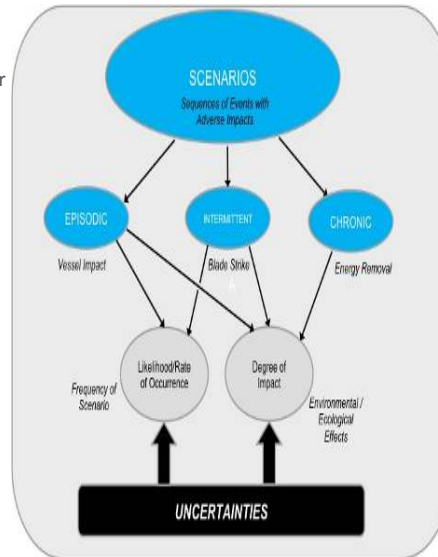
There are many perceived environmental risks, but risks have not been comprehensively analyzed or prioritized at the pilot or commercial scale—results in heavy environmental research burdens for pioneer projects.

### DOE Approach - Risk Analysis:

#### •Environmental Risk Evaluation System

- Uses attributes of technologies, receptors, water bodies in real case studies
- Determine most important environmental interactions
- Help regulators & project proponents to agree on monitoring and mitigation

**Case Studies:** Three case studies: Puget Sound Tidal, Mississippi Hydrokinetic, and **Oregon Wave** (Ocean Power Technology's Reedsport project)



## Understanding System-Wide Effects

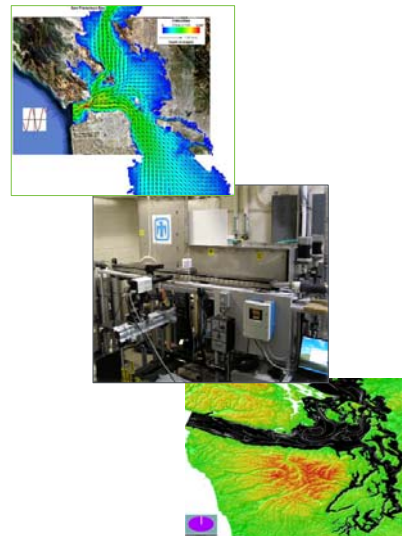
Assessing the system wide effects of devices is technically complex and expensive, but may be required in pre-deployment studies.

### DOE Approach – Lab-led Computational and Conceptual Modeling of Physical and Ecosystem Effects:

- Conceptual models to understand relationships and predict interactions
- Computational models to rapidly assess potential ecosystem effects and adapt technology or siting practices to mitigate these effects
- Understand and evaluate effects of commercial arrays

#### Research areas include:

- What happens when energy is extracted from a system?
- Near- and far-field changes in flow
- Far-field changes in water quality (tidal)
- Changes in sediment transport (wave, riverine, tidal)



## Environmental Research: Both National and Site-Specific Issues

*Collecting new baseline data to satisfy regulatory requirements can be **prohibitively expensive** for a nascent industry.*

### DOE Approach - Support for Research that Tackles both National and Site Specific Issues of Regulatory Concern.

#### •Direct assistance to industry for site specific environmental studies

- Answering key regulatory and siting questions for initial deployments.
- Projects underway, scheduled completion in FY2012
- Multiple industry partners

#### •Lab and university studies of effects on aquatic organisms

- Targeted research on questions likely to be important across the industry
- Project underway, scheduled completion in FY2012
- ORNL, PNNL, National Marine Renewable Energy Centers

#### Research areas include:

- Acoustic effects of tidal power turbines
- Direct effects of MHK devices on fish and marine mammals
- EMF
- Mitigation and deterrence
- Benthic and sediment transport issues



## Energy Resource Assessments

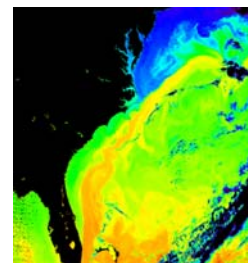
### Goals for Resource Assessments

- Determine maximum extractable energy (theoretical limit)
- Calculate technically extractable energy based on achievable energy conversion rates, current and/or future technology performance, device spacing, etc.
- Characterize seasonal variability of resources, and aggregate information useful for site-specific assessments where possible
- Studies not designed with the intent of producing information that is detailed enough for project/device siting
- Display results in GIS formatted database—MMC Incorporation

**END USERS:** DOE, Congress, State and Federal Regulators, Research Institutions, Developers

### Resource Assessment Awards:

- Wave: EPRI, end of FY 2008
- Tidal: Georgia Tech, end of FY 2008
- Ocean Current: Georgia Tech, end of FY 2009
- Instream Hydrokinetic: EPRI, end of FY 2009
- Ocean Thermal: Lockheed Martin, end of FY 2009



## Tools and Information to Inform Coastal and Marine Spatial Planning

*Coastal and marine spatial planning requires new data layers, data management, and new ways to analyze data and assess tradeoffs.*

*Bayesian Integration for Marine Spatial Planning and Renewable Energy Siting—Kevin Halsey (Parametrix)*

**Partners:** Harte (OSU), Davies (Aquaterra), Ullman (Robust Decisions, Inc.), Carter (Nature Conservancy)

**Project Highlights:**

- Data synthesis/analysis, rather than data compilation
- Uses innovative probabilistic methods to describe cumulative impacts and support multi-criteria decision making
- Needed next methodological step to inform CMSP
- Broadly applicable to other regions—builds on previous Oregon Wave Energy Trust project.



## Outreach, Collaboration, Policy and Protocols Development

*Collaboration and coordination between regulators, industry, and researchers to ensure DOE research is effective and targeted towards issues of greatest need.*

**DOE Approach—Stakeholder Outreach, Interagency Collaboration, and Collaborative Development of Protocols:**

- Tools that allow developers to understand **stakeholder views** and effectively incorporate input into the process.
- Participation in policy formulation efforts and stakeholder outreach to ensure that renewable energy is considered in **coastal and marine spatial planning efforts**.
- Coordination with agency partners** through MOUs, interagency working groups, and joint interagency funding opportunities.
- Pacific Energy Ventures Environmental Research and Monitoring **Protocols**. In partnership with BOEM and NOAA.



## Contact Information

**Thank you!**

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