

Overcoming Environmental Deployment Challenges for Ocean Renewable Energy

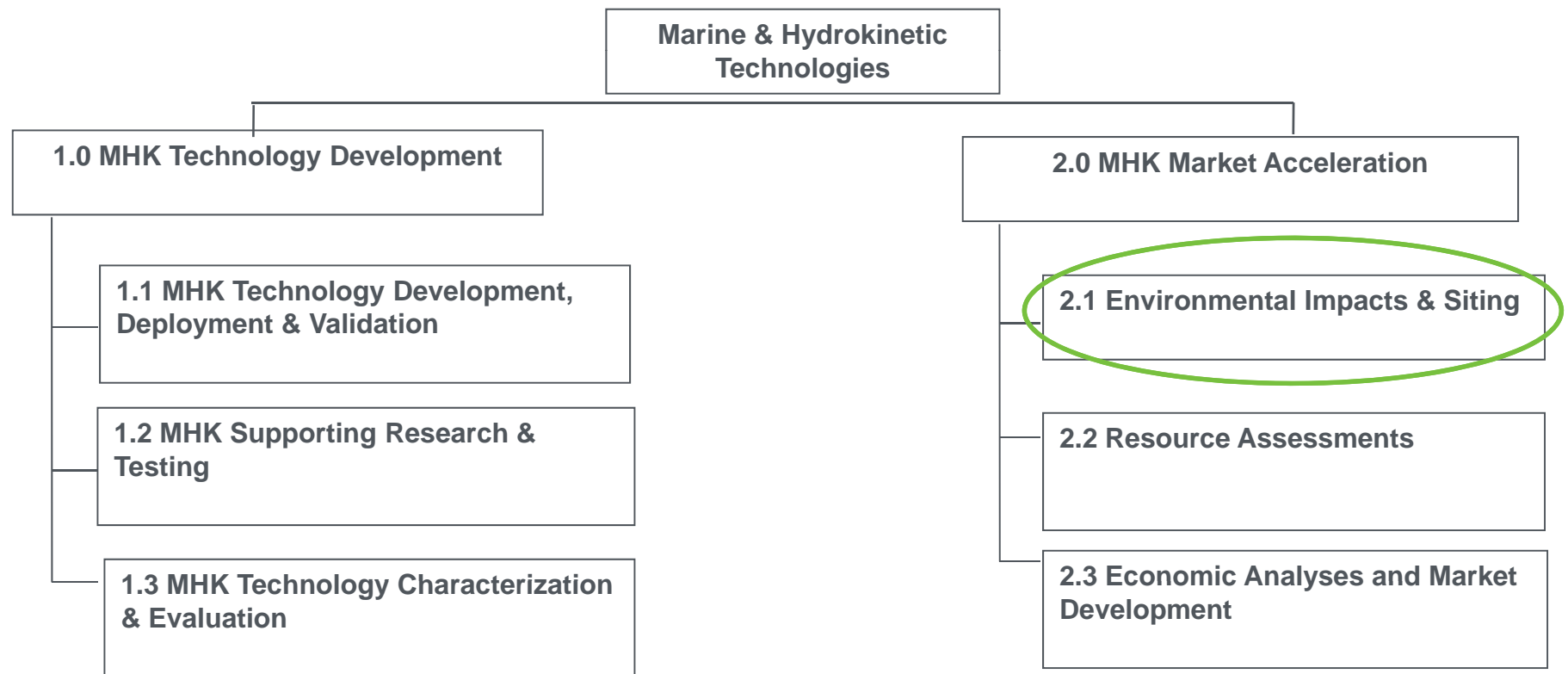
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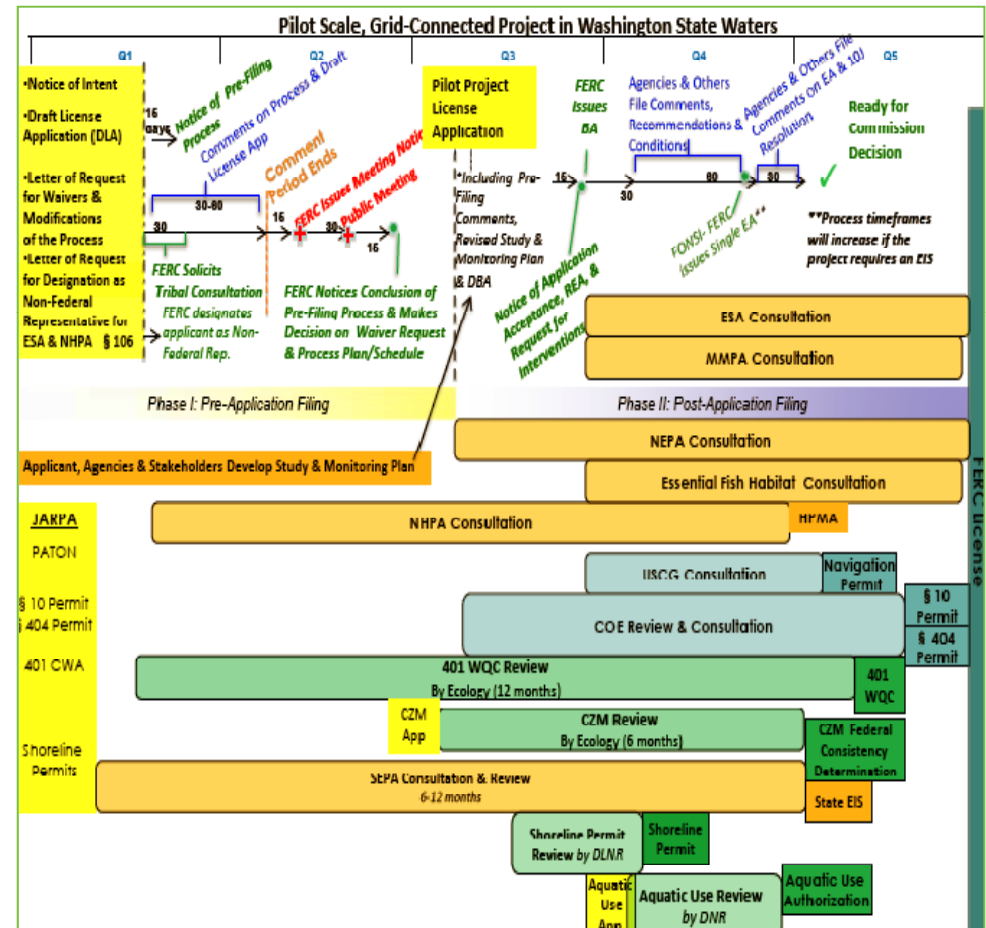
Water Team Mission: Develop and employ novel technologies, improved operational procedures, and rigorous analysis to:

- 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.



Environmental Deployment Challenges

1. Data is often scarce and expensive
2. Magnitude of potential environmental effects has not been assessed
3. Siting, permitting, and mitigation require a wealth of environmental data
4. Lack of pre-deployment and monitoring standards leads to regulatory uncertainty



Data is often scarce and expensive

*Environmental effects data necessary for pre-deployment permitting is either **lacking, proprietary, or difficult to obtain**— leads to **increased costs** and **length** of pre-deployment environmental studies*

DOE Approach - Data and Information Management:

- **Knowledge Management System (known as “Tethys”)**
 - “Smart” searchable data base
 - Houses MHK environmental data and information
 - Support risk framework
 - Project underway, scheduled completion in FY2012
- **Annex 4**
 - Will incorporate international data from nine member nations into the Knowledge Management System
 - Will gather environmental data and evaluate effects, monitoring methods, and mitigation strategies
 - Project underway, completed in FY2012



Tethys—Greek titaness and aquatic sea goddess

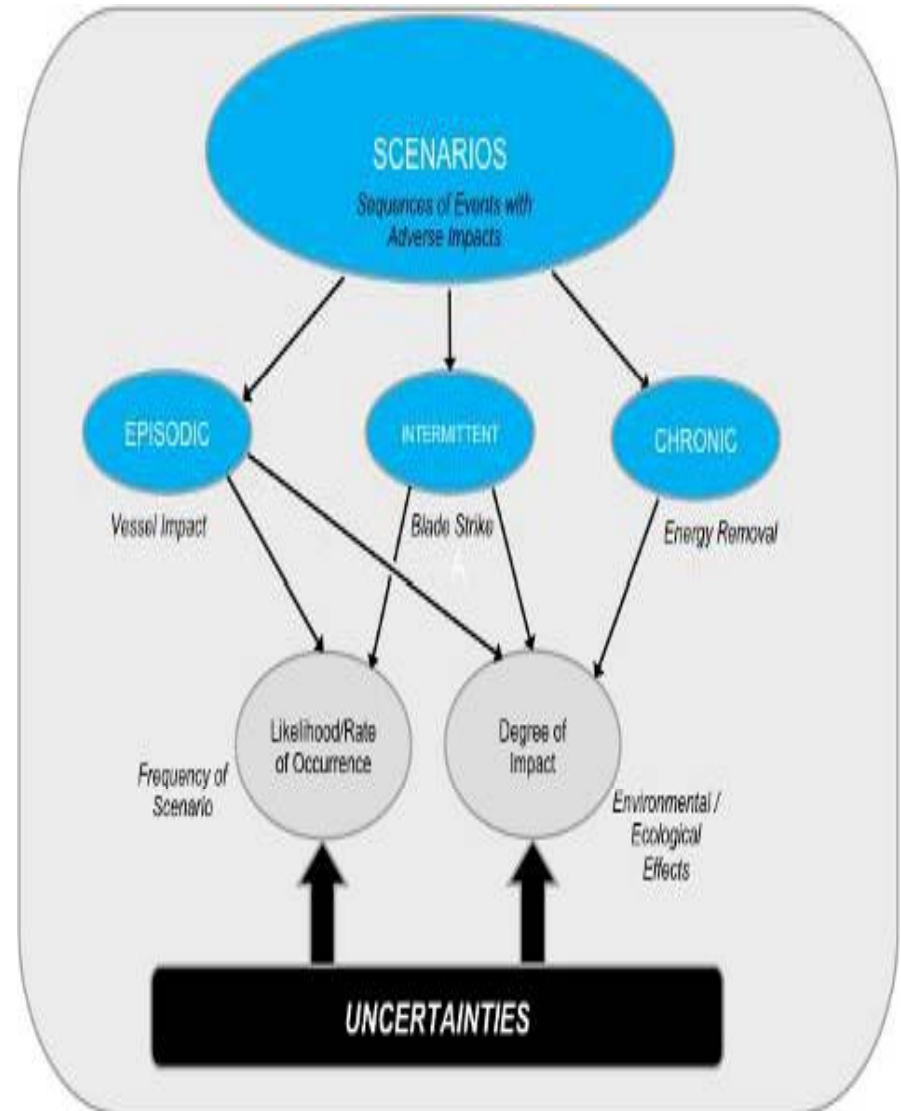
Magnitude of potential environmental effects has not been assessed

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
- Allow regulators & project proponents to agree on monitoring and mitigation



Magnitude of potential environmental effects has not been assessed

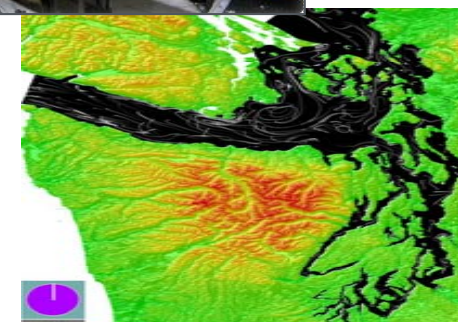
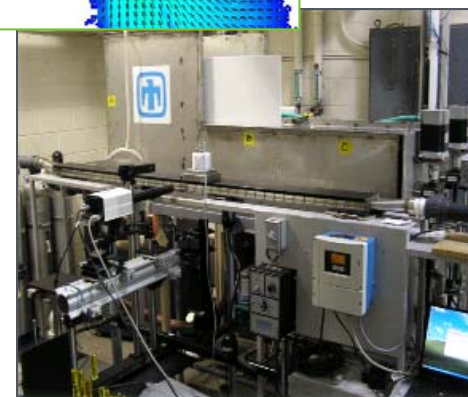
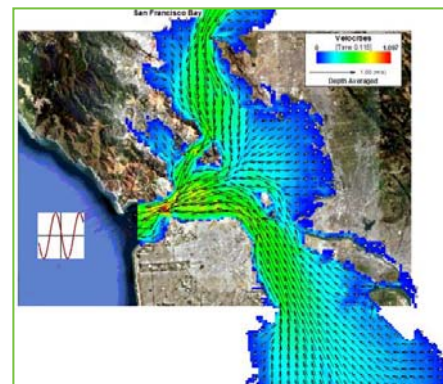
*Assessing the system wide effects of devices is **complex** and **expensive**, but may be required in pre-deployment studies*

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)



Siting, permitting, and mitigation require a wealth of environmental data

Collecting new baseline data to satisfy pre-deployment regulatory requirements is **prohibitively expensive** for a nascent industry.

DOE Approach - Support for Site Specific Research:

- **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



Lack of pre-deployment and monitoring standards leads to regulatory uncertainty

Collaboration and coordination between regulators, industry, and researchers needs to improve to ensure environmental study requirements are achievable and research is targeted and effective.

DOE Approach – Regulatory and Stakeholder Outreach and Coordination:

- 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 equities** are represented in **coastal and marine spatial planning efforts**.
- **Coordination with agency partners** through MOUs, interagency working groups, and joint interagency funding opportunities.

Marine spatial planning for offshore energy in Massachusetts



Key Challenges

High cost of energy

- High capital costs
- Reliability & maintenance challenges
- Perceived technology risks

Permitting processes and siting considerations

- Radar interference
- Environmental and siting risks
- Regulatory timelines

Technical challenges

- Domestic supply chain development
- High cost of grid connection
- Incomplete knowledge of offshore resource

DOE Activities

Technology Development

- Innovative system concepts
- Component development & testing
- Design codes, methods, and verification
- Testing facilities; manufacturing process research

Reducing Market Barriers

- Interagency coordination & collaboration
- Siting & permitting strategies
- Offshore wind resource characterization
- Transmission planning strategies
- Environmental data gathering & sharing

Advanced Technology Demonstration



- DOE will contribute unique technical knowledge and R&D capabilities to address these barriers
- DOE can't go it alone: collaboration with federal & state agencies essential



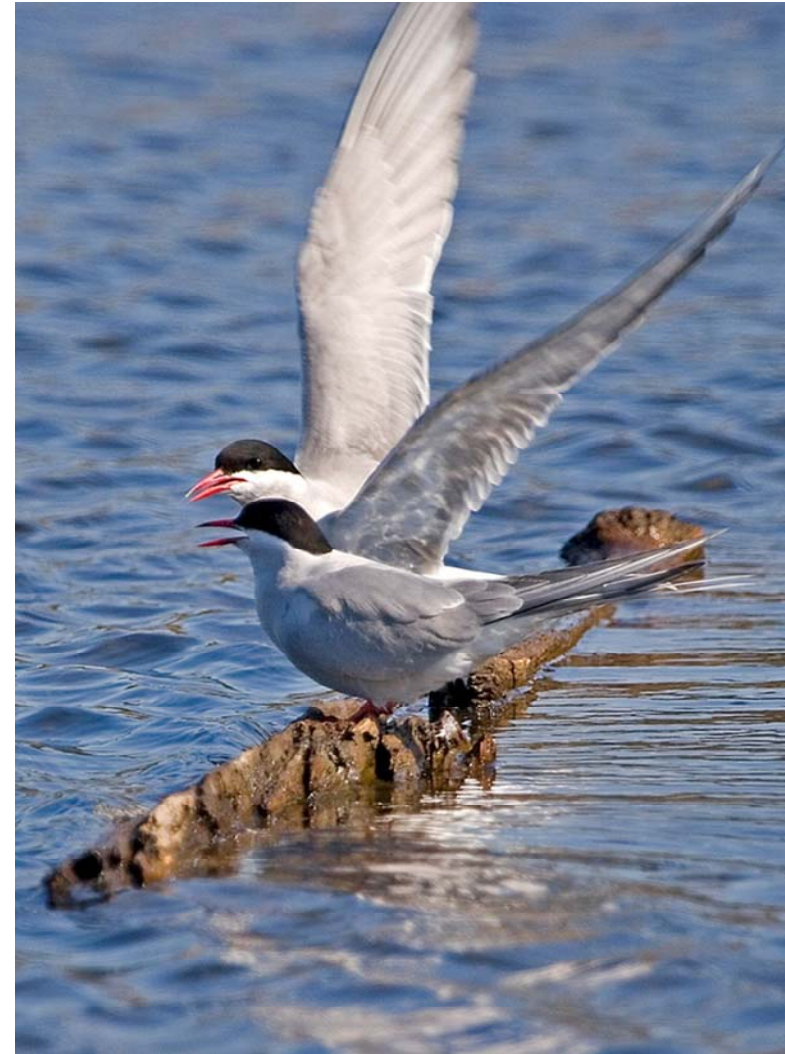
- Challenges
 - Lack of credible, objective analysis to inform stakeholders of costs & benefits of projects
- Solutions
 - Develop methods for evaluating offshore wind costs & benefits
 - Support objective analysis of policy & regulatory options
 - Improve understanding & mitigation of public acceptance risks



- Challenges
 - Untested permitting processes
 - Hundreds of environmental, competing-use factors must be considered in permitting
- Solutions
 - Build on work with regulators, states to maximize efficiency of project permitting regimes
 - Tools to build confidence and clarity: standardized protocols, adaptive management

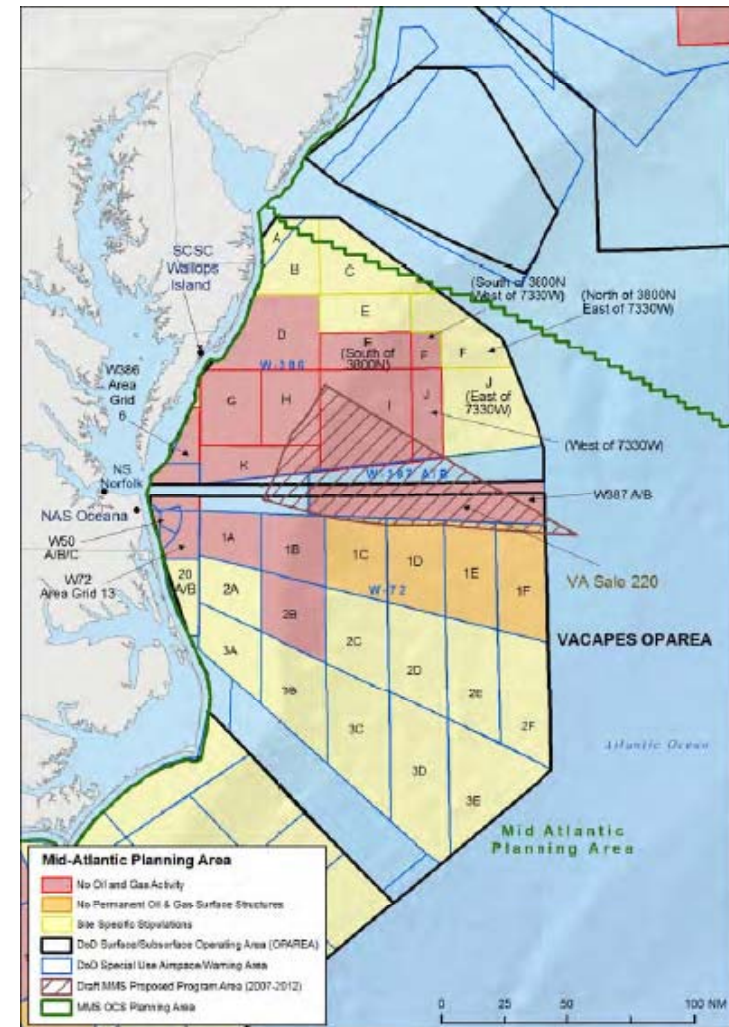


- Challenges
 - Major environmental data gaps delay project permitting
 - Burden of research on first-generation projects
- Solutions
 - Aggregate and disseminate existing information
 - Improve methods of collecting necessary enviro. data
 - Site-specific enviro. studies
 - Broad-scale enviro. studies



Siting and Permitting: National Security Concerns

- Challenges
 - Turbine-radar interference
 - Operational & training areas
 - Navigation & airspace
- Solutions
 - Develop & deploy radar system upgrades to mitigate turbine interference
 - Engage DOD to ensure that offshore wind priority areas reflect DOD training & operations equities





BOEM, DOE, & NOAA BAA

- ✓ Funds environmental monitoring and protocol development for ocean renewable energy
- ✓ **\$5 million** in research funding under eight topic areas
- ✓ Addresses **immediate and long-term environmental information needs** of both the offshore wind and marine and hydrokinetic industries.

Topics:

- Characterization & Potential Impacts of Noise Producing Construction & Operation Activities on the Outer Continental Shelf
- Protocols for Baseline Studies and Monitoring for Ocean Renewable Energy
- Evaluation of Environmental Monitoring Technologies for Offshore Renewable Energy
- Sub-Seabed Geologic Carbon Dioxide Sequestration Best Management Practices
- Renewable Energy Visual Evaluations
- Ocean Renewable Energy Siting in the Context of Coastal and Marine Spatial Planning.

- **BOEM & DOE recently signed an MOU for the coordinated deployment of MHK and offshore wind on the OCS.**
 - Environmental research and permitting
 - Resource characterization
 - Technical standards
 - Stakeholder outreach
 - Deployment goals
- **DOE to be active in the new National Ocean Council and in the CMSP process.**
- **DOE leads the Federal Renewable Ocean Energy Working Group**
 - Increase Federal communication
 - Facilitate partnerships

MHK & Offshore Wind Environmental Barriers to Deployment

- Ultimately MHK & offshore wind face many similar barriers to deployment
- Barriers will need to be addressed through interagency and stakeholder collaboration, in addition to targeted DOE efforts
- In the face of climate change it is imperative that we move quickly and collaboratively to address these barriers