

Cost Considerations for Offshore Energy Development

Hope Herron, Tetra Tech
Energy Ocean 2008



Tetra Tech

- 8500 employees and 350 offices nationwide
- Full service marine energy contractor
 - Environmental
 - Engineering
 - Construction
 - O&M
- Our current projects range from:
 - Site ID and critical issues analysis, Bluewater Wind
 - Electrical generation and distribution system assessments for wave power, Ocean Power Technology
 - Over 3,000 NEPA related studies



Presentation Goal

- Provide an overview of the steps associated with developing an ocean power project
- Identify aspects of development that can affect overall costs of construction



Premier Cost Factor

Site Selection:

- Resource factors (wind, wave, etc)
- Transmission and Interconnection Factors
- Leasing and acquisition factors
- Environmental constraints
- Engineering, transportation, and constructability constraints
- Public and governmental acceptability



Regulatory Impacts to Costs

■ OCS Waters

- Offshore Wind
 - MMS, Lead agency (USACE, FAA, USFWS, NOAA, EPA, and State CZMA Agency)
- Wave, Current, Tidal
 - Unclear. MOU currently being negotiated b/t FERC and MMS. FERC asserted jurisdiction over wave energy projects up to 12 miles out in Aqua Energy, 102 FERC (USACE, FAA, USFWS, NOAA, EPA, and State CZMA Agency)

■ State Waters

- Offshore Wind
 - Unclear. Either, the USACE, Rivers and Harbors Act and/or state siting agency
- Wave, Current, Tidal
 - FERC, Lead agency



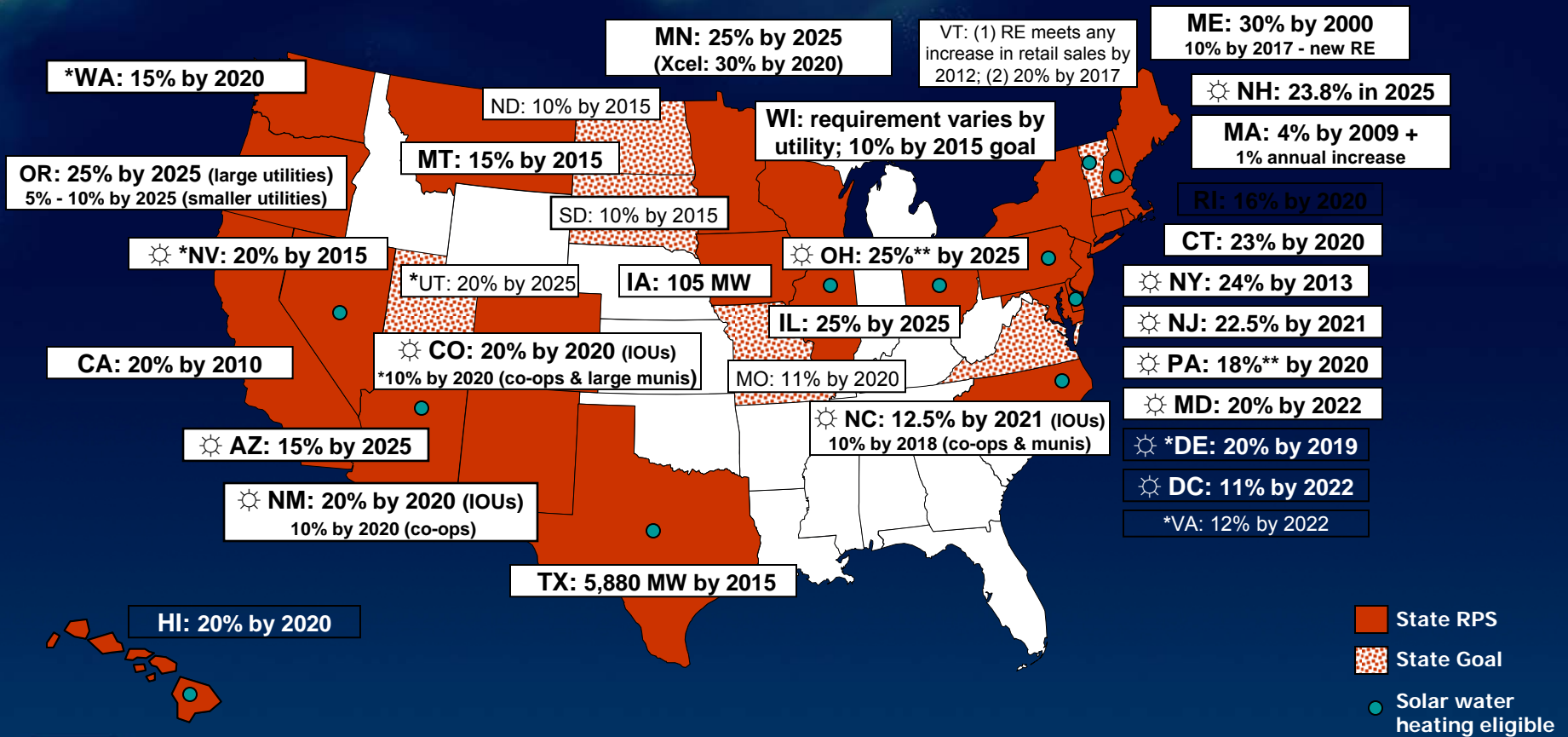
Governmental Cost Incentives

- R&D: Energy Independence and Security Act of 2007
- State Level
 - Renewable Portfolio Standards
- Federal Level (Wind)
 - Production Tax Credit
 - Renewable Energy Production Incentive
 - Clean Renewable Energy Bonds

Note: Renewal (PTC and CREBs) and Availability (REPI) issues



Renewable Portfolio Standards



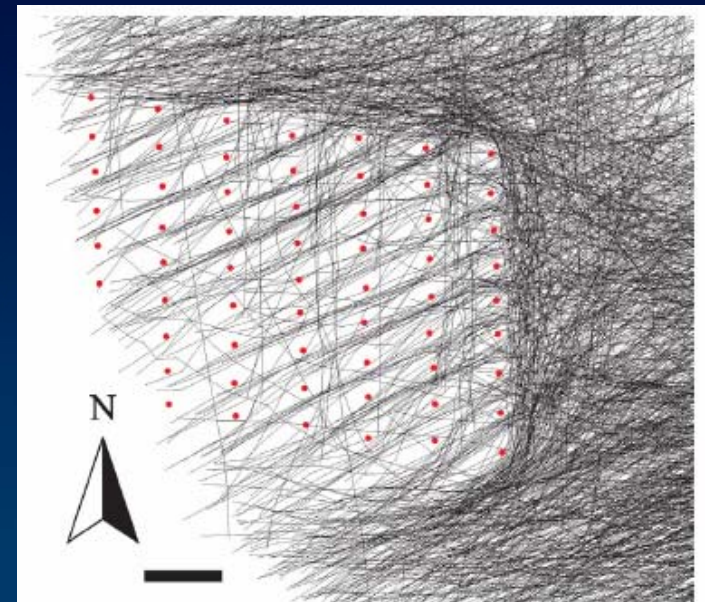
Unique State Issues

	Main Strengths	Main Weaknesses
Texas	Direct and Stable Govt involvement RTF portfolio	Neotropical and Bat Flyway
New Jersey	Upfront Environmental Study Incentives for Commercial Scale Project	Potential for NIMBY Issues



Testing Costs

- Offshore Wind:
 - Meteorology: Met Tower, Wind Measurement Equipment and Installation; Data Collection and Interpretation; Meteorological Consultation and Advice
 - Avian Data Collection; Data Collection and Interpretation



Avian collision risk at an offshore wind farm, Mark Desholm* and Johnny Kahlert, Department of Wildlife Ecology and Biodiversity, National Environmental Research Institute, Grenåvej 12, 8410 Rønde, Denmark

Transmission Costs

- Development Electrical Engineering
 - Feasibility Study
 - Conceptual collection system and high voltage interconnection design
 - Interturbine cabling and submarine cabling
 - System Reliability Interconnection Study
- Utility Interconnection
 - Fees and filings associated with interconnection
 - Cost allocation for system upgrades
- Transmission legal
 - Outside counsel for interconnection agreements, filings, FERC



Lease Costs

- Signing payments
- Met tower payments
- Option payments
- Legal
- Insurance
- Ports and Harbors



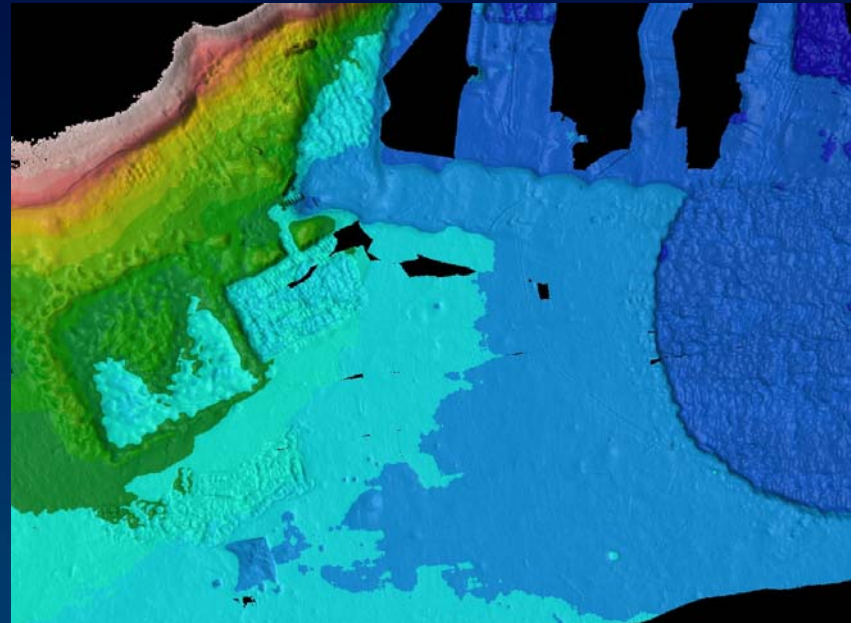
Public and Governmental Relations Costs

- Local Office
 - Media Point
 - Staff and equipment
- Community Public Relations
 - Mailings, Ads, Community events and fairs, Charitable sponsorships
- Governmental Relations
 - Lobbyists, Public Meeting Support



Civil Engineering Costs

- Conceptual Layout
 - Constraint Mapping
 - Initial geotech
 - Transportation study
 - Initial siting



Civil Engineering Costs

- Permitting Layout Development
 - Initial horizontal alignment
- Engineering-heavy permits
 - DOT permits for road improvements
 - NPDES NOI for construction with SWPPP and SPCCP
 - NPDES NOI for operation with SWPPP and SPCCP
 - Coastal Construction Permit



Environmental Permitting Costs

- Environmental Construction Compliance Plan
- Permitting fees
 - Actual permit fees
 - Agency collection agreements
- Permitting Legal
 - Outside counsel



Environmental Permitting Costs

- Environmental Studies and Permitting Costs:
 - Consultants
 - Permit applications and regulatory representation
 - Avian and bat studies, reports, consultations
 - Coastal Zone Management Act consultations and permits
 - Fisheries, benthic organisms, marine mammal studies, reports, consultations, mitigation
 - Archeological and historical resource studies and consultations, mitigation
 - Communications interference studies (including homeland security)
 - Aviation interference studies
 - Visual and noise impact analysis
 - Marine and tidal studies
 - Navigation studies and Coast Guard consultations
 - Socioeconomic studies as required
 - Section 401 water quality certificate
 - EAs, DEISs, FEISs and/or equivalent reports and processes



Preconstruction Costs

- Negotiations with equipment/service providers
- Finalize Long-Lead-Time Item Procurement (Turbine)
- Final Construction Plans and Drawings
- Develop Environmental Construction Compliance Plan
- Secure Construction Owner-Representative Team
- Secure Construction Contractors
- Develop Mobilization Plan



Preconstruction Costs *(Wind Platforms)*

- Buoyancy Tank Cost
- Mooring Line System Cost
- Anchors Cost
- Load Out Cost
- On-Site Installation Requirements
- Decommissioning and Maintainability
- Corrosion Resistant Requirements
- System Weight Sensitivity
- Induced Tower Top Motions



Unproved Technological Costs

(Wave Energy)

- Reliability and maintainability of mechanical and electrical devices in or near the ocean;
- Irregularity of ocean energy device interaction with respect to synchronous power generation;
- Relative high cost per kW associated with installation and maintenance in a high energy environment;
- Difficulty in accessing and performing routine maintenance in a high energy environment;
- Mooring and power cable components require specialized design, fabrication, and installation.



Take Away Points

- Appropriate planning can vastly improve long term economics
- Adaptive management strategy
- Early engineering and constructability review can save tens of millions of construction dollars



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