

Critical Issues Analysis for Siting and Interconnecting Offshore Wind Parks



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EnergyOcean 2008
June 25, 2008



TETRA TECH EC, INC.
Wind Energy Services



Goals of the Presentation

- **Tetra Tech Introduction**
- **Overview of the offshore wind generation market**
- **Overview of the offshore wind generating facility development process**
- **Offshore Critical Issues Analysis Process**
- **Inter–relation of environmental, engineering and constructability data on each phase of wind farm development**
- **Importance of designing and permitting *constructable* and *economic* wind projects**





Tetra Tech, Inc.

- Tetra Tech, Inc. is a leading, U.S.-based national and international firm delivering solutions in, consulting, construction, engineering, remediation and restoration
- Publicly traded company (TTEK)
 - Chosen by *Smart Money* magazine as one of the “10 Stocks for the Next 10 Years”
- Annual revenues in excess of \$1.4 billion; financial strength to stand behind large wind energy projects, including EPC & BOP
- Over 8,500 employees in 300 offices world-wide
- Consistently ranked in *Engineering News Record* as one of the top ten environmental consulting companies
- Supporting development of >180 wind farms in U.S.



Full-Service Energy Solutions



Development

- Energy Management Services
- Preliminary Siting
- GIS Applications & Data Management
- Constraint Mapping
- Critical Issues Analysis
- Land Acquisition Services
- Conceptual and Design Engineering – Civil and Structural
- Geologic Hazard Assessment
- Transportation Studies & Permitting
- Environmental Review & Permitting
- Biology Assessments
- Cultural Resources Assessments
- Noise Assessment
- Visual Impact Assessment
- Public Involvement



Pre-Construction

- Constructability Review
- Geotechnical Studies and Design
- Land and Property Survey
- Conceptual and Final Budgets & Schedules
- Construction Plans
- Value Engineering
- Safety Planning & Training
- Procurement



Construction

- Engineer-Procure-Construct (EPC) Services
- Balance of Plant (BOP) Services
- Project Management
- Construction Management
- Engineering Submittal Reviews
- Design Modifications
- Construction Engineering Support Services
- Field Services
- Environmental Compliance Management & Inspection
- As-Built Drawings



Operations

- Maintenance Support
- Monitoring & Compliance Testing
- Post-Construction Environmental Services
- Supplemental Engineering
- Retrofit and Upgrade



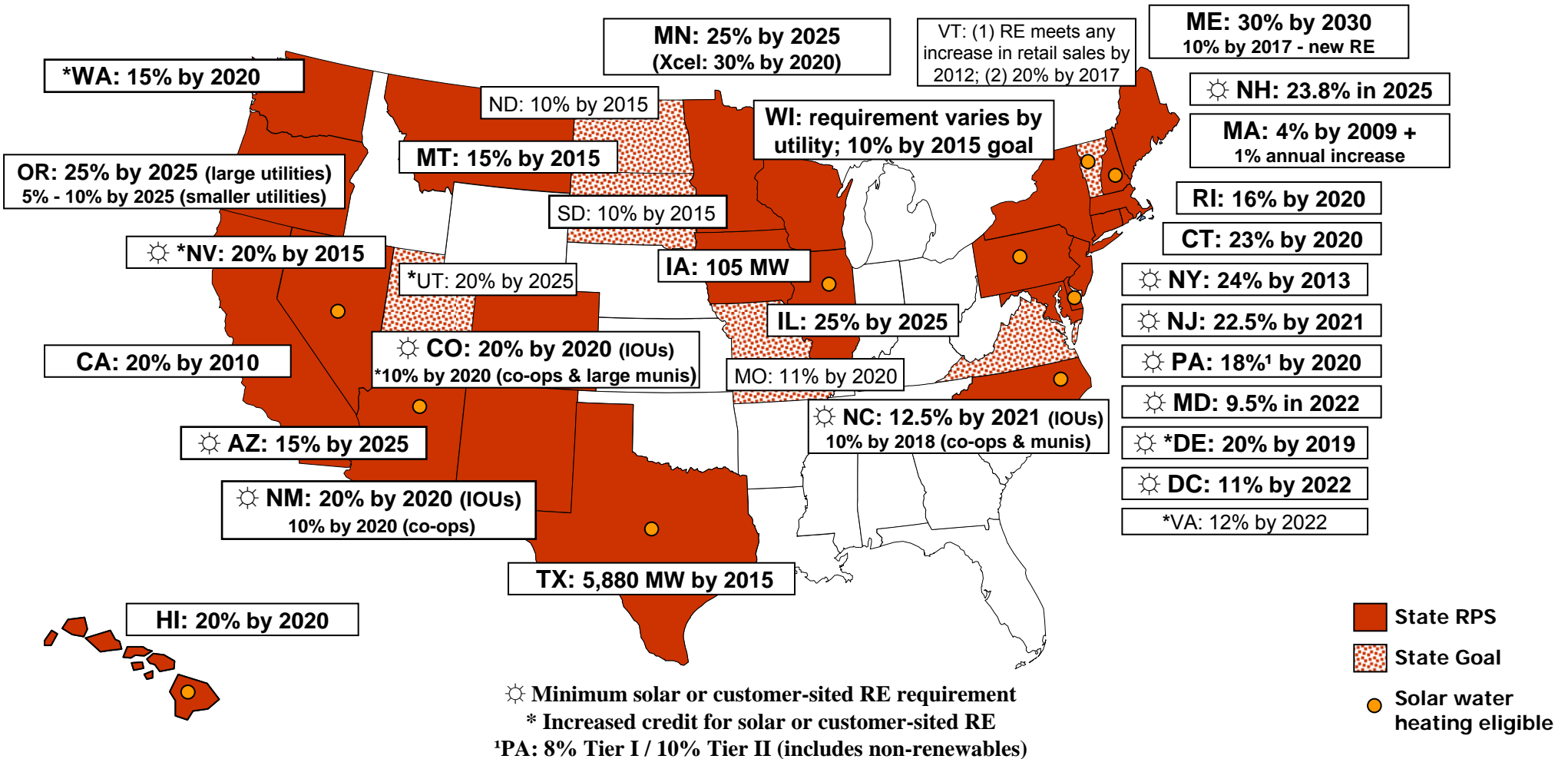


Current Offshore Wind Energy Market

- 100s of Wind Turbines operating off coast of Denmark, Germany, Netherlands, Sweden; since early 1990's
- FPLE wins LIPA RFP 2003 (Bluewater Wind runner up)
- Bluewater Wind (supported by Tetra Tech) wins Delaware RFP in 2007; negotiating PPA.
 - Bluewater submits MMS Nomination for Met Tower Lease
 - Bluewater submits application to MMS to construct Met Tower
- New Jersey RFP Response by Bluewater Wind (Tetra Tech).
- Rhode Island RFP Response by Bluewater Wind (Tetra Tech).
- MMS received Met Tower Nominations for X Sites.

Major Drivers

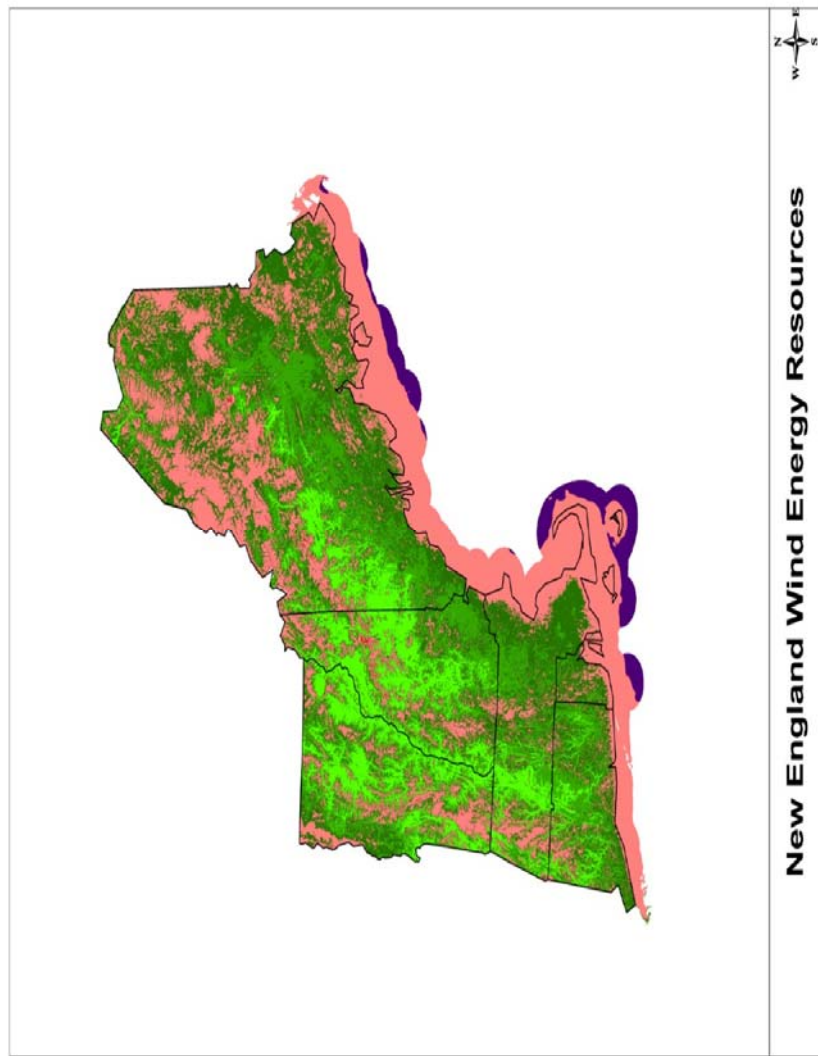
Renewables Portfolio Standards



<http://www.dsireusa.org/> March 2008



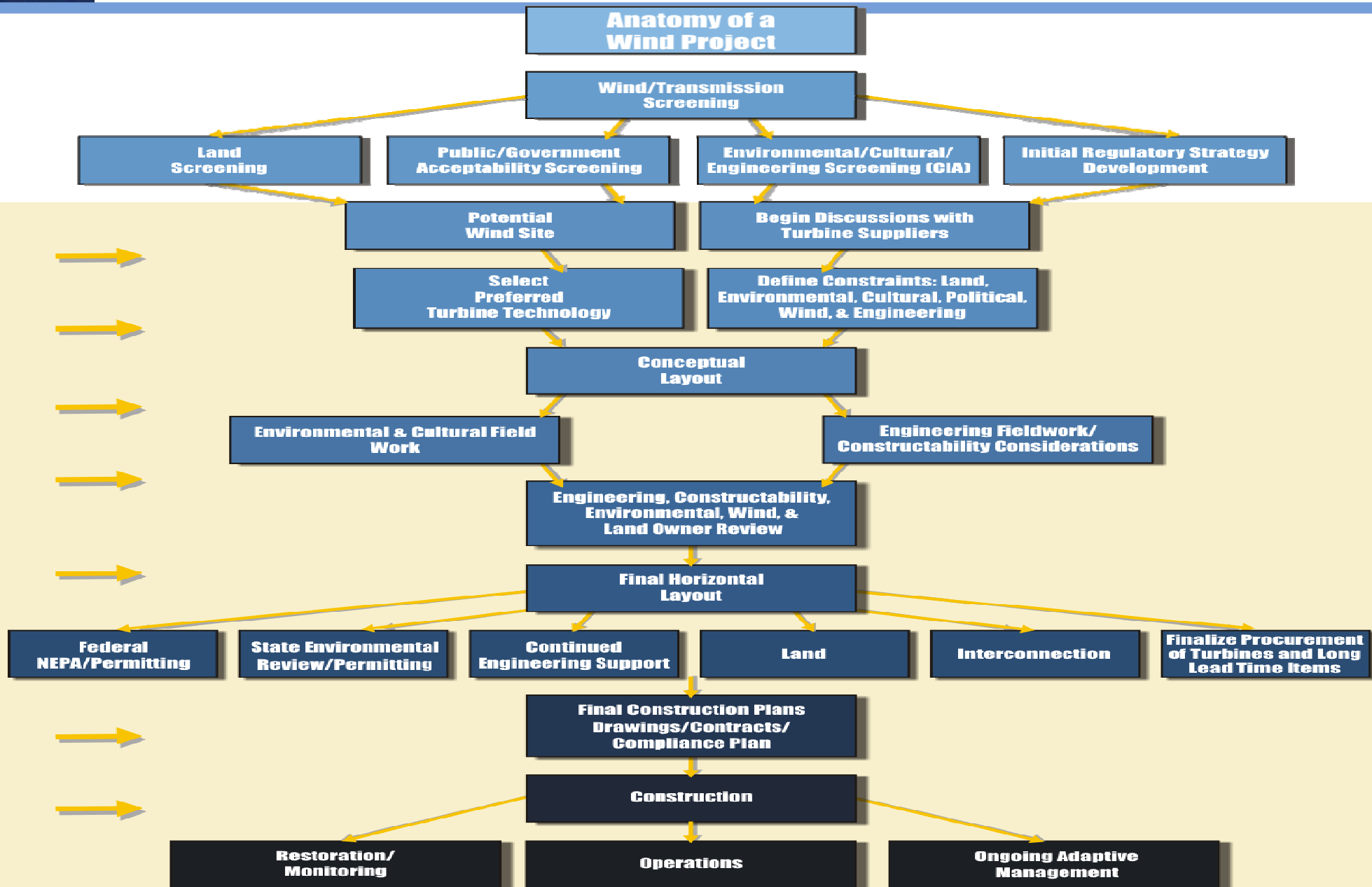
New England Wind Resource Map





Overview of the Development Process

Public & Governmental Outreach and Involvement





Site Selection/Screening

- **Two most basic questions:**
 - Is the site less than 100 feet deep and windy?
 - Is the site near adequate “take away” transmission?
- **If you pass the basic questions then:**
 - Investigate public and local government acceptability
 - Investigate environmental and engineering considerations
 - Critical Issues Analysis





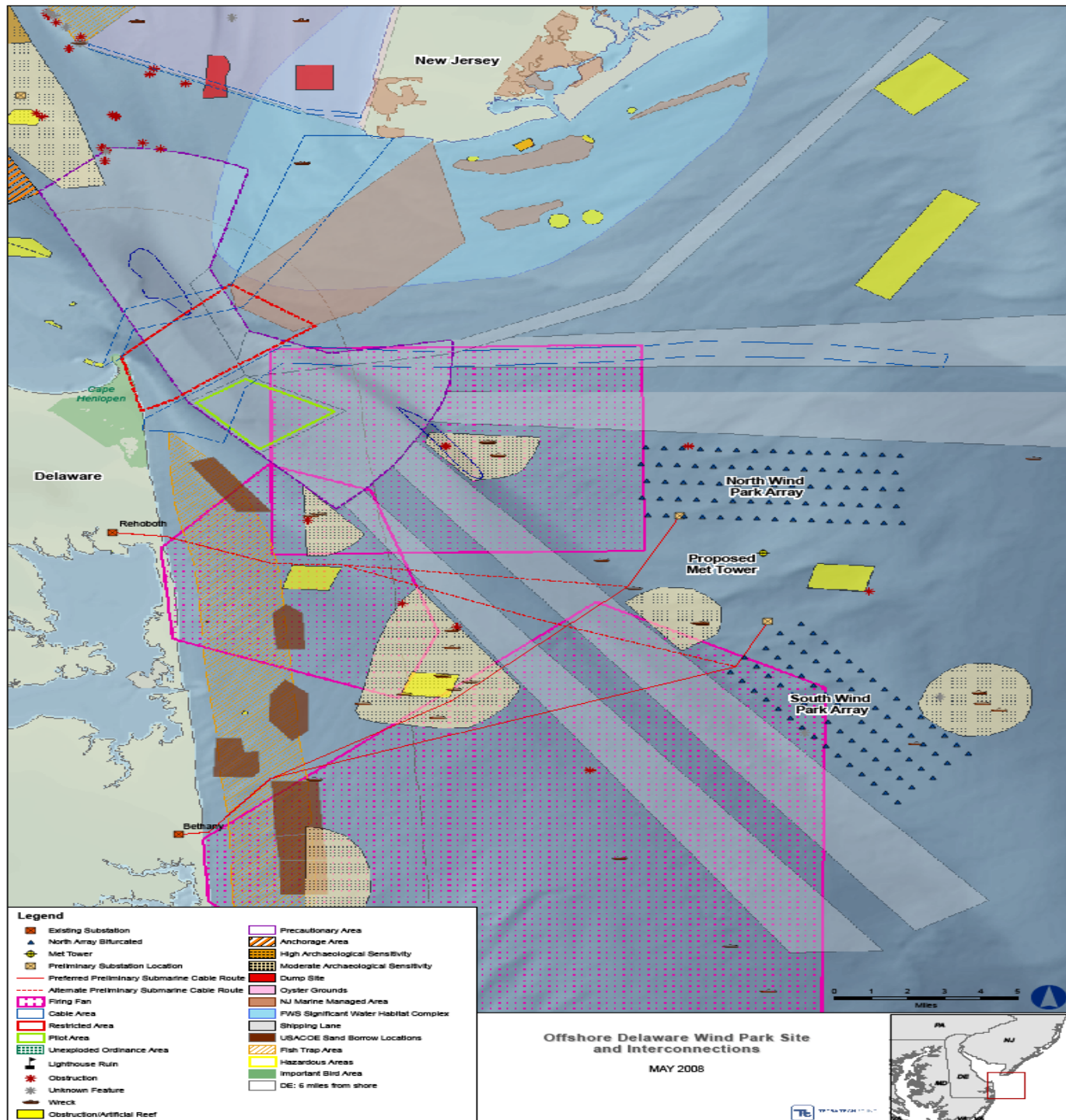
Critical Issues Analysis

- **Critical Issues Analysis is a study that:**
 - Identifies likely siting issues at a proposed site
 - Projects impacts on schedule/budget
 - Provides management strategies to reduce impacts on schedule/budget

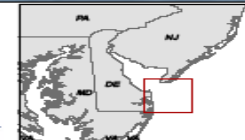
- **Components include:**
 - Phase I - Desktop studies
 - Available a la carte (Biological, Cultural, Aesthetics, Geotechnical, Telecommunications, Aviation, Land Use and Permitting, etc.)
 - Phase II – Reconnaissance-level Field Studies
 - Critical Issues Analysis Report
 - Documents key issues that warrant special consideration
 - Provides: permit matrix, recommendations, and schedule



Constraints Map



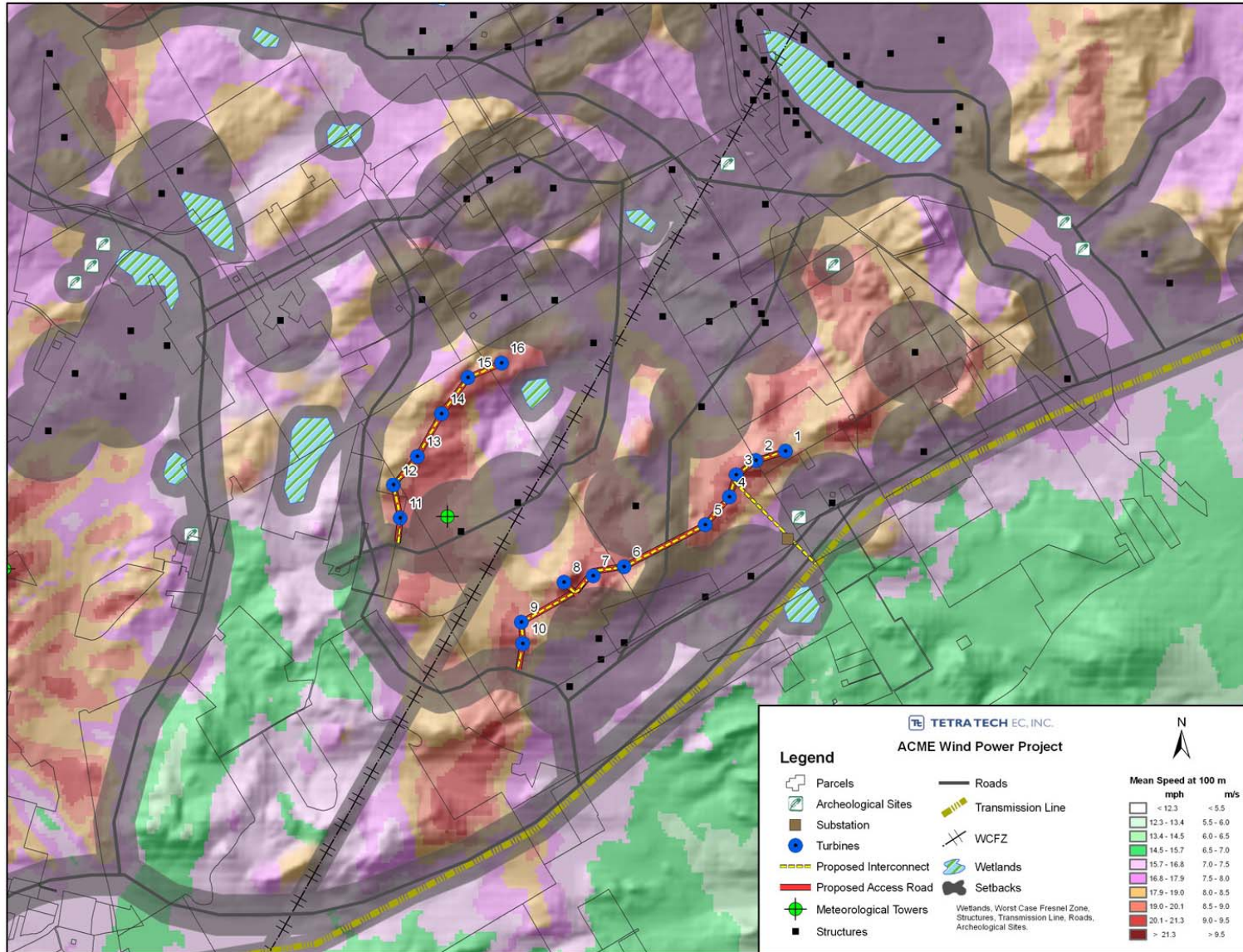
Offshore Delaware Wind Park Site and Interconnections
MAY 2008



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Constraints Map





Typical Offshore Constraints

- Sensitive environmental areas
 - Ocean Sanctuaries
 - Critical Habitat for Endangered or Threatened Species
 - Breeding areas for Whales or other rare species
- Shipwrecks and other sensitive cultural resources;
- navigation areas; cultural resource sites (mostly shipwrecks); dump sites; unexploded ordnance; cable crossings; commercial and recreational fishing areas and environmental resources such as oyster beds, marine mammals, and significant marine habitats.
- Areas of known geotechnical instability;
- Fresnel zones and other communication/radar related constraints;
- Areas impacted by air traffic (both civilian and military); and
- Any other environmental and land use constraints identified for the site.
- Wetlands, surface waters, and any regulatory buffers around them;





Moving from the Conceptual Layout to the Final Layout

- Wind projects have a lot of moving parts: wind resource, property rights, landowner preferences, setbacks, environmental constraints, cultural resources, engineering constraints, transportation issues, constructability and other factors influence where project facilities will ultimately be sited
- Study results must be communicated and their impact on layout must be understood and incorporated
- The best team includes a meteorologist, an environmental scientist, an engineer, and a constructability expert
- Data management with multiple team members can be a challenge



The Timing of Studies

- **This is the hardest part of advising a wind client**
 - We need to provide enough preliminary study for siting, but it is easy to waste the clients money by providing detailed study on facilities that are not in their final location
 - If possible, we should not perform full wetland and cultural delineations on the exact locations of project facilities until they are in more or less their final location
 - Also consider timing when running visual simulation, writing up noise study, etc.
 - Because siting is an iterative process, there will always be some inefficiency in study



Transportation Study

- Perform traffic and transportation study, for oversized or heavy deliveries, to assess adequacy of existing offsite roadways, bridges, crossings over culverts, overpasses/underpasses, turning radii, utilities, etc.
- Within project boundary, determine whether turning radii at existing intersections along the delivery route need to be modified
- Assess whether surface replacements or upgrades will be required



Wildlife Studies

- Typically include:
 - Side Scan Sonar for topographic features
 - Sub-bottom profiling
 - Geotechnical survey for turbine foundations
 - Magnetometric studies for shipwrecks, cultural artifacts
 - Avian use surveys
 - Bat habitat inventory and/or risk analysis
 - Raptor shoreline nesting surveys (Condor)
 - State Natural Heritage database/USFWS T&E species inquiries
 - Critical Habitat inventory
 - Threatened, endangered, sensitive species focused surveys if appropriate

- Studies will vary geographically and by state





Wetland Studies

- It often makes sense to start with reconnaissance level study, saving complete delineation until the layout is final
- All project facilities must be cleared for wetlands
 - Public road improvements, especially public road culvert replacements, are easily forgotten
 - Transportation plan, including the location of widenings, intersection improvements, bridge replacements, and culvert upgrades should be completed prior to delineations
- Good communication between wetland staff and design engineers is critical
- Data management is critical
- Keep a change log





Cultural Resource Studies

- **Consult with State Historic Preservation Office (SHPO)**
- **Define the Study Area for Archeology and for Historic Architecture**
- **Magnetometric Survey**
- **Sub-bottom Profiling**
- **Define the Area of Potential Effects (in consultation with SHPO) as Project is more precisely defined**
 - Archeology
 - Historical Architecture





Transmission Interconnection Studies

- **Feasibility Study** – estimates cost of interconnection
- **System Reliability Impact Study** – determines cost and equipment for maintaining reliability of existing system
- **Complete Facility Upgrade Study** determines final cost of all interconnection and system upgrade equipment
- **Negotiate Interconnection Agreement** with transmission utility





Permitting – Meteorological Towers

- **U.S. N.O.A.A. Minerals Management Service**
 - Nominate Site for Lease to MMS
 - Application for Site Lease & Construction to MMS
- **Section 404/10 Application to U.S. Army Corps of Engineers**
 - Nationwide Permit #5 for Scientific Measurement Devices
- **Coastal Zone Management Act Certification to Delaware Coastal Management Program**





Permitting Phase – Local

■ Local

- Many state (and federal) agencies are uncomfortable with or prohibited from issuing their own approvals for a wind farm before controversies with local officials are resolved.
- Similar to the state regulatory process, the need for local approvals and the process for obtaining approvals vary throughout the country.
- In some areas, the local approval process will be time-consuming and the project will be subject to close scrutiny. In contrast, some municipalities require only a building permit.
- The development team should assess which local approvals will be required and consult with local counsel.





Permitting Phase – State

■ State

- Numerous state regulatory programs are likely to be triggered by a proposed wind energy project. While such programs often mirror, implement (through delegated authority), or complement similar federal laws, the state version is typically more stringent than its federal counterpart.
 - Endangered Species
 - Wetland Permits
 - Stream Crossing Permits
 - Use Authorizations for State Owned Aquatic Land
 - Historic Preservation
 - Stormwater
 - Agricultural Protection
 - DOT (Roadway) Permitting





Permitting Phase – Federal

- **National Environmental Policy Act**
- **Federal Wetland and Waterbody Laws**
- **National Pollutant Discharge Elimination System (NPDES) permits for stormwater during construction and operation**
- **Endangered Species Act and other Wildlife Protection Laws**
- **National Historic Preservation Act**
- **Federal Aviation Administration Clearances**
- **Federal Land Use Authorizations**
- **Federal Transmission Line Interconnections**





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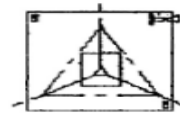


Jack-Up Barge Platform for Met Tower

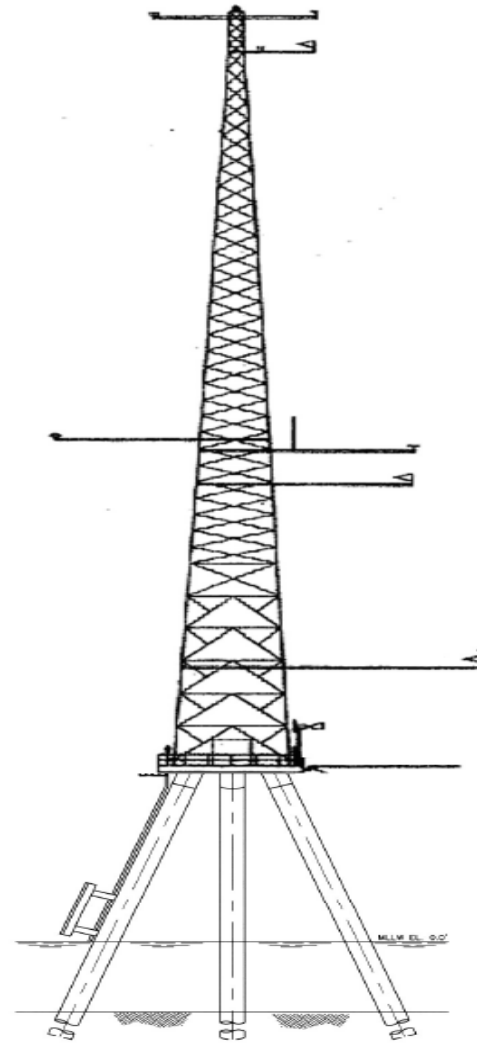




Fixed Met Tower Foundation



Plan



Profile

