Powering A Green Maine

Presented By
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Wind Farm Challenges

- Site Selection
- Landowner Outreach
- Permitting, FERC & Interconnection Studies
- Infrastructure Design & Construction
- Turbine Acquisition & Handling
- Turbine Foundations & Erection
- Commissioning
January 2002 Site Selection

• Potential Wind Resource
Site Selection

- Potential Wind Resource
- Meteorologist Review
Site Selection

- Potential Wind Resource
- Meteorologist Review
- Grid Transmission Facilities
Site Selection

- Potential Wind Resource
- Meteorologist Review
- Grid Transmission Facilities
- Community Buy In
Site Selection

- Potential Wind Resource
- Meteorologist Review
- Grid Transmission Facilities
- Community Buy In
- Meteorological Data
Landowner Outreach

- Tax Maps
Landowner Outreach

- Tax Maps
- Lease Options
Landowner Outreach

- Tax Maps
- Lease Options
- Easements
Landowner Outreach

- Tax Maps
- Lease Options
- Easements
- Community
Permitting

- Environmental Avian Analysis
Permitting

- Environmental Avian Analysis
- Wetland Delineation
Permitting

- Environmental Avian Analysis
- Wetland Delineation
- Visual
Permitting

- Environmental
- Avian Analysis
- Wetland
- Delineation
- Visual
- Sound
Permitting

• Environmental Avian Analysis
  Wetland Delineation
  Visual Sound
  Archeology
Permitting

- Environmental
- Avian Analysis
- Wetland
- Delineation
- Visual
- Sound
- Archeology
- Air
- and
- Construction
- BMP’s
FERC & Interconnection Studies

- FERC
  - Federal Energy Regulatory Commission
  - Feasibility Study
  - Turbine Generic
  - Capacity Specific
FERC & Interconnection Studies

- **FERC**
  - Federal Energy Regulatory Commission
  - Feasibility Study
    Generic to utility capacity
  - System Impact Study
    Turbine Specific
    Capacity Specific
    Grid Impact Specific
FERC & Interconnection Studies

• FERC
  • Federal Energy Regulatory Commission
  • Feasibility Study
  • System Impact Study
    Turbine specific
  • Facilities Study
    Physical, Electrical, & Protection of Utility Infrastructure
Local Permits

- City/Town
- Zoning Ordnance
Local Permits

- City/Town
- Zoning Ordnance
- Planning Board
Local Permits

- City/Town
- Zoning Ordnance
- Planning Board
- Town Council
Local Permits

- City/Town
- Zoning Ordnance
- Planning Board
- Town Council
- Public Hearings
Turbine Handling

- Transport
- Ship
Turbine Handling

- Transport
  - Ship
  - Train
Turbine Handling

• Transport
  Ship
  Train
  Truck
  W/ Challenges!
Turbine Handling

- Transport
  Ship
  Train
  Truck
Turbine Handling

- Transport
  - Ship
  - Train
  - Truck
  - Air
Turbine Component Handling

- Transport
- Handling
- Storage

Blades
Turbine Component Handling

- Transport
- Handling
- Storage
  - Blades
  - Towers
- Searsport to Pad
Turbine Component Handling

- Transport
- Handling
- Storage
  - Blades
  - Towers
  - Nacelles
  - Hubs
Infrastructure Design/Construction

- Meteorological Turbine Location
Infrastructure Design/Construction

- Meteorological Turbine Location
- Civil Site Design
Infrastructure Design/Construction

- Meteorological Turbine Location
- Civil Site Design
- Site Accessibility
Infrastructure Design/Construction

- Meteorological Turbine Location
- Civil Site Design
- Site Accessibility
- Turbine Pads
Infrastructure Design/Construction

- Meteorological Turbine Location
- Civil Design
- Electrical Utility Interconnection
  - Developer funded
  - Utility owned
Infrastructure Design/Construction

- Meteorological Turbine Location
- Civil Design
- Electrical Design
  - Utility Interconnection
  - Transmission Line Design
Infrastructure Design/Construction

- Meteorological Turbine Location
- Civil Design
- Electrical Design Utility Interconnection Transmission Line Const
Infrastructure Design/Construction

- Meteorological
  - Turbine Location
- Civil Design
- Electrical Design
  - Utility Interconnection
  - Transmission Line
  - Collector Sub Design
Infrastructure Design/Construction

- Meteorological Turbine Location
- Civil Design
- Electrical Design
  Utility Interconnection
  Transmission Line
  Collector Sub Const.
Infrastructure Design/Construction

- Meteorological
- Turbine Location
- Civil Design
- Electrical Design
- Utility Interconnection
- Transmission Line
- Collector Sub
- Collector System
- UG Design
Infrastructure Design/Construction

- Meteorological Turbine Location
- Civil Design
- **Electrical Design**
  - Utility Interconnection
  - Transmission Line
  - Collector Sub
  - Collector System
  - UG Construction
Infrastructure Design/Construction

- Meteorological Turbine Location
- Civil Design
- **Electrical Design**
  - Utility Interconnection
  - Transmission Line Collector Sub
  - Collector System
  - Underground Overhead
Infrastructure Design/Construction

- Site work
  5 Mi of Access Road
Infrastructure Design/Construction

- Site work
- 5 Mi of Access Road
- Average 32’ wide
Infrastructure Design/Construction

- Site work
  5 Mi of Access Road
  Average 32’ wide
  350k yds of earth work
Infrastructure Design/Construction

- **Site work**
  - 5 Mi of Access Road
  - Average 32’ wide
  - 350k yds of earth work
Turbine Foundation

- Foundation Design/Const.

Spread Foundation
Turbine Foundation

- Foundation Design/Const.
- Spread Foundation CSP
Turbine Foundation

- Foundation Design/Const.
- Spread Foundation
- CSP Foundation
- Rock Foundation
Turbine Foundation

- Foundation Design/Const.
  Rock Foundation
  45 Foot Anchors
Turbine Foundation

- Foundation Design/Const.
- Rock Foundation Anchors
Turbine Foundation

- Foundation Design/Const.
  - Rock
  - 20k# Rebar
Rock Anchor Testing

- 45’ Anchor W/ grout
  2 ½” Williams
  Pulled to 630k# 
  Tested elongation 
  & Max strength

Calc. Failure 650k#
Turbine Erection

Components
• Tower sections (3)
Turbine Erection

Components
• Tower sections (3)
• Nacelle
Turbine Erection

Components

- Tower sections (3)
- Nacelle
- Rotor
Commissioning Turbines

- Two Party Process

  Developer

  Turbine Manufacturer
Commissioning

- Two Party Process
- Turbine Power Curve

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Commercial Operation-March 28\textsuperscript{th} 2007
7 Years of Lessons Learned
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