Wind Energy Development and Wildlife: Industry Challenges and Perspectives

Wind Energy and Wildlife Workshop
November 5, 2008
Sara McMahon Parsons, IBERDROLA RENEWABLES
Arlo Corwin, Horizon Wind Energy
Agenda

• Elements of Wind Energy Development
• Critical Issues to Wind Industry
• Key to Project Success with Environmental Stakeholders
The 6 Key Elements of Wind Energy Development

- Wind – 1 mph difference is make or break
- Land – need willing landowners
- Permits – wildlife and NIMBY issues
- Transmission (capacity and proximity)
- Buyer (Power Purchase Agreement)
- Financing – need all 5 above to get it
The 6 Key Elements of Wind Energy Development

• Need **ALL** 6 elements to build a project

• The lack of any **one** kills a project

• Unlike natural gas, coal or nuclear power plants, we can not transport our “fuel” (wind) to a desirable location – we have to go to where the resource is

• Rate of return is set by capital markets- it is not a question of “how much can we make?” but rather, “can this project get built?”
Sequence of Development Process

• The sequence of evaluating each element varies by site, but often the order is:
  – Wind – evaluate the resource
  – Land – are landowners interested?
  – Permits – initial review of permitting issues
  – Transmission – capacity; cost
  – Buyer – general market; specific buyer(s)
  – Financing – based on all of the above
Developer Sensitivity re. Confidentiality

• At early stages of a project, confidentiality is a very real business issue for us
  – Agencies subject to FOIA/state sunshine laws
  – Fierce competition for best sites and land
  – Until you know you plan to develop a site, you don’t want to waste scarce
time and resources debating potential impact questions

• Confidentiality requirement causes great deal of miscommunication and
  mistrust between developers and wildlife agencies/advocates.

• Closer to actually applying for permits, developer should be willing to discuss
details
The 6 Key Elements of Wind Energy Development

- Wind - is the most absolute requirement
  - Energy is function of cube of wind speed
  - Avg. wind speeds of 16-19 mph in most areas
  - At higher altitudes, air density drops - requires a higher wind speed for same output
  - Depends on region’s market price for power
  - No mitigation for low wind speed!

Big Horn Wind Project
Klickitat County, WA

Text Provided by Horizon Wind Energy
Viability Very Sensitive to Wind Speed
The 6 Key Elements of Wind Energy Development

- **Land - Owners must be willing**
  - Can’t build without land.
  - Need large, contiguous parcels.
  - Compatible land uses - e.g. ranching, dry land (un-irrigated) agriculture, open space
  - Developers do **not** have power of eminent domain.
Permits and Environmental

– Wildlife impacts are typically the top issue

– But - many issues and stakeholders to address and potentially conflicting interests to reconcile (e.g. wildlife, NIMBY, archaeological)

– Different agencies and advocates have different agendas and concerns

– Developer has to strike a balance among all
The 6 Key Elements of Wind Energy Development

- Transmission
  - Typically connect to 115/230/345-kV lines
  - Transmission must have capacity available
  - Feeder lines typically < 5 to 10 miles
  - Ability to finance feeder lines and upgrades depends on project size and economics. Bigger projects with better winds can afford longer feeder lines and more upgrades
  - Long feeder lines may be difficult and expensive to acquire and permit

Text Provided by Horizon Wind Energy
The 6 Key Elements of Wind Energy Development

• **Market - Must have a buyer for power**
  
  – Most, but not all, areas of the country have growing need for power
  
  – RPS and other policies drive demand
  
  – This typically dictates the region more than the individual site (i.e. ND vs. NY)
  
  – Closely related to transmission – who owns the lines, where do they go, etc.
## Renewable Portfolio Standards (RPS) and RPS Goal States

**26 States + D.C.**

<table>
<thead>
<tr>
<th>State</th>
<th>RPS Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI</td>
<td>20% - 2020</td>
</tr>
<tr>
<td>MT</td>
<td>15% - 2015</td>
</tr>
<tr>
<td>NV</td>
<td>20% - 2015</td>
</tr>
<tr>
<td>CA</td>
<td>20% - 2010</td>
</tr>
<tr>
<td>AZ</td>
<td>15% - 2025</td>
</tr>
<tr>
<td>UT</td>
<td>20% - 2025</td>
</tr>
<tr>
<td>CO</td>
<td>20% - 2020 (IOU) 10% - 2020 (Muni/Coop)</td>
</tr>
<tr>
<td>NM</td>
<td>25% - 2025</td>
</tr>
<tr>
<td>SD</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>NE</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>SD</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>UT</td>
<td>20% - 2025</td>
</tr>
<tr>
<td>TX</td>
<td>5,880 MW - 2015</td>
</tr>
<tr>
<td>WI</td>
<td>20% - 2015</td>
</tr>
<tr>
<td>IL</td>
<td>25% - 2025</td>
</tr>
<tr>
<td>MO</td>
<td>11% - 2020</td>
</tr>
<tr>
<td>MN</td>
<td>25% - 2025 Xcel: 30% - 2020</td>
</tr>
<tr>
<td>ND</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>IA</td>
<td>105 MW</td>
</tr>
<tr>
<td>IA</td>
<td>12.5% - 2020 'Tier 1'</td>
</tr>
<tr>
<td>MD</td>
<td>10% - 2017 “New”</td>
</tr>
<tr>
<td>DC</td>
<td>Load growth by 2012 23.8% - 2025</td>
</tr>
<tr>
<td>VT</td>
<td>24% - 2013</td>
</tr>
<tr>
<td>NH</td>
<td>15% - 2020</td>
</tr>
<tr>
<td>MA</td>
<td>15% - 2020</td>
</tr>
<tr>
<td>RI</td>
<td>16% - 2020</td>
</tr>
<tr>
<td>CT</td>
<td>20% - 2010</td>
</tr>
<tr>
<td>NY</td>
<td>22.5% - 2020</td>
</tr>
<tr>
<td>NJ</td>
<td>20% - 2019</td>
</tr>
<tr>
<td>DE</td>
<td>20% - 2020</td>
</tr>
<tr>
<td>NC</td>
<td>12.5% - 2021 (IOU) 10% - 2018 (Muni/Coop)</td>
</tr>
<tr>
<td>OH</td>
<td>8% - 2020</td>
</tr>
<tr>
<td>PA</td>
<td>20% - 2013</td>
</tr>
<tr>
<td>VA</td>
<td>12% - 2022</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
<tr>
<td>WV</td>
<td>10% - 2015</td>
</tr>
</tbody>
</table>

**6 States with nonbinding goals**
Wind Project Siting Hurdles

© Kenny Stein, FPL
What Else is Required?

• Site must be accessible – must be able to deliver and erect turbines over 400’ tall

• Need adequate level ground around each turbine site – crane pads, laydown areas

• Need adequate spacing between rows of turbines – 1/3 to 1 mile
Wind Energy Facilities and Construction Sequence
Project Facilities

• Access Roads – Gravel roads linking wind turbine strings to existing roads.

• Electrical Collection System – Cables that electrically connect wind turbines to the project collection substation.

• Project Collection Substation – Steps up voltage to interconnection level.

• Operations & Maintenance Building – Houses central office, computer systems for facility operations, equipment storage and maintenance areas.
Construction Sequence

• Construct Roads & Work Areas
• Excavate & Pour Foundations
• Install Wind Turbines
  – Erect Tower Sections
  – Set Nacelle
  – Assemble and Set Rotor
  – Connect Electrical Systems
• Install Electrical Collector System
Roads: Grading and Drainage

- Prepare road for construction
- Install culverts, fords at drainage areas
Roads: Install Base Material

- Place geo-fabric or Geo-Grid on top of compacted 16- to 20-foot wide road sub-grade.
- Place 6 to 8 inches of gravel over road surface.
- Finish road profile slightly above natural grade with a 2% crown in the center to promote drainage.
- Construct shoulders with a maximum of 2% side slope for crane travel (reclaimed after construction).
Foundation: Tower Pier with Spreadfooter

- **Footing:** 50-80 ft diameter, 4ft depth with taper.
- **Pier:** 16-20 ft diameter, 3ft height.
- **Apron:** Compacted area over footing diameter with 4-6 in. rock surface.

**Construction:**
- Excavation depth to ~8ft and +50ft base elevation.
- Mud Mat – 2 to 4 inches lean concrete.
- Rebar cage and anchor bolts cage.
- Concrete (5000 psi) formed and poured in two lifts.
- Backfilled with native soil.
Tower Erection

• The 80-meter turbine tower is composed of three to four cylindrical steel sections.

• The tower sections are typically unloaded adjacent to each wind turbine foundation to minimize handling of these heavy steel components.

• Each tower section typically weighs between 35 and 70 tons.
Tower Erection

- The lower tower section is set first. A flange on the bottom of this 15’ diameter section allows it to be bolted to the top of the foundation pedestal.

- After the tower sections are set, the nacelle is raised and bolted to the top of the tower.

- A 2 megawatt class turbine nacelle weighs over 90 tons.
Tower Erection

• The rotor assembly is erected last.

• The rotor consists of three blades and a hub that mount on the front of the nacelle.

• Typically, the blades and hub are assembled on the ground and then raised as a single unit, called the rotor, and attached to the nacelle.
Collector Cable Construction
Collector Substation
Collector Substation Transformer
O&M Building
FAA Lights

- Red, synchronized flashing lights on ends of turbine strings and approximately every ½ mile

- Standard turbine finish serves as daylight marking—no day-time lighting needed
Critical Issues to Wind Industry

Flexibility in Final Project Design

- **Micrositing Corridors**
  - Allows developer flexibility to continually fine tune the layout based on turbine type, up to date meteorological data, and sensitive areas
  - Defines the range of possible wind facility impacts and demonstrates that in all potential configurations, the facility will meet applicable regulatory standards
  - Allows agencies to evaluate “worst-case” project impacts
Critical Issues to Wind Industry

Flexibility in Final Project Design

• **Overhead (OH) vs. underground (UG) collector lines**

  • Majority will be UG, but developer needs flexibility to place OH for following reasons:
    – Steep terrain where the use of backhoes and trenching machines infeasible or unsafe
    – Stream and wetland crossings where an aboveground line avoids or minimizes environmental impacts
    – Soil with low thermal conductivity preventing adequate heat dissipation from the conductor, and rocky conditions that significantly increase trenching costs

  • Agencies review max # miles of UG and OH
Critical Issues to Wind Industry

Certainty in Operational Costs

• Mitigation for Temporary and Permanent Impacts to Habitat
  – Agencies concerned with viability of restoration of desert environments. Developers need certainty in terms of mitigation requirements and costs.
  – ODFW habitat mitigation policy requires no net loss of valuable native habitat.
  – Oregon Guidelines encourage development on land already used for cropland and recommend avoiding Category 1 and 2 habitats, and minimizing and mitigating for impacts to Category 3, 4 and 5 native habitat.
Certainty in Operational Costs, con’t.

- **Mitigation for Avian/Bat Impacts**
  - Moving, altering or curtailing turbines post-construction adds uncertainty and risk to project. Tax equity investors are wary of these uncertainties.
  - IBR and others are currently conducting experiments to test effectiveness of curtailment for reducing bat mortality in locations in the Northeastern US where bat mortality has raised concerns.
  - Anticipated costs for habitat and wildlife mitigation are included in project capital and operational expenditure budgets prior to construction and disclosed to financial partners.
  - Un-anticipated costs during operation are in excess of allocated budgets and affect financial partners.
Key to Project Success with Environmental Stakeholders

Follow OR Wind Siting Guidelines

- Conduct a fatal flaw or critical issues analysis and site projects in areas with fewer sensitive wildlife habitats
- Map and rate habitat, survey avian use, identify raptor nests, and conduct T/E other wildlife surveys
- Consult with agencies, environmental stakeholders and public
- Microsite layout to minimize habitat and wildlife impacts
- Educate and train construction and operational about sensitive wildlife and other environmental concerns
- Restore areas temporarily disturbed during construction with native vegetation
- Set up a conservation easement in native habitat to offset impacts to wildlife habitat
- Conduct fatality monitoring and work with Technical Advisory Committee
- Train operations staff to monitor site for avian and bat fatalities and respond to injured birds and bats
# Steps to Follow OR Guidelines

<table>
<thead>
<tr>
<th>Phase</th>
<th>Timing</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Macrositing</td>
<td>Early evaluation of potential</td>
<td>Information/desktop review of habitat, wildlife, plants, and cumulative impacts; review of regulatory requirements; preliminary scoping of potential issues with resource agencies and permitting authorities</td>
</tr>
<tr>
<td></td>
<td>wind project site</td>
<td></td>
</tr>
<tr>
<td>2- Pre-Project</td>
<td>During preparation of permit</td>
<td>Identification of micrositing corridors, habitat mapping; early coordination with resource agencies regarding survey protocols; undertaken raptor surveys; avian use surveys; T/E species and other wildlife surveys; assessment of project impacts; presentation of habitat mitigation proposal and initial calculation of habitat mitigation acreages to resource agencies.</td>
</tr>
<tr>
<td>Assessment</td>
<td>application</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Submit Permit Application for</td>
<td>Review of application by resource agencies and permitting authority for completeness. Scoping/public comment period. Wind project developers are encouraged to engage stakeholders with wildlife expertise.</td>
</tr>
<tr>
<td></td>
<td>Agency and Public Review</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Permit application review</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Steps to Follow OR Guidelines (cont.)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Timing</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Permit Issued</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - Micrositing</td>
<td>Can occur prior to or after permit issuance, and continues through construction.</td>
<td>Initial micrositing to minimize habitat and wildlife impacts. Continuation of discussions with resource agencies.</td>
</tr>
<tr>
<td>4 - Construction</td>
<td>After permit is issued, prior to and during construction.</td>
<td>Identification of key compliance staff; environmental training; flagging and micrositing to avoid sensitive resources; implementation of construction best management practices (BMPs).</td>
</tr>
<tr>
<td>5 - Operation</td>
<td>After construction, during operations.</td>
<td>Implementation of habitat mitigation prior to wind project operation start date; site revegetation; operational monitoring; engagement with the TAC; determine potential additional mitigation with resource agencies and permitting authority as necessary.</td>
</tr>
</tbody>
</table>
Thank You!

Sara McMahon Parsons,
IBERDROLA RENEAWABLES
1125 NW Couch St., Suite 700
Portland, Oregon, 97209
Telephone (503) 796-7732
Cellular (503) 709-3541
Sara.Parsons@Iberdrolausa.com

Arlo Corwin
Horizon Wind Energy
Director of Project Development
503-535-1517
Arlo.Corwin@Horizonwind.com