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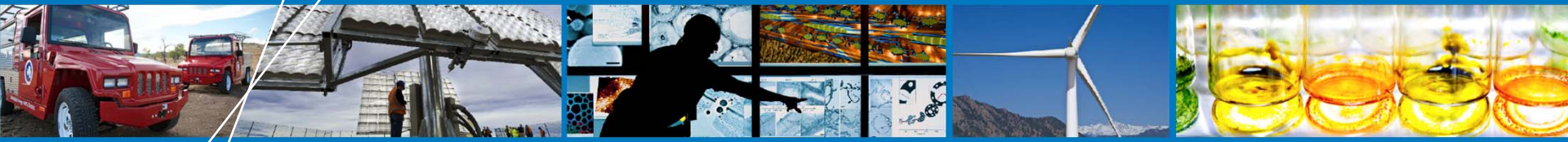
Impacts from Deployment Barriers on the United States Wind Power Industry: *Overview & Preliminary Findings*



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Eric Lantz, Suzanne Tegen, Maureen Hand, and Donna Heimiller: NREL

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Presentation Overview

- **Background**
- **Developer perspectives and decision-making**
- **Land area and resource potential impacted by barriers**
  - Public acceptance
  - Radar
  - Wildlife
  - Transmission
- **Conclusions**

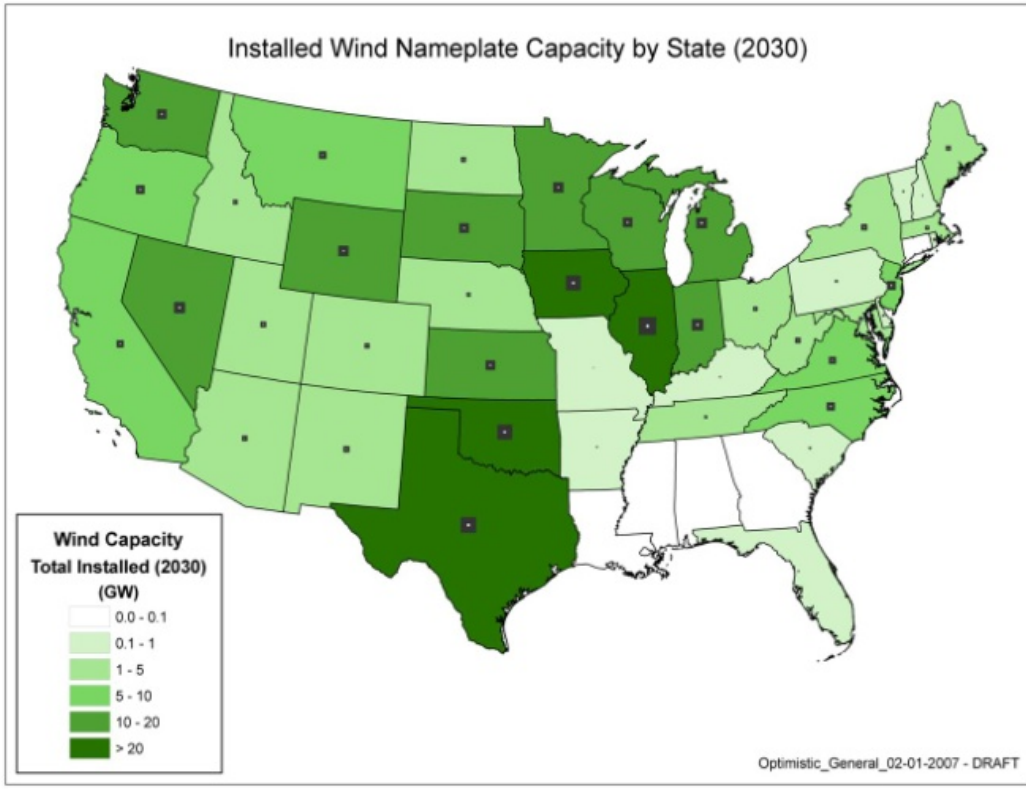
Background

- **Regardless of cost and performance, some wind projects cannot proceed to completion as a result of "deployment barriers."**
- **Even if wind was unquestionably competitive on purely economic grounds, there would be many places in the United States where developers would not build due to various non-technical barriers.**
- **Current methods for developing research agendas and understanding non-technical barriers facing the industry fail to:**
  - Accurately characterize the costs to the industry imposed by deployment barriers (as a result of project delays, increased permitting stringency, and failed projects)
  - Define the extent of the challenges faced by the industry.
- **Barriers must be better understood and quantified.**

Primary Objectives

1. **Quantify the potential impact of barriers on developable capacity (MW)**
   - Utilize semi-structured interviews with developers and GIS datasets to better understand the impacts on the industry

2. **Quantify the potential impact of barriers on the installed costs *and* total system cost from 20% Wind**
   - Collect data from developers and consultants detailing actual or representative costs for developer operations, technical studies, permitting fees, etc.
   - Estimate relative cost of 20% Wind at various levels of barrier stringency



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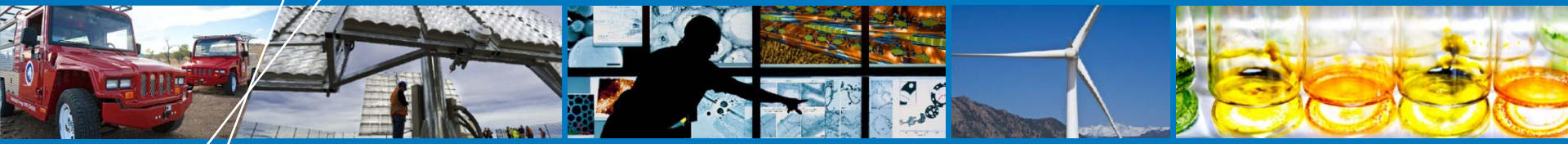

Developer Perspectives and Decision-making

Development Time Horizon Is 5+ Years

- **Typical project is planned on a 5-year time horizon.**
  - 12 years maximum reported, but it is increasingly difficult to justify a project timeline of more than 5 years.
  - Interconnection alone can require 3-4 years.
  - Timelines are likely extended if:
    - Projects include post-construction work (additional 2-4 years)
    - NEPA or comparable state environmental processes are triggered (additional 1-2 years)
    - Land management plans need revision (additional 1-2 years)
    - Litigious opponents are present (additional 1-2 years)

- **U.S. Fish and Wildlife Service guidance indicates movement toward longer lead times and more upfront data collection.**

- **More time required for development = higher capital investment.**
  - Typical initial development cost estimates: $30/kW - $50/kW – however costs may exceed $150/kW in extreme cases
  - Example: a 60 MW project has been in development for 8 years with $6.1 million in costs thus far
    - Equates to a cost of $100/kW (in development costs alone) with still no assurance of a successful project
  - "Mitigation costs" can add substantial additional costs (e.g., $20/kW - $40/kW or more)

Development timeline ranges vary greatly. Uncertainty is the greatest challenge in terms of timing for developers

Explore and Engage Barriers Early, Often

- **Deployment barriers begin to factor in at the very first prospecting stage and must be managed throughout the development process.**
- **A strictly linear development approach will not proceed rapidly enough and may over-commit developers.**
  - Development processes occur in parallel.
  - Issue resolution is ongoing and part of every step.
- **Policy risk is substantial.**
- **Deployment barriers alone do not block success.**
  - A project with a buyer can spend more to mitigate barriers.
  - Projects with few or no issues may fail anyway, as a result of insufficient demand.

Industry Has Gained Sophistication Over Time

- **Development process is evolving and market analysis is more thorough:**
  - 2000-2005: buy land in the good wind resource sites
  - 2005-2010: buy windy land close to transmission
  - 2012: find the market for potential PPA
    - Emerging development model: individual utilities as clients
    - Projects are chosen to meet a specific "client" need (e.g., local wind for RPS)
    - Utilities want to see more projects in their service territory – long haul power exports are increasingly difficult to sell

- **Multiple variables shape developer strategies and prospective sites**
  - Market
  - Competition
  - Transmission/ available interconnection
  - Protected/ sensitive areas (environmental, radar, cultural)

- **Better market analysis, better success rates**
  - 2000-2005, success rates were about 1 in 10
  - 2012 success rates are improving: in some cases, 1 in 3 projects are successful

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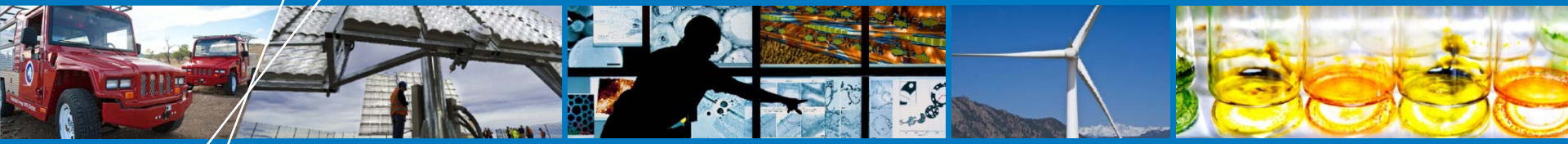

Land Area and Resource Potential Impacted by Barriers

Public Acceptance Approach

Initially we developed two analysis scenarios

- **A moderate-level barrier consistent with the current market conditions and the trajectory we anticipate in the absence of any deliberate actions to mitigate public acceptance barriers**
  - 1,500 ft no build buffer; Cost adder ($75/kW) buffer from 1,500 ft to 2,000 ft
- **A more extreme barrier case, but one that is still within the realm of possibilities based on current public debates**
  - 2,500 ft no build buffer; Cost adder ($125/kW) from 2,500 ft to 3,000 ft
- **Each scenario includes a 'no build' buffer zone and a 'cost adder' buffer zone**
  - Cost adders were determined by analysis of the direct cost data and the additional costs that could result from increased spending on public meetings, permitting, land acquisition as well as more expenditures for wildlife studies resulting from greater public scrutiny of a project

Recent Modifications

- **Scenarios outlined above do not allow for the possibility that some of the proximate residences could be project participants and therefore have likely signed away any non-safety setback rights**
- **Preliminary findings suggest developers are building in locations with up to 5 residences per square mile; assuming roughly a third to a half of those residences are project participants (e.g., leaseholders) suggests that we can build generally wherever we want when there are only two project residences per square mile**
- **Revised approach**
  - Filter out all the locations that have only 2 occupied landscan cells per square mile
  - Apply the buffer zones (i.e., no build and cost adder) only to those regions that have 3 or more (>2) occupied landscan cells

Wildlife Approach

1. **Quantify entire habitat or migratory path impact**
2. **Refine habitat and migratory areas**
   - Show percentage of habitat or migration corridors impacted instead of entire species distribution

Emphasis on:

- Species at risk for collision (Indiana bat, Whooping Crane)
- Species with habitat at risk (Prairie Chickens, Sage Grouse)
- Protected species with broad-based habitat (Golden & Bald Eagles) – New regulations to require an Eagle Conservation Plan

Databases: USGS, The Nature Conservancy, USFWS, others

Next Steps:

- Incorporate most recent policies/guidance
- Collect and incorporate peer review input

Radar Approach

Plot Sub-barriers (defined by NOAA):

1. Remove from consideration (3km and under)
2. Potential mitigation required (>3km-26km)
3. Consultation (>26km-57km)

Measured by: Distance to radar tower

Databases: NOAA, NRDC Radar includes Airport Surveillance, Air Route Surveillance, Next Generation Weather and Terminal Doppler Weather Radar

Next Steps: Refine radar datasets, incorporate new data and insights as they become available; engage DOD and FAA for additional data

Radar Insights from Developers

- **Radar barriers are improving but can still present challenges**
- **DOD/FAA database of radar towers has assisted prospecting effectiveness significantly**
  - Response time may still be problematic
  - It may be difficult to discern the appropriate level of mitigation
- **Developers rely on FAA database of hazard determinations**
- **General strategy is primarily mitigation, but some areas are simply avoided**

Transmission Approach

- **Analyze impacts of changes in available capacity**
  - Baseline in 20% = 10% availability
  - Sub scenario 1% availability (high barrier) + no new inter-regional transmission
  - Sub scenario 1% availability (medium barrier)
- **Include case study from one balancing area**
- **Possibly use modeled transmission availability data to conduct a more refined nationwide analysis**

Transmission Insights from Developers

- **Transmission is observed to be a major challenge; projects fail as a result of:**
  - Limited availability (of lines or capacity),
  - No cost effective delivery (e.g., due to wheeling charges, high interconnection costs)

- **Transmission/Interconnection is among the highest risk endeavors**
  - There is significant uncertainty in the processes
  - Proceeding through the interconnection review/study process requires significant sums of money, portions of which are not refundable
  - System operator assumes everyone in front of you in the queue is going to build

- **Queuing and power sales contract timing requirements may be mismatched**
  - System operator wants you ready for construction, utility wants an interconnection agreement in hand

Preliminary Conclusions

- **Deployment barriers including public acceptance are important but market fundamentals ultimately rule the day.**

- **Deployment barriers appear to have a larger impact on the developable wind resource; impacts to COE, however, are not trivial.**

- **Analyzing the impact of deployment barriers on a broad basis presents significant data, modeling, and analysis challenges**
  - There is an exception to every rule
  - Sometimes the target is moving

Thank You

Eric Lantz
Research Analyst
Strategic Energy Analysis Center
National Renewable Energy Laboratory
http://www.nrel.gov/analysis/
http://www.windpoweringamerica.gov/

15013 Denver West Parkway
Golden, CO 80401-3305
P: (303) 384-7418
email: Eric.Lantz@nrel.gov

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