Advancing Wind Power in Illinois Conference 2011

Jonathan Nieuwsma
Illinois Wind Energy Association

Small Wind “How To”
Breakout Session
Friday, July 22, 2011, 11:15 AM
Small Wind Presentation for IWWG Conference
July 21, 2011

Jonathan Nieuwsma
Chairman, Small Wind Committee
Illinois Wind Energy Association

The Illinois Wind Energy Association
Small Wind Committee

Introduction

Jonathan Nieuwsma
Illinois Wind Energy Association
• Chairman, Small Wind Committee

Heston Wind and Renewable Energy LLC
• Business Development Director

CS2-Creative Solar Structures LLC
• Partner

Certified MREA Small Wind Site Assessor
Outline

1) Wind Energy Basics
2) Site Assessment
3) Zoning Issues
4) Net Metering
5) Interconnection

Wind Turbine Physics

How much power is in wind?

Power = \( \frac{1}{2} \rho A v^3 \)

\( \rho \) = air density
\( A \) = swept area
\( v \) = wind speed

For standard HAWT:
\( A = \pi r^2 \), so
Power = \( \frac{1}{2} \rho \pi r^2 v^3 \)

2x blade radius = 4x power
2x wind speed = 8x power

Power Curve for “100kW” Turbine
Wind Speed Varies With:

- Turbine Height
- Turbine Location
- Wind Direction
- Time of Day/Year

Small Wind Site Assessments per MREA protocol
Site Assessment Objective/ Deliverables

Objective: Maximize energy production
- Excludes VAWTs
- Excludes building mounted turbines
- Educational/marketing value not considered

Deliverables: Turbine placement recommendation
- Estimated Annual Energy Production
- and more...

Required by: Illinois Clean Energy Community Foundation

Site Assessment: Turbine Placement

Turbine Placement Factors:
- Locations and heights of buildings, trees, other obstacles
- Prevailing wind direction
- Proximity to tie-in point

The 30’ Rule:
The bottom of the turbine blade should be at least 30’ above any obstruction within 500’.
Site Assessment: Energy Production

Energy Production Factors:
- Baseline wind speed, height
- Wind shear coefficient
- Tower height
- Turbulence Intensity

V_2 = V_1 (Z_2/Z_1)^\alpha

Surrounding Terrain

<table>
<thead>
<tr>
<th>Surrounding Terrain</th>
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<tbody>
<tr>
<td>Smooth ground</td>
<td>0.10</td>
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<tr>
<td>Short grass, short trees, lake, ocean</td>
<td>0.14 to 0.18</td>
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<td>Short grass, short trees, lake, ocean</td>
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<td>Tall crops, hedges, short trees,</td>
<td>0.17 to 0.23</td>
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<td>Tall crops, hedges, open ground</td>
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Site Selection Tools

Aerial Maps
Site Selection Tools

Topographical Maps

County GIS Maps
Site Selection Tools

Energy Calculation Tools
Site Assessment Report

Small Wind Zoning Issues
Small Wind Zoning Issues

- Permit type: by-right (permitted use) or special use
- Permit fee
- Setback requirements
- Tower height restrictions
- Tower type restrictions
- Other concerns: sound, shadow, birds...

Setback and Tower Height Restrictions

- $1.1x$ maximum setback per state law for “systems used exclusively by an end user”

For a square lot with turbine in exact center:

<table>
<thead>
<tr>
<th>Lot Size (Acres)</th>
<th>Max. System Height (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>47</td>
</tr>
<tr>
<td>0.5</td>
<td>67</td>
</tr>
<tr>
<td>1</td>
<td>95</td>
</tr>
<tr>
<td>1.5</td>
<td>116</td>
</tr>
<tr>
<td>2</td>
<td>134</td>
</tr>
<tr>
<td>3</td>
<td>164</td>
</tr>
<tr>
<td>4</td>
<td>190</td>
</tr>
<tr>
<td>5</td>
<td>212</td>
</tr>
</tbody>
</table>

Setback requirement imply tower height restrictions; no need to do so separately.
Tower Type Restrictions

Free Standing

- Lattice
- Monopole

Guyed Support

- Lattice
- Monopole

Typical Question: Sound

How much sound does a wind turbine make?

- 35 - 45 decibels at 350 meters (1,148 ft)

- Usually masked by ambient sounds
- Varies by turbine type.
- Modern equipment is much quieter.
- Exponentially quieter with distance
- White noise: less tonal than flagpole clasp
Typical Question: Shadow Flicker

- Not an issue for smaller turbines due to higher RPMs.
- Predictable and easily avoidable.
- Only occurs during certain hours and certain days.
- Setback requirements usually preempt any issues.
- Formal studies not required for small turbines.

Typical Question: Birds

<table>
<thead>
<tr>
<th>Causes of Bird Fatalities</th>
<th>Number per 10,000 fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Turbines</td>
<td>250</td>
</tr>
<tr>
<td>Communication Towers</td>
<td>700</td>
</tr>
<tr>
<td>Pesticides</td>
<td>700</td>
</tr>
<tr>
<td>Vehicles</td>
<td>800</td>
</tr>
<tr>
<td>High Tension Lines</td>
<td>1000</td>
</tr>
<tr>
<td>Other</td>
<td>1000</td>
</tr>
<tr>
<td>Cats</td>
<td>5500</td>
</tr>
<tr>
<td>Buildings/Windows</td>
<td></td>
</tr>
</tbody>
</table>

Typical Question: Birds

“On balance, Audubon strongly supports wind power as a clean alternative energy source that reduces the threat of global warming. Each individual wind project, however, has a unique set of circumstances and should be evaluated on its own merits.”

- Audubon Society

Source: Congressional testimony of Mike Daulton, Director of Conservation Policy, National Audubon Society, before the Committee on Natural Resources Subcommittee on Fisheries, Wildlife and Oceans, May 2007.

Typical Question: Property Value

- Studies of utility scale wind show no impact on property values (LBNL Report, Sept. 2009)
- No formal studies for small wind.
- Anecdotal evidence that neighboring values increase.
- Sign of progressive community.
Typical Question: Safety

- Turbines and towers are engineered structures.
  - Like lamp posts, cell towers, utility poles...
  - Setback distances are appropriate.
- Attractive Nuisance (tower climbing)
  - Depends on tower style.
  - Access required for maintenance.
- Braking redundancies prevent over speed.
- Foundations are professionally engineered.

Typical Question: Ice

Bolton Valley Ski Area
Bolton, VT
Typical Question: Lightning

Small Wind Zoning Resources

- AWEA: resource guide, model ordinance
ttp://www.awea.org

- DWEA: fact sheets, bird/bat study, more
ttp://www.distributedwind.org

- IIRA/Illinois Wind: model ordinance, county-by-county zoning guide
ttp://www.illinoiswind.org

- IWEA Small Wind Committee: education, lobbying
ttp://www.windforillinois.org
Net Metering Concept
Net Metering in Illinois

For turbines up to 40 kW
- Customer is charged for net amount of electricity (kWh)
- Excess kWhs are rolled over for later use
- Unused excess expires at end of contract year (April or October)
- Utility decides the necessary metering type:
  - Bi-directional mechanical meter (residential customers)
  - Dual channel meter
- Customer not charged additional fee for meter

For turbines 41 kW to 2 MW
- Delivery charges, taxes, fees on gross amount of electricity supplied
- Supply charges based on net electricity
- Net excess generation paid at “avoided cost” rate
- Dual channel meter is required
- Customer pays monthly rental on meter

Net Metering/Interconnect Application Process

- Fill out Interconnection and Net Metering application forms
- Submit application forms
- Utility reviews for completeness, eligibility
- Utility mails Net Metering Agreement for customer signature

ComEd
www.comed.com
- customer service
- rates
- interconnection

Ameren
www.ameren.com
Search “net metering”

ComEd
Net Metering - Energy Efficiency Services
Three Lincoln Center
Oakbrook Terrace, IL 60181
Fax: 630-576-6353
Netmetering@ComEd.com

Ameren Illinois Net Metering Coordinator
607 East Adams, MC Springfield, 10th Floor
Springfield, IL 62701
renewablesillinois@ameren.com
Thank you!

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