



Advancing Wind Power in Illinois Conference 2011

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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



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



McGlynn Middle School
Medford, MA



Wind Turbine Physics

How much power is in wind?

$$\text{Power} = \frac{1}{2} \rho \times A \times v^3$$

ρ = air density

A = swept area

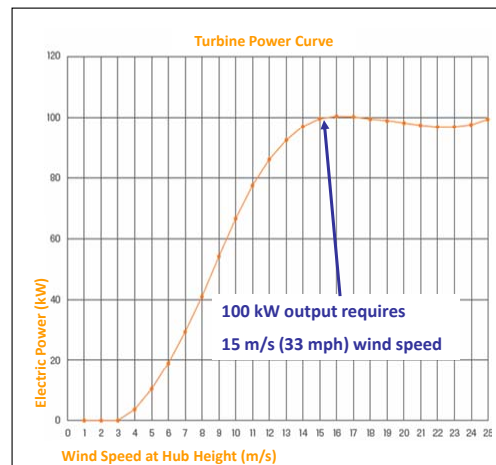
v = wind speed

For standard HAWT:

$$A = \pi r^2, \text{ so}$$

$$\text{Power} = \frac{1}{2} \rho \times \pi r^2 \times v^3$$

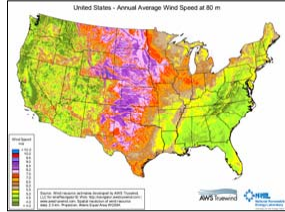
2x blade radius = 4x power
2x wind speed = 8x power



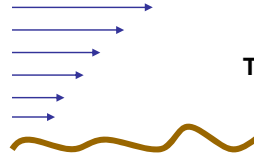
Power Curve for "100kW" Turbine



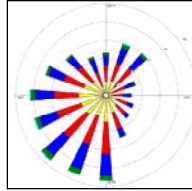
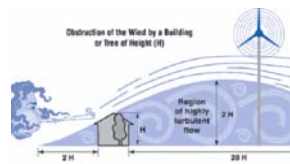
Wind Speed Varies With:



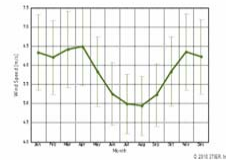
Turbine Location



Turbine Height



Wind Direction



Time of Day/Year

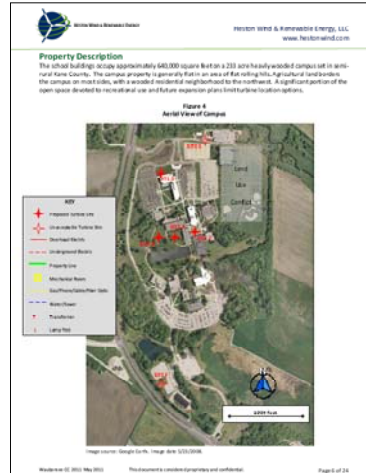


Small Wind Site Assessments per MREA protocol



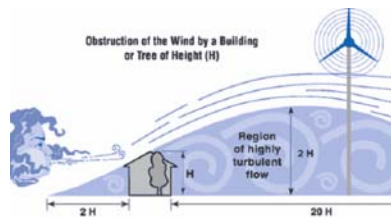
Site Assessment Objective/ Deliverables

- 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

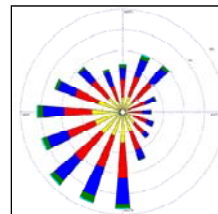
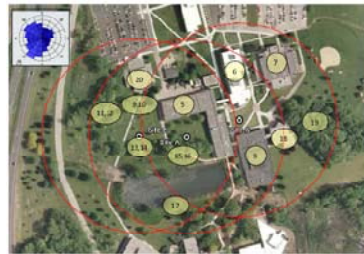


Site Assessment: Turbine Placement

- 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'.



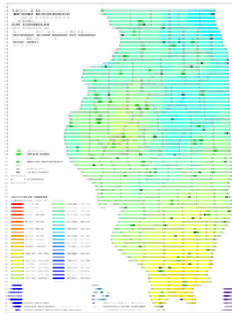
Site Assessment: Energy Production

Energy Production Factors:

- Baseline wind speed, height
- Wind shear coefficient
- Tower height
- Turbulence Intensity

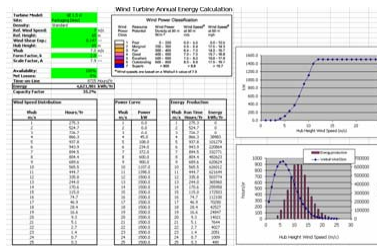
calculate wind speed at hub height → calculate AEP

De-rate AEP



Surrounding Terrain	α
Smooth hard ground, lake, ocean	0.10
Short grass or tilled ground	0.14 to 0.18
Level country, foot high grass,	0.16 to 0.20
Tall row crops, hedges, few trees	0.20 to 0.25
Hilly country with open ground	0.20 to 0.25
Many trees, occasional buildings	0.22 to 0.50
Wooded country, small towns	0.28 to 0.55

$$V_2 = V_1 (Z_2 / Z_1)^\alpha$$



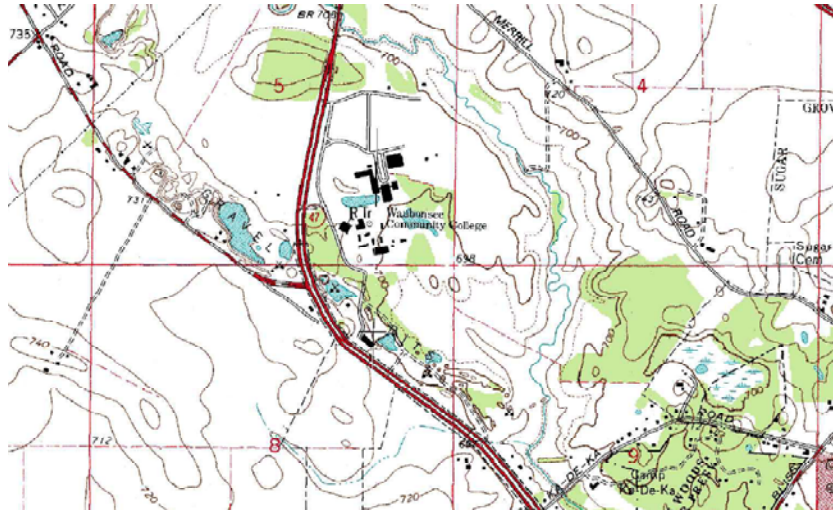
Site Selection Tools



Aerial Maps



Site Selection Tools



Topographical Maps



Site Selection Tools



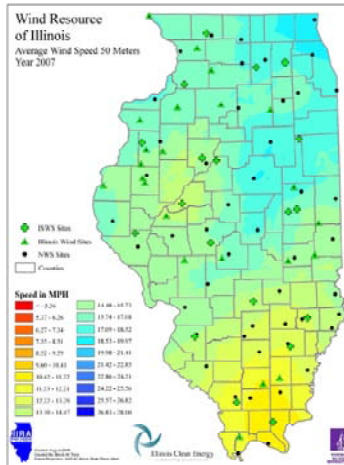
County GIS Maps



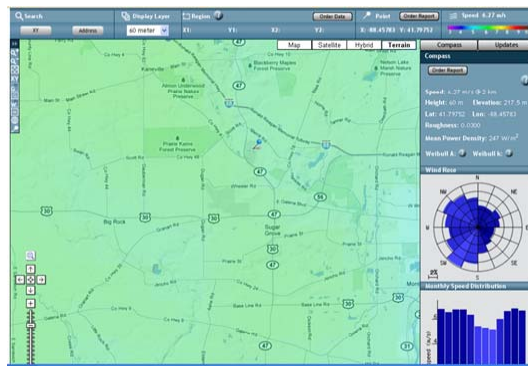
Site Selection Tools



Energy Calculation Tools



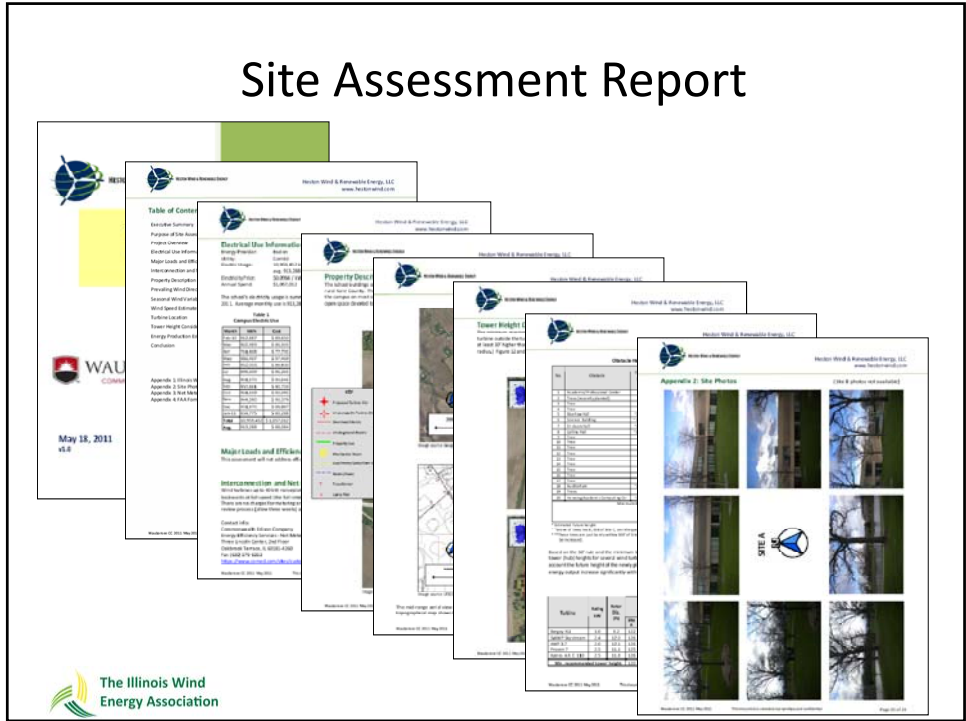
Public Domain Wind Maps



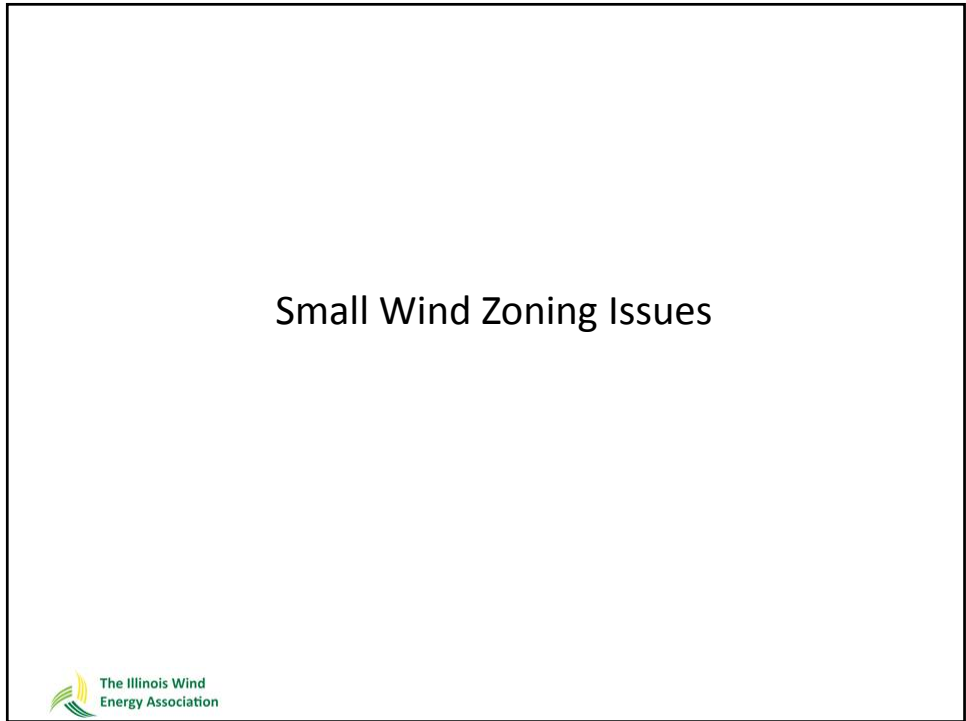
Proprietary Wind Speed Modeling Software



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...



Small Wind ≠ Big Wind



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:

Lot Size (Acres)	Max. System Height (ft)
0.25	47
0.5	67
1	95
1.5	116
2	134
3	164
4	190
5	212

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



Tower Type Restrictions

Free Standing



Lattice



Monopole

Guyed Support



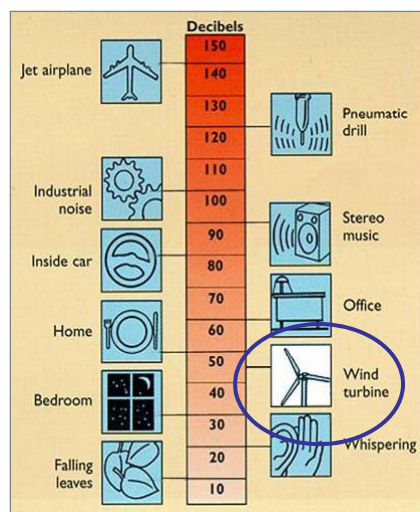
Lattice



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



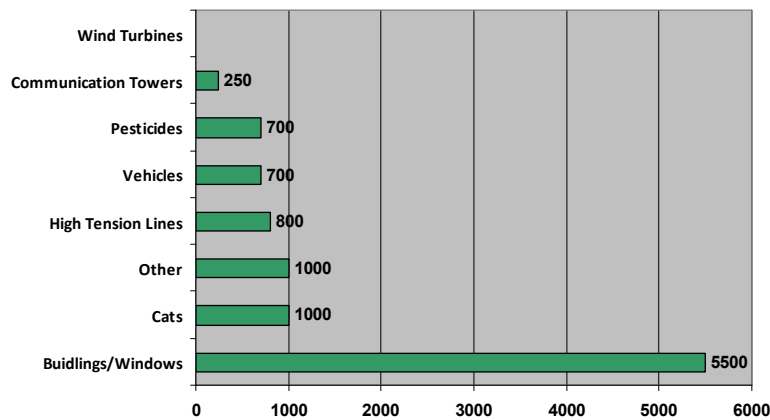
Typical Question: Shadow Flicker

- 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

Causes of Bird Fatalities
Number per 10,000 fatalities



Source: Erickson, et al. Summary of Anthropogenic Causes of Bird Mortality, 2002.



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.



30 foot rule?



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

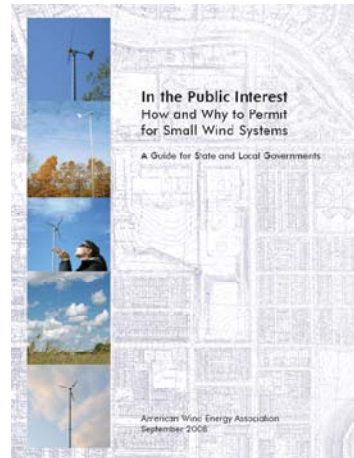


Typical Question: Lightning



Small Wind Zoning Resources

- AWEA: resource guide, model ordinance
www.awea.org
- DWEA: fact sheets, bird/bat study, more
www.distributedwind.org
- IIRA/Illinois Wind: model ordinance, county-by-county zoning guide
www.illinoiswind.org
- IWEA Small Wind Committee: education, lobbying
www.windforillinois.org



Net Metering



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

Full
Credit

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

Partial
Credit



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

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



Ameren
www.ameren.com
Search “net metering”

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





Thank you!

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