

Wind Power Technology And Siting Issues

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Wind Powering America All-State Summit

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Image courtesy of NEG Micon



Market Barriers

- Actual
 - Transmission Constraints
 - Financing
- Perceived
 - Typical Local Siting Concerns



Perceived market barriers may be based on old technologies or installations

Understanding current technology may reduce market concerns



Siting Issues

- Turbine reliability
- Aesthetics
- Sound
- Bird collisions
- Bat collisions
- Shadow flicker
- Ice shedding
- Safety
- Property values



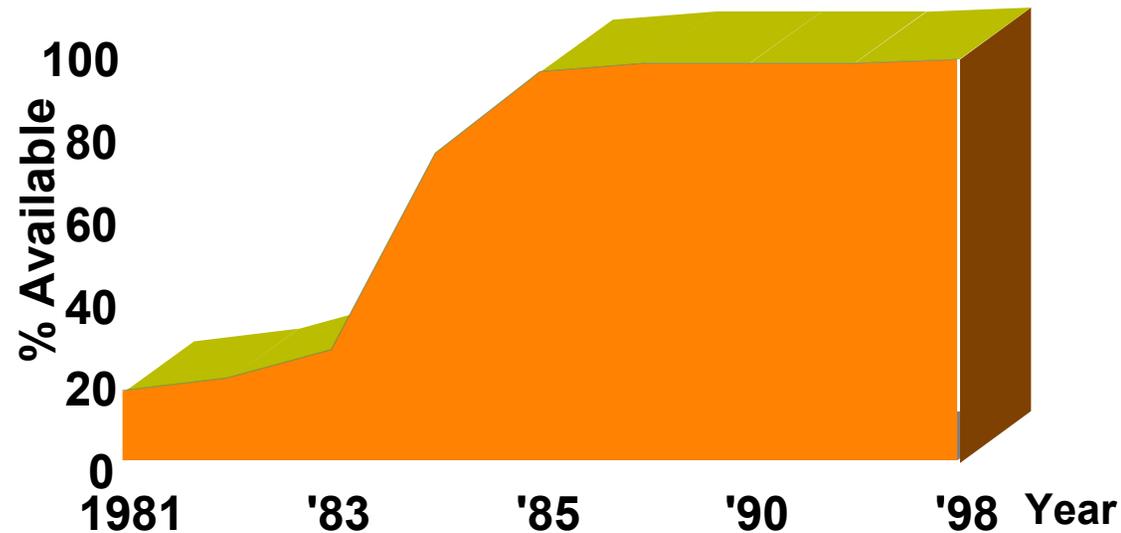
Turbine Reliability

- Public prefers to see turbines operating



Technology Improvements Lead to Better Reliability

- Drastic improvements since mid-80's
- Projects now achieve over 98% 'availability'



Quantifying Wind Power Performance

- 99% Availability
- 70 – 90%+ Operating time
- 25 – 35% Annual Average Capacity
- 10 – 45% Monthly *Accredited* Capacity
- <10% Operating time at peak capacity



Aesthetics

Visual impact cannot be avoided.
However, it can be reduced by:

- Layout of wind farm
- Design of turbines



Altamont Pass wind development area Livermore, CA, 1982



Wind power plant in Palm Springs, CA
(where the winds come from a single direction)

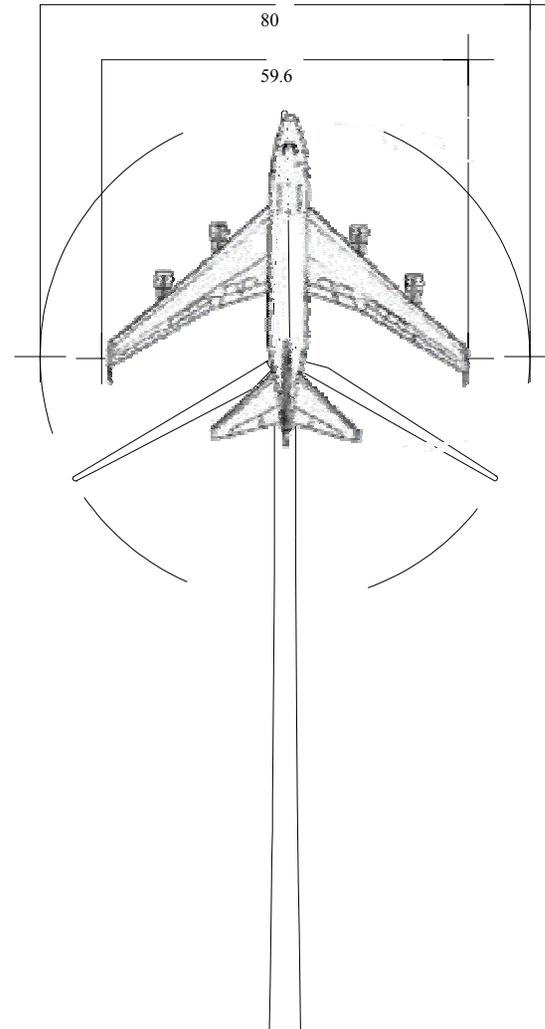


Top of Iowa, Joice, IA



How big is a 2-MW wind turbine?

This picture shows a
Vestas V-80 2-MW
wind turbine
superimposed on a
Boeing 747 jumbo jet



Nacelle for 1.65-MW turbine



Cross section of blade for 1.65-MW turbine



Aesthetics

- Modern turbines use tubular towers
- Turbines at many sites must be separated in all directions to avoid turbulence
- Larger size = wider spacing
- Modern turbines rotate about once every 3 seconds
- Photo simulations may be a very useful tool



Sound

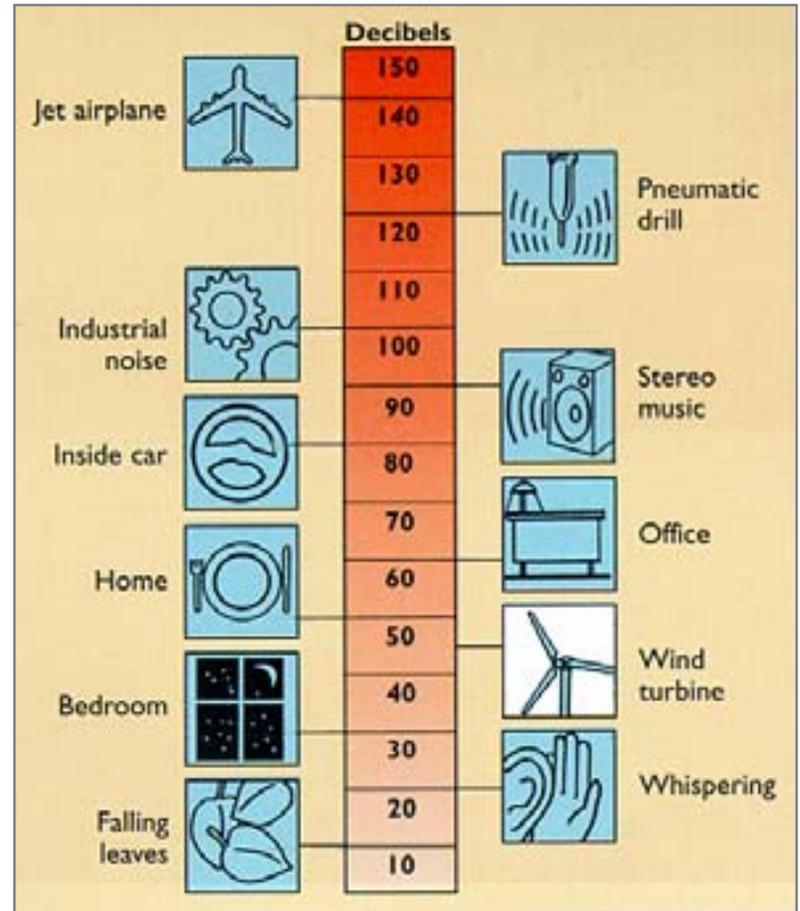
- Rotor – three-bladed
- Configuration – upwind
- Blades – redesigned
- Gearbox – nacelle soundproofing



Sound

How loud is the sound from a utility-scale turbine?

45 decibels at 350 meters



Wind turbine noise (at 200 m) is as loud as your refrigerator heard from the living room



Sound

- Most wind projects are in quiet rural areas
- ‘Receptors’ may be sheltered from the wind
- Topography may amplify sound
- Sound perception is highly subjective
- Acoustical consultant may be helpful



Shadow Flicker

- Phenomenon: Sun low in sky; sunbeam interrupted by rotating turbine blade
- Function of season, latitude, time of day
- Temporary phenomenon as sun moves across sky
- Minimized by proper setbacks
- Developer may negotiate sight easement



Ice Shedding

- Small pieces of ice may be thrown
- Larger pieces usually drop within blade length from tower – not thrown
- Recommended setback – 1.5 x total height
- Tens of thousands of turbines worldwide—no case of injury known



Safety

- Turbines have tubular towers with locked doors, not externally climbable
- Blade throw extremely rare today, even in catastrophic failure
- Setbacks of 3-5 rotor diameters common



Safety

- Turbine failed at Weatherford, OK, May 7, 2005
- Winds light at time – tower snapped
- No one injured, cause under investigation
- Turbines engineered to international safety standards (Germanischer Lloyd, Det Norske Veritas)
- Isolated incident



Property Values

- Phoenix Economic Development Group study, October, 2002:
 - *“Views of wind turbines will not negatively impact property values. Based on a nation-wide survey conducted of tax assessors in ... areas with wind power projects, we found no evidence supporting the claim that views of wind farms decrease property values.”*



Property Values

- Renewable Energy Policy Project (REPP) study, May, 2003:
 - “The statistical analysis of all property sales in the view shed and the comparable community provides no evidence that wind development has harmed property values within the view shed. *There is no valid empirical support for claims that wind development will harm property values.*”



Grid-connected, net-metered residence



Montfort Wind Farm, Wisconsin 20 1.5-MW turbines



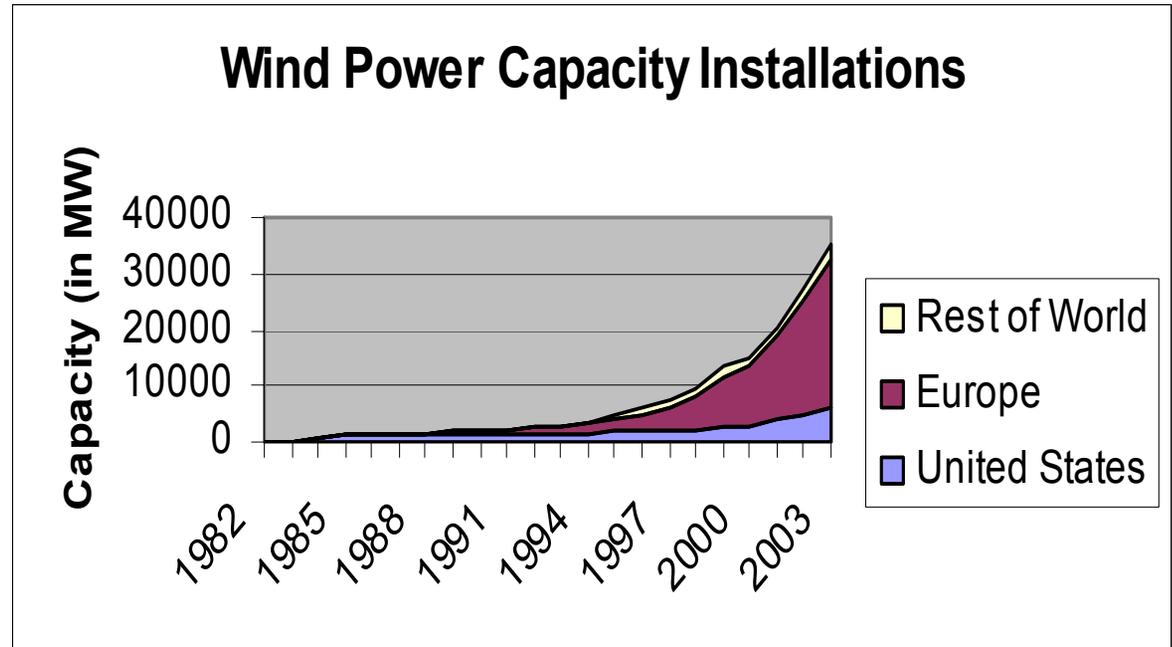
Harvesting corn among the turbines Lake Benton, MN



Wind Is Growing Worldwide

1. Germany: 14,609 MW
2. U.S.: 6,374 MW
3. Spain: 6,202 MW
4. Denmark: 3,110 MW
5. India: 2,110 MW

*As of January 1, 2004



Source: AWEA's Global Market Report



www.awea.org

American Wind Energy Association

www.nationalwind.org

National Wind Coordinating Committee

