Residential Wind Turbine Installation Considerations

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For: Idaho Wind Working Group
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College of Southern Idaho
Agenda:

1) Tower Heights and Types
2) Noise
3) Safety
4) Aesthetics and Neighbor Relations
5) Net Metering
6) Dangerous Connections
7) Q/A
Micro wind turbines are classified as any turbine under 1000 watts. Turbines of this size are mostly used for battery charging, water pumping and have proven useful in many commercial applications, like remote telecommunications and railroad and pipeline protection (cathodic protection).
Turbines ranging from 1kW all the way up to 50 kW are the most common for residential and small farm applications.

Southwest Air-400 w  Bergey 1 kW  Endurance 50 kW
A popular wind turbine is the SkyStream 3.7 (3.7kW). It has been adapted for many uses, both residential and commercial. Wal-Mart is leading the way in Palms Dale, Ca. with 17 SkyStream 3.7 adapted to fit onto light poles.
TOWER HEIGHTS
Locating the Tower and Height Considerations

- It is important to get the turbine up as high as possible to maximize energy production.
- Avoid obstructions – go for high ground; position turbine at least 30 feet (10 m) above any obstruction within 300 ft.

**Recommendations**
1) Tower heights should be between 45-120’ for small turbines.
2) Suggest the set back is equal to the tower height.
3) Setbacks are for visual impacts not safety. Nobody ever killed by falling tower after properly installed.
**Recommendations**

1) All towers must comply with IBC and AASHTO standards
2) Limit guyed towers within city limits for aesthetics?
American Wind Energy Assn. 9.1

- PURPOSE- This standard was created by the small wind turbine industry, scientists, state officials, and consumers to provide consumers with realistic and comparable performance ratings and an assurance the small wind turbine products certified to this standard have been engineered to meet carefully considered standards for safety and operation. The goal of the standard is to provide consumers with a measure of confidence in the quality of small wind turbine products meeting this standard and an improved basis for comparing the performance of competing products.
## North American Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWEA 9.1</td>
<td>Small Wind Turbine Safety and Performance</td>
</tr>
<tr>
<td>UL 1004-1, -2, -4; CSA C22. No 100</td>
<td>Generator and Motor</td>
</tr>
<tr>
<td>IEC 61400-2</td>
<td>Design reqts. for small wind turbines</td>
</tr>
</tbody>
</table>
International Standards Cont.

- **UL6141**  Proposed Standard for Wind turbine converter products and assemblies
- **UL6142**  Proposed Standard for Safety for Wind Turbine Generating Systems - Small
- **IEEE 1547**  Standard for Interconnecting Distributed Resources with Electric Power Systems
References

http://www.nrel.gov/wind/international_research.html
http://www.intertek.com/wind/small/
http://www.awea.org/_cs_upload/learnabout/small
wind/4423_1.pdf
NOISE

Guess which one produces more noise...

NO WIND TURBINES

NIMBY!
What makes a small wind turbines quiet

- Airfoils specifically designed for low noise
- Very low max RPM – about 320
- Slot-less alternator technology
- Electronic stall regulation prevents loud sound in high wind
- Specially designed blades reduce tower shadow induced sound

Most small wind turbines produce up to 45-65 DB (less than the average AC unit)
## Typical sound pressure levels in dBA

<table>
<thead>
<tr>
<th>Source</th>
<th>Dist. from source</th>
<th>dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td></td>
<td>140</td>
</tr>
<tr>
<td>Jet engine</td>
<td>200 ft/61 m</td>
<td>120</td>
</tr>
<tr>
<td>Jackhammer</td>
<td>200 ft/61 m</td>
<td>120</td>
</tr>
<tr>
<td>Freight train</td>
<td>100 ft/30 m</td>
<td>70</td>
</tr>
<tr>
<td>Vacuum cleaner</td>
<td>10 ft/3 m</td>
<td>70</td>
</tr>
<tr>
<td>Freeway</td>
<td>100 ft/30 m</td>
<td>70</td>
</tr>
<tr>
<td>Large transformer</td>
<td>200 ft/61 m</td>
<td>55</td>
</tr>
<tr>
<td>Wind in trees</td>
<td>40 ft/12 m</td>
<td>55</td>
</tr>
<tr>
<td><strong>Small wind turbine</strong></td>
<td></td>
<td><strong>45-65</strong></td>
</tr>
<tr>
<td>Light traffic</td>
<td>100 ft/30 m</td>
<td>50</td>
</tr>
<tr>
<td>Average home</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Soft whisper</td>
<td>5 ft/2 m</td>
<td>30</td>
</tr>
<tr>
<td>Quiet bedroom</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Threshold of hearing</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Reference: Windpower, Gipe 2004, pg. 286
Recommendations

All zoning regulations should specify a noise level. The decibel level should be less than 55 at the property line.

It is a good idea to periodically allow the turbine to exceed noise levels only during extreme (winds above 30 mph) wind events.
Safety

- Current design standard is IEC 61400-2
- All grid tied inverter based wind turbines must be certified to UL-1741 and IEE-1547
Safety Recommendations

1) Provisions preventing tower climbing
2) Turbine should be certified to a national or international standard
3) All wires must be buried and connected in accordance to NEC
4) Visible external disconnect (generally a utility requirement)
Aesthetics

Small wind turbines of today are becoming smaller and less noticeable. There has never been a case where a wind turbine, large or small has impacted home values.

DESIGN OBJECTIVES OF SMALL WIND

- Not be noticed (blends in)
- Pleasing appearance
- Conforms to environment (such as a light pole)
- Operates quietly
- Can be easily purchased and installed and performs as a home appliance
An ugly fence dividing N. and S. Korea
• Color selection to blend in with skyline.
• Replace nacelle covers and nose cones.
Windvertising

- The Windvertising platform enables advertisements to be placed on WePOWER's PacWind turbines. Each of the turbine's air foil blades reflect an image, and as the blades spin, the images appear to move' essentially creating an animated ad.
Recommendations

- Neutral colors that blend into the environment
- Non reflective paints
- Route power cables below ground
- Advertising?
Neighborhood Relationships

- Talk to neighbors well before construction begins so they feel consulted rather than pressured into supporting you.
- Have fact sheets, pictures, and information for their review.
Sample Letter to Neighbors

Communicating with your neighbors about your plans to install a residential wind generator is a courtesy that can prevent misperceptions. A short letter like the one below will address most concerns and pre-empt questions about the technology.

Dear Neighbor,
You may be interested to learn that I plan to install a small wind energy system on my property at [address]. This modern, non-polluting system will generate electricity for my own use, reducing my dependence on the local utility. Any excess generation will be supplied to the utility system.

I plan to install a [generator make and model] that will be mounted on a [height] feet wind generator tower, set back [#] feet from the street and [#] feet from my [north/east/south/west] property line. This generator uses a [two/three] bladed propeller [#] feet in diameter. It does not turn until the wind speed reaches at least [#] mph.

On calm, quiet days the generator will not likely be audible. When the rotor is turning, the sound of the wind passing over the blades will register about [#] decibels (dBA) at a distance of [#] feet, which will barely be audible from neighboring residences over other sounds caused by the wind.

[Manufacturer] has installed [#] of [generator make and model] in the United States [and overseas]. They have a proven track record of producing quiet, clean energy. If you have any questions about the proposed installation, please feel free to contact me.

courtesy of Southwest Windpower, Inc
Federal Aviation Administration
Aircraft

- U.S. laws mandate that obstructions within one mile of an airport or when the height of the tower plus one blade length exceeds 200 ft. must be registered with the Federal Aviation Administration (FAA).
- The turbine is noted on aviation maps.
- Flashing lights or red and white paint on turbine may be required.
CFR Title 14 Part 77.9

- States that any person/organization who intends to sponsor any of the following construction or alterations must notify the Administrator of the FAA:
- Any construction or alteration exceeding 200 ft. above ground level
CFR Title 14 Part 77.9 (cont’d)

• Any construction or alteration:
  • Within 20,000 ft of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 ft
  • Within 10,000 ft of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway more than 3,200 ft
  • Within 5,000 ft of a public use heliport which exceeds a 25:1 surface
CFR Title 14 Part 77.9 (cont’d)

- Any highway, railroad or other traverse way whose prescribed adjusted height would exceed the above noted standards
- When requested by the FAA
- Any construction or alteration located on a public use airport or heliport regardless of height or location
FAA wind turbine FAQ’s

National Agricultural Aviation Assn. (crop dusters) have issues with <200 feet towers. They are proposing that states adopt regulations for short towers.
Idaho Power and Renewable Energy

Net Metering Frequently asked questions
What is net metering?

Net metering is a program that allows customers to generate power on their property and connect it to a utility’s power system. The electric meter “spins” backwards, providing a credit for energy produced against charges for energy used. Systems connected to the grid are referred to as “interconnected.”
What type of generation is allowed under the Net Metering tariff?

Idaho Power’s Net Metering program is restricted to wind, solar, hydro, biomass and fuel cell technologies. Other renewable technologies may be included in the future.
Is there a limit to the size of generation from the customer?

Yes. For residential and small commercial customers, generation is limited to 25 kW of nameplate generation or less. Other rate classes can connect higher levels but under different requirements and rate structures. Contact Idaho Power for more information.
Are there any costs involved to go on the Net Metering tariff?

Yes. There is a $100 application fee for processing, project review, the connections, and review of the lines and transformers. If the project requires upgrades to Idaho Power equipment, the applicant also will pay those costs.
Idaho Power Requires UL listed inverters and Equipment.

UL is the Underwriters Laboratories, the standard in safety.

Bad Ideas
Grid tie inverters are an important part of a wind and solar system. They are used for converting 12-24 VDC to a usable ~120 VAC at 60 hertz. The internet is full of cheaper units that would work. Inverters such as the Xantrex Cost ~$1,034.00 as opposed to the plug-n-play option of ~$300.00, These should be not be used to a grid connect a house as they **do not guarantee against “islanding”**
Islanding refers to the condition in which a inverter continues to power a location even though electrical grid power from the electric utility is no longer present. Islanding can be dangerous to utility workers, who may not realize that a circuit is still powered. For that reason, Inverters must detect a “Black Out” and immediately stop producing power.
Conclusion

A friendly residential-wind zoning ordinance will:
- Give people an option to produce their own electricity
- Increase jobs in the community
- Protect citizens from increasing cost of electricity
- Reduce strain on electrical infrastructure
- A well written standard should be flexible and change as confidence grows with small wind systems
  - Tower heights
  - Setbacks
  - Units allowed on a property

Utility crew and students installing a Skystream as part of the U.S. DOE “Wind for Schools” educational program
Slides courtesy of:

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Questions?