

# Wind Power: Resource Assessment



## Wind Power on the Community Scale

Community  
Wind Power  
Fact Sheet #

5

### RERL—MTC Community Wind Fact Sheet Series

In collaboration with the Massachusetts Technology Collaborative's Renewable Energy Trust Fund, the Renewable Energy Research Laboratory brings you this series of fact sheets about Wind Power on the community scale:

1. Technology
  2. Performance
  3. Impacts & Issues
  4. Siting
  5. Resource Assessment
  6. Wind Data
  7. Permitting
- Case Studies

## Why assess wind resource?

The amount of power in the wind is very dependent on the speed of the wind. Because the power in the wind is proportional to the cube of the wind speed, small differences in the wind speed make a big difference in the power you can make from it. A 10% difference in speed makes about a 33% change in power.

This gives rise to the primary reason for wind resource assessment. In order to more accurately predict the potential benefits of a wind power installation, wind speeds and other characteristics of a site's wind regime must be accurately understood.

There are also important technical reasons for studying a site's wind characteristics. Wind speeds, wind shear, turbulence and gust intensity all need to be specified when procuring a wind turbine, designing its foundation, etc.

This fact sheet introduces wind assessment methods and technologies. See Fact Sheet #6, "Interpreting Your Wind Resource Data" for more information on wind data itself.

## How to assess wind resource

Typically, wind is measured at a height of at least 40 m (131') for a year or more. Equipment designed specifically for wind power is used — weather stations are not sufficient.

*Anemometers on a tower:* Meteorological towers, or "met towers" are the most common and cost effective method. The height of the met tower depends on the topography and nearby trees.

*SODAR:* a Sonic Detection And Ranging device produces detailed profiles of wind speeds and directions up to hundreds of feet above ground, which is useful, for instance, for understanding wind shear, i.e. how wind speeds vary with height. Because of its expense, SODAR is

generally not used for a full year at a single proposed wind site, but when needed, is used for a shorter time and compared with longer term data from anemometers.



A met tower and a SODAR

*Wind Maps:* computer models can be used to predict annual average wind speed and maps created by these programs, like TrueWind Solutions' maps, are useful as a screening tool for potential wind power sites. However, these maps do not eliminate the need for more precise and thorough wind data collection.

### Inside this Edition: Resource

Why assess wind resource	p. 1
How to assess wind resource	p. 1
Must the met tower go in the same place as the wind turbine?	p. 1
Met towers & anemometry	p. 2
Siting a met tower	p. 2
For more information	p. 2

## Must the met tower be in the same place as the wind turbine?

Ideally, wind is measured at the exact spot and hub-height of the proposed wind turbine. Realistically, this precision is not usually possible. First, wind is measured at a different height, because most turbine towers are taller than standard met towers.

Second, met towers have different siting requirements than turbines, so they may not be able to fit in

the same area. In practice, the data will need some amount of extrapolation. If sufficient data are available, computer models that consider terrain can be used to extrapolate wind speeds measured at the met tower in one place, to a nearby turbine location.

# Renewable Energy Research Laboratory

University of Massachusetts at Amherst



160 Governors Drive  
Amherst, MA 01003  
413-545-4359  
rerl@ecs.umass.edu  
[www.ceere.org/rerl/](http://www.ceere.org/rerl/)



Mass. Technology Collaborative  
Mass. Renewable Energy Trust  
75 North Drive  
Westborough, MA 01581  
508-870-0312  
[www.mtpc.org/RenewableEnergy/index.htm](http://www.mtpc.org/RenewableEnergy/index.htm)



*Anemometer & vane in the field.*

## Met towers & anemometry

### Towers:

The most common equipment is a 40 or 50-meter met tower supported by guy wires. This type of tower is a temporary structure. No foundation is required.

In some cases, anemometers can be mounted on existing cell phone towers, although this is not necessarily easy; the instruments must be mounted on long enough booms to minimize “tower shadow” effects, i.e. disturbances in the wind caused by the obstruction. Depending on the cell tower type, a sensor might need to be as far away as 7 times the tower diameter to maintain an error of under 1%. This may result in long and heavy booms.

### Instruments:

A cup anemometer & a direction vane designed for wind power applications are pictured here. The turning speed of the anemometer indicates the wind speed, and the direction of the vane indicates wind direction.



*Anemometer & vane (NRG Systems)*

### Data Logger:

The instruments send low-voltage electrical signals to a data recorder at the base of the tower, where ten-minute averages of the speeds and direction are recorded in memory. Some loggers are equipped with internal cell phones that can send the data back to a computer modem; in others, the data-card is swapped out and brought back the office to collect the data.

## Siting a met tower

Ideally, wind is measured for at least a year at the proposed site of the wind turbine, using a met tower. Met towers have different siting requirements than do wind turbines, and occasionally the met tower is not put in the same place as the proposed wind turbine site.

The typical 40 and 50-meter (131’ and 164’) met towers are temporary and transportable. A tower consists of a small base plate that sits on the ground and nested 10-foot sections of 6” or 8” diameter tubing. The tower is supported by guy wires which are held by anchors into the ground. The land must be cleared of trees and shrubs. There must not be any electrical or telephone wires within a distance of 1.5 times the tower height.

Minimum clearing required is given in the following table. More clear space is preferable.

Tower Height	Minimum D (Guy diameter)	Minimum L (Space to lay the tower down)
40 meter (131’)	160 feet	135 feet
50 meter (164’)	240 feet	165 feet

To get a feeling for these sizes, compare them to a football field, 160’ x 300’.

Some towns require building permits or zoning variances for temporary towers, while others do not.

## For More Information

### About Wind Data:

Danish Wind Industry Association: [www.windpower.org/en/tour/wres/index.htm](http://www.windpower.org/en/tour/wres/index.htm)

US Dept. of Energy: [http://www.eere.energy.gov/windandhydro/windpoweringamerica/ne\\_building\\_resource.asp](http://www.eere.energy.gov/windandhydro/windpoweringamerica/ne_building_resource.asp)

See also Fact Sheet 5, “Interpreting Your Wind Resource Data” and the rest of this fact sheet series: [www.ceere.org/rerl/about\\_wind](http://www.ceere.org/rerl/about_wind)

### Wind Data on the Web:

TrueWind’s New England map: [truewind.teamcamelot.com/ne/](http://www.truewind.teamcamelot.com/ne/)

MTC’s work with TrueWind: <http://www.>

[masstech.org/RenewableEnergy/green\\_power/ProjectReportWind1.pdf](http://masstech.org/RenewableEnergy/green_power/ProjectReportWind1.pdf)

### Met Tower & Instrument Manufacturers:

NRG: [www.nrgsystems.com/](http://www.nrgsystems.com/)

Second Wind: [www.secondwind.com/](http://www.secondwind.com/)

### SODAR Manufacturers:

ART: [www.sodar.com/](http://www.sodar.com/)

Aerovironment: [www.aerovironment.com/](http://www.aerovironment.com/)

Wind Energy Explained: Theory, Design and Application, Manwell, McGowan, & Rogers, Wiley, 2002