

Wind Resource

The national wind resource assessment of the United States was created for the U.S. Department of Energy in 1986 by the Pacific Northwest Laboratory and is documented in the *Wind Energy Resource Atlas of the United States*, October 1986. The atlas can be viewed on the Internet at <http://rredc.nrel.gov/wind/pubs/atlas/>.

The wind resource assessment was based on surface wind data, coastal marine area data and upper-air data, where applicable. In data-sparse areas, three qualitative indicators of wind speed or power were used when applicable: topographic/meteorological indicators (e.g. gorges, mountain summits, sheltered valleys); wind deformed vegetation; and eolian landforms (e.g. playas, sand dunes). The data was evaluated at a regional level to produce 12 regional wind resource assessments, the regional assessments were then incorporated into the national wind resource assessment.

The conterminous United States was divided into grid cells 1/4 degree of latitude by 1/3 degree of longitude. Each grid cell was assigned a wind power class ranging from 1 to 6, with 6 being the windiest. The wind power density limits for each wind power class is shown in Table 1-1. Each grid cell contains sites of varying power class. The assigned wind power class is representative of the range of wind power densities likely to occur at exposed sites within the grid cell. Hilltops, ridge crests, mountain summits, large clearings, and other locations free of local obstruction to the wind are expected to be well exposed to the wind. In contrast, locations in narrow valleys and canyons, downwind of hills or obstructions, or in forested or urban areas are likely to have poor wind exposure.

Table 1-1 Classes of wind power density at 10 m and 50 m^(a).

Wind Power Class*	10 m (33 ft)		50 m (164 ft)	
	Wind Power Density (W/m ²)	Speed ^(b) m/s (mph)	Wind Power Density (W/m ²)	Speed ^(b) m/s (mph)
1	0	0	0	
2	100	4.4 (9.8)	200	5.6 (12.5)
3	150	5.1 (11.5)	300	6.4 (14.3)
4	200	5.6 (12.5)	400	7.0 (15.7)
5	250	6.0 (13.4)	500	7.5 (16.8)
6	300	6.4 (14.3)	600	8.0 (17.9)
7	400	7.0 (15.7)	800	8.8 (19.7)
	1000	9.4 (21.1)	2000	11.9 (26.6)

(a) Vertical extrapolation of wind speed based on the 1/7 power law.

(b) Mean wind speed is based on Rayleigh speed distribution of equivalent mean wind power density. Wind speed is for standard sea-level conditions. To maintain the same power density, speed increases 3%/1000 m (5%/5000 ft) elevation.

*NOTE: Each wind power class should span two power densities. For example, Wind Power Class = 3 represents the Wind Power Density range between 150 W/m² and 200 W/m². The offset cells in the first column attempt to illustrate this concept.

Areas designated class 3 or greater are suitable for most utility-scale wind turbine applications, whereas class 2 areas are marginal for utility-scale applications but may be suitable for rural applications. Class 1 areas are generally not suitable, although a few locations (e.g., exposed hilltops not shown on the maps) with adequate wind resource for wind turbine applications may exist in some class 1 areas. The degree of certainty with which the wind power class can be specified depends on three factors: the abundance and quality of wind data; the complexity of the terrain; and the geographical variability of the resource. A certainty rating was assigned to each grid cell based on these three factors, and is included in the *Wind Energy Resource Atlas of the United States*.