



Estimates of Windy¹ Land Area and Wind Energy Potential, by State, for areas \geq 30% Capacity Factor at 80m



February 4, 2010 (updated April 13, 2011 to add Alaska and Hawaii)

These estimates show, for each of the 50 states and the total U.S., the windy land area with a gross capacity factor (without losses) of 30% and greater at 80-m height above ground and the wind energy potential that could be possible from development of the “available” windy land area after exclusions. The “Installed Capacity” shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the “Annual Generation” shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (<http://navigator.awstruewind.com>) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| State | Windy Land Area \geq 30% Gross Capacity Factor at 80m | | | | | Wind Energy Potential | |
|-------------|---|--|------------------------------|----------------------|--------------------------------|--------------------------------------|-------------------------|
| | Total (km ²) | Excluded ² (km ²) | Available (km ²) | Available % of State | % of Total Windy Land Excluded | Installed Capacity ³ (MW) | Annual Generation (GWh) |
| Alabama | 80.4 | 56.7 | 23.6 | 0.02% | 70.6% | 118.2 | 333 |
| Alaska | 412,610.7 | 313,670.1 | 98,940.6 | 6.57% | 76.0% | 494,702.9 | 1,620,792 |
| Arizona | 4,545.0 | 2,364.1 | 2,180.8 | 0.74% | 52.0% | 10,904.1 | 30,616 |
| Arkansas | 4,663.2 | 2,823.2 | 1,840.1 | 1.34% | 60.5% | 9,200.3 | 26,906 |
| California | 26,901.3 | 20,079.2 | 6,822.0 | 1.67% | 74.6% | 34,110.2 | 105,646 |
| Colorado | 95,830.4 | 18,386.5 | 77,443.9 | 28.73% | 19.2% | 387,219.5 | 1,288,490 |
| Connecticut | 31.4 | 26.1 | 5.3 | 0.04% | 83.1% | 26.5 | 73 |
| Delaware | 36.6 | 34.7 | 1.9 | 0.04% | 94.8% | 9.5 | 26 |
| Florida | 9.6 | 9.5 | 0.1 | 0.00% | 99.2% | 0.4 | 1 |
| Georgia | 281.3 | 255.3 | 26.0 | 0.02% | 90.7% | 130.1 | 380 |
| Hawaii | 4,537.0 | 3,884.0 | 653.0 | 3.91% | 85.6% | 3,264.9 | 12,363 |
| Idaho | 13,420.4 | 9,805.3 | 3,615.1 | 1.67% | 73.1% | 18,075.6 | 52,118 |
| Illinois | 70,763.6 | 20,787.1 | 49,976.4 | 34.25% | 29.4% | 249,882.1 | 763,529 |
| Indiana | 46,255.2 | 16,609.7 | 29,645.5 | 31.63% | 35.9% | 148,227.5 | 443,912 |
| Iowa | 134,900.1 | 20,757.3 | 114,142.8 | 78.32% | 15.4% | 570,714.2 | 2,026,340 |
| Kansas | 211,861.3 | 21,387.1 | 190,474.2 | 89.38% | 10.1% | 952,370.9 | 3,646,590 |
| Kentucky | 48.7 | 36.6 | 12.1 | 0.01% | 75.1% | 60.6 | 173 |
| Louisiana | 125.5 | 43.6 | 82.0 | 0.07% | 34.7% | 409.8 | 1,100 |
| Maine | 6,026.5 | 3,776.2 | 2,250.2 | 2.69% | 62.7% | 11,251.2 | 33,779 |



Estimates of Windy¹ Land Area and Wind Energy Potential, by State, for areas \geq 30% Capacity Factor at 80m



February 4, 2010 (updated April 13, 2011 to add Alaska and Hawaii)

These estimates show, for each of the 50 states and the total U.S., the windy land area with a gross capacity factor (without losses) of 30% and greater at 80-m height above ground and the wind energy potential that could be possible from development of the “available” windy land area after exclusions. The “Installed Capacity” shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the “Annual Generation” shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (<http://navigator.awstruewind.com>) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| State | Windy Land Area \geq 30% Gross Capacity Factor at 80m | | | | | Wind Energy Potential | |
|----------------|---|--|------------------------------|----------------------|--------------------------------|--------------------------------------|-------------------------|
| | Total (km ²) | Excluded ² (km ²) | Available (km ²) | Available % of State | % of Total Windy Land Excluded | Installed Capacity ³ (MW) | Annual Generation (GWh) |
| Maryland | 567.7 | 271.1 | 296.6 | 1.18% | 47.8% | 1,482.9 | 4,269 |
| Massachusetts | 1,709.0 | 1,503.4 | 205.6 | 0.99% | 88.0% | 1,028.0 | 3,323 |
| Michigan | 19,761.3 | 7,952.9 | 11,808.5 | 7.85% | 40.2% | 59,042.3 | 169,221 |
| Minnesota | 121,884.7 | 24,030.6 | 97,854.1 | 44.83% | 19.7% | 489,270.6 | 1,679,480 |
| Mississippi | 0.0 | 0.0 | 0.0 | 0.00% | N/A | 0.0 | 0 |
| Missouri | 69,676.8 | 14,805.8 | 54,871.0 | 30.39% | 21.2% | 274,355.1 | 810,619 |
| Montana | 232,768.6 | 43,967.7 | 188,800.9 | 49.60% | 18.9% | 944,004.4 | 3,228,620 |
| Nebraska | 199,627.8 | 16,028.0 | 183,599.7 | 91.64% | 8.0% | 917,998.7 | 3,540,370 |
| Nevada | 5,873.6 | 4,424.2 | 1,449.4 | 0.51% | 75.3% | 7,247.1 | 20,823 |
| New Hampshire | 1,663.8 | 1,236.8 | 427.1 | 1.78% | 74.3% | 2,135.4 | 6,706 |
| New Jersey | 280.8 | 254.5 | 26.4 | 0.14% | 90.6% | 131.8 | 373 |
| New Mexico | 111,445.8 | 13,029.1 | 98,416.7 | 31.25% | 11.7% | 492,083.3 | 1,644,970 |
| New York | 17,705.8 | 12,549.6 | 5,156.3 | 4.10% | 70.9% | 25,781.3 | 74,695 |
| North Carolina | 1,155.6 | 994.1 | 161.5 | 0.13% | 86.0% | 807.7 | 2,395 |
| North Dakota | 182,374.6 | 28,335.4 | 154,039.2 | 84.25% | 15.5% | 770,195.8 | 2,983,750 |
| Ohio | 17,189.9 | 6,205.9 | 10,983.9 | 10.28% | 36.1% | 54,919.7 | 151,881 |
| Oklahoma | 123,243.6 | 19,879.2 | 103,364.4 | 57.10% | 16.1% | 516,822.1 | 1,788,910 |
| Oregon | 17,109.8 | 11,689.7 | 5,420.1 | 2.16% | 68.3% | 27,100.3 | 80,855 |
| Pennsylvania | 2,123.5 | 1,462.1 | 661.4 | 0.56% | 68.9% | 3,307.2 | 9,673 |



Estimates of Windy¹ Land Area and Wind Energy Potential, by State, for areas \geq 30% Capacity Factor at 80m



February 4, 2010 (updated April 13, 2011 to add Alaska and Hawaii)

These estimates show, for each of the 50 states and the total U.S., the windy land area with a gross capacity factor (without losses) of 30% and greater at 80-m height above ground and the wind energy potential that could be possible from development of the “available” windy land area after exclusions. The “Installed Capacity” shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the “Annual Generation” shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (<http://navigator.awstruewind.com>) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| State | Windy Land Area \geq 30% Gross Capacity Factor at 80m | | | | | Wind Energy Potential | |
|----------------|---|--|------------------------------|----------------------|--------------------------------|--------------------------------------|-------------------------|
| | Total (km ²) | Excluded ² (km ²) | Available (km ²) | Available % of State | % of Total Windy Land Excluded | Installed Capacity ³ (MW) | Annual Generation (GWh) |
| Rhode Island | 74.0 | 64.7 | 9.3 | 0.35% | 87.4% | 46.6 | 153 |
| South Carolina | 102.8 | 65.8 | 37.0 | 0.05% | 64.0% | 185.0 | 504 |
| South Dakota | 193,828.3 | 17,345.8 | 176,482.5 | 88.36% | 8.9% | 882,412.4 | 3,411,690 |
| Tennessee | 359.9 | 298.1 | 61.9 | 0.06% | 82.8% | 309.3 | 900 |
| Texas | 435,638.6 | 55,332.7 | 380,305.9 | 55.54% | 12.7% | 1,901,529.7 | 6,527,850 |
| Utah | 5,273.6 | 2,652.8 | 2,620.7 | 1.19% | 50.3% | 13,103.7 | 37,104 |
| Vermont | 2,569.6 | 1,979.8 | 589.7 | 2.39% | 77.0% | 2,948.7 | 9,163 |
| Virginia | 1,567.2 | 1,208.5 | 358.7 | 0.35% | 77.1% | 1,793.3 | 5,395 |
| Washington | 11,932.6 | 8,236.9 | 3,695.7 | 2.12% | 69.0% | 18,478.5 | 55,550 |
| West Virginia | 1,495.2 | 1,118.6 | 376.6 | 0.60% | 74.8% | 1,883.2 | 5,820 |
| Wisconsin | 30,228.8 | 9,477.3 | 20,751.4 | 14.29% | 31.4% | 103,757.1 | 300,136 |
| Wyoming | 146,166.2 | 35,751.7 | 110,414.5 | 43.58% | 24.5% | 552,072.6 | 1,944,340 |
| U.S. Total | 2,988,328 | 796,945 | 2,191,382 | 22.36% | 26.7% | 10,956,912 | 38,552,706 |

¹ NREL’s wind potential estimates were based on maps produced by AWS Truewind using their MesoMap® system.

² Excluded lands include protected lands (national parks, wilderness, etc.), incompatible land use (urban, airports, wetland, and water features), and other considerations. See Table 1 for full listing.

³ Assumes 5 MW/km² of installed nameplate capacity

| Wind Resource Exclusions | |
|---|---|
| Criteria for Defining Available Windy Land (numbered in the order they are applied): | |
| <i>Environmental Criteria</i> | <i>Data/Comments:</i> |
| 2) 100% exclusion of National Park Service and Fish and Wildlife Service managed lands | USGS Federal Lands shapefile, Dec 2005 |
| 3) 100% exclusion of federal lands designated as park, wilderness, wilderness study area, national monument, national battlefield, recreation area, national conservation area, wildlife refuge, wildlife area, wild and scenic river or inventoried roadless area. | USGS Federal Lands shapefile, Dec 2005; Inventoried Roadless Areas, 2004; BLM Areas of Critical Environmental Concern (2008) |
| 4) 100% exclusion of state and private lands equivalent to criteria 2 and 3, where GIS data is available. | State/GAP land stewardship data management status 1, from Conservation Biology Institute Protected Lands database, 2004 |
| 7) 50% exclusion of remaining USDA Forest Service (FS) lands (incl. National Grasslands) except ridgecrests | USGS Federal Lands shapefile, Dec 2005 |
| 8) 50% exclusion of remaining Dept. of Defense lands except ridgecrests | Military Lands boundary files, internal dataset (2007) |
| 9) 50% exclusion of state forest land, where GIS data is available | State/GAP land stewardship data management status 2, from Conservation Biology Institute Protected Lands database, 2004 |
| <i>Land Use Criteria</i> | |
| 5) 100% exclusion of airfields, urban, wetland and water areas. | USGS North America Land Use Land Cover (LULC), version 2.0, 1993; ESRI airports and airfields (2006); U.S. Census Urbanized Areas (2000 and 2003) |
| 10) 50% exclusion of non-ridgecrest forest | Ridge-crest areas defined using a terrain definition script, overlaid with USGS LULC data screened for the forest categories. |
| <i>Other Criteria</i> | |
| 1) Exclude areas of slope > 20% | Derived from 90 m national elevation dataset. |
| 6) 100% exclude 3 km surrounding criteria 2-5 (except water) | Merged datasets and buffer 3 km |
| Note - 50% exclusions are not cumulative. If an area is non-ridgecrest forest on FS land, it is just excluded at the 50% level one time. | |