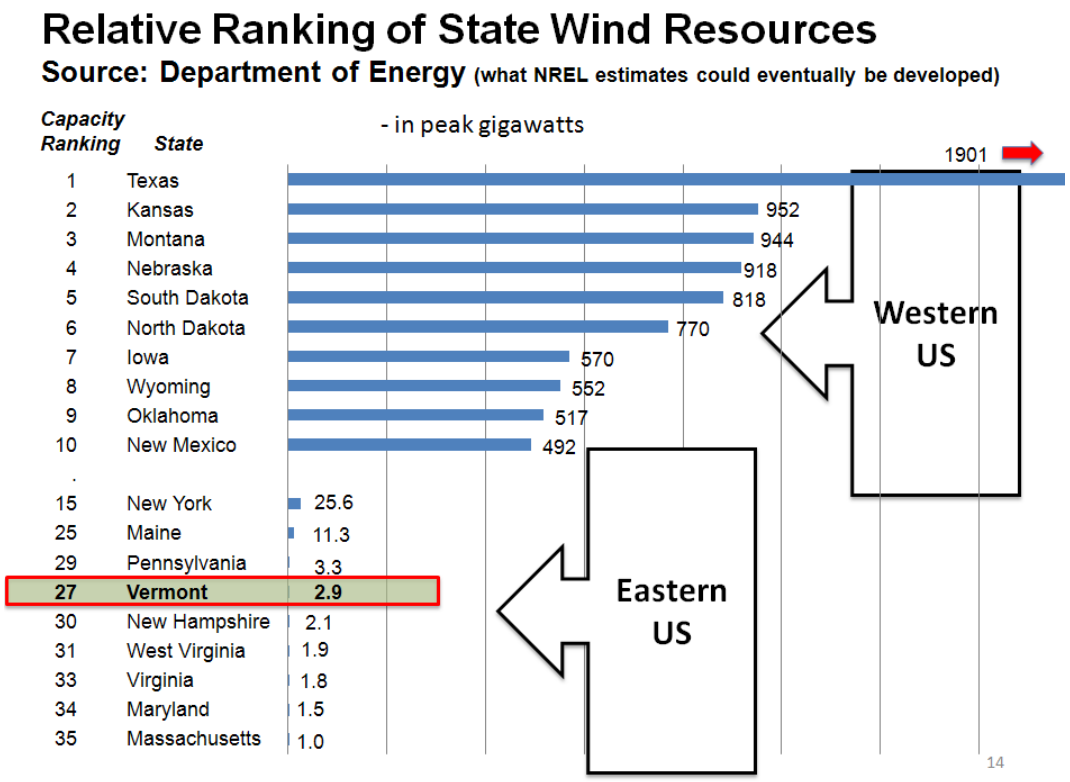
Resource Comparison of Eastern US Wind and Solar Power Resources

Prepared by Ben Luce, Assistant Professor of Physics
Renewable Energy Research Program, Lyndon State College. Email: ben.luce@lyndonstate.edu.

Renewable Energy policy decisions are likely to be most effective and beneficial when based on a comprehensive, objective, and scientific evaluation of renewable energy resources, potential environmental impacts, and cost and technology trend information. This short summary is intended to facilitate this process, specifically with respect to resource considerations.

Perhaps surprisingly to many, Department of Energy estimates of wind resources demonstrate that the onshore wind resources of the Eastern US are essentially negligible on the scale of national electricity consumption: The rankings below show NREL's (National Renewable Energy Lab) estimate of developable wind resources in the top ten western states, and then for *all* of the states in the Eastern US that have at least 1 gigawatt of potential (according to NREL):



The total for the Eastern States listed above is 52 gigawatts (more than half of which is in New York State). Even if all of this potential was realized, the amount of total US electricity generation offset would be less than 4%. This follows by first multiplying this figure by the "capacity factor" for wind that NREL used (.3) to take into account the intermittency of the resource, and then dividing by the average total rate of electricity consumption in the US, which is roughly 470 gigawatts. That is:

52 GW x .3 / 470 GW = .0338 < 4%.

It should also be noted that these NREL estimates are likely seriously overestimated, as they do not take into account myriad local factors, such as local environmental factors. As such they must be considered as only as gross upper estimates of potential capacity. In reality, possibly less than ¼ or even a tenth of this estimate may be achievable.

Wind resources off the East Coast are potentially much larger, but it is not clear yet whether developing this resource is economically, technically, or environmentally viable. It is widely expected that offshore wind development will be quite expensive, and there is in fact no objective, scientific basis yet for asserting the commercial and environmental viability of massive offshore wind development. Some evidence now also exists (e.g. a recent study by Carnegie Mellon engineers) that offshore wind development may be hampered by potential damage to turbines by hurricanes[1].

In contrast to this, the developable solar power resource in the Eastern US completely dwarfs the onshore wind resource. Very conservative estimates by the Department of Energy[2] show that 20% of US electricity demand in general could be met easily with rooftop photovoltaics alone, and much of that resource exists in the East. This is easy to understand, given that a typical home can theoretically produce all of its typical electrical power from a PV system covering a minority fraction of the roof. The assumptions used in the same study clearly indicate that substantially more could be achieved with rooftop PV if installations were more aggressively sized up. Additional ground mounted systems, carports, and larger solar projects, could easily double or triple that number with little or no encroachment on natural habitats, as the additional space is already abundantly available in the form of back yards, parking lots, brown fields, fallow fields, and other appropriate sites.

Data Source for wind resources: NREL data available from www.windpoweramerica.gov. See example below, showing how the number for Massachusetts is obtained from this data:

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Estimates of Windy[1] Land Area and Wind Energy Potential, by State, for areas >= 30% Capacity Factor at 80m

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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).

	Windy Land Area >= 30% Gross Capacity Factor at 80m					Wind Energy Potential	
State	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%	[illegible]	4,269
Massachusetts	1,709.0	1,503.4	205.6	0.99%	88.0%	1,028.0	[illegible]
Michigan	19,761.3	7,952.9	11,808.5	7.85%	40.2%	[illegible]	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

1028 MW
~ 1 GW

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[1] "Quantifying the Hurricane Risk to Offshore Wind Turbines", Stephen Rose, Paulina Jaramillo, Mitchell Small, Iris Grossmann and Jay Apt, Proceedings of the National Academy of Sciences (PNAS), February 13, 2012.
[2] http://www.nrel.gov/docs/fy09osti/44073.pdf