Comparison of Cape Wind Scientific Data Tower Wind Speed Data with ISO New England List of Top Ten Electric Demand Days

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Due in part to the Sea Breeze Effect, Cape Wind would have produced an average of 321 megawatts (76% of Cape Wind's total capacity) during the times of greatest electric demand in New England according to the list of Ten Top Demand Days maintained on the website of the electric grid manager, ISO New England. By providing this substantial supply of clean energy during times of greatest electric demand, Cape Wind would improve electric reliability, reduce air pollution, reduce wholesale electricity costs and increase energy independence. Previously, the U.S. Department of Energy also found that Cape Wind would improve electric reliability during extreme cold winter conditions when availability of natural gas to generate electricity is reduced due to increased heating demand.

II. Sea Breeze Effect

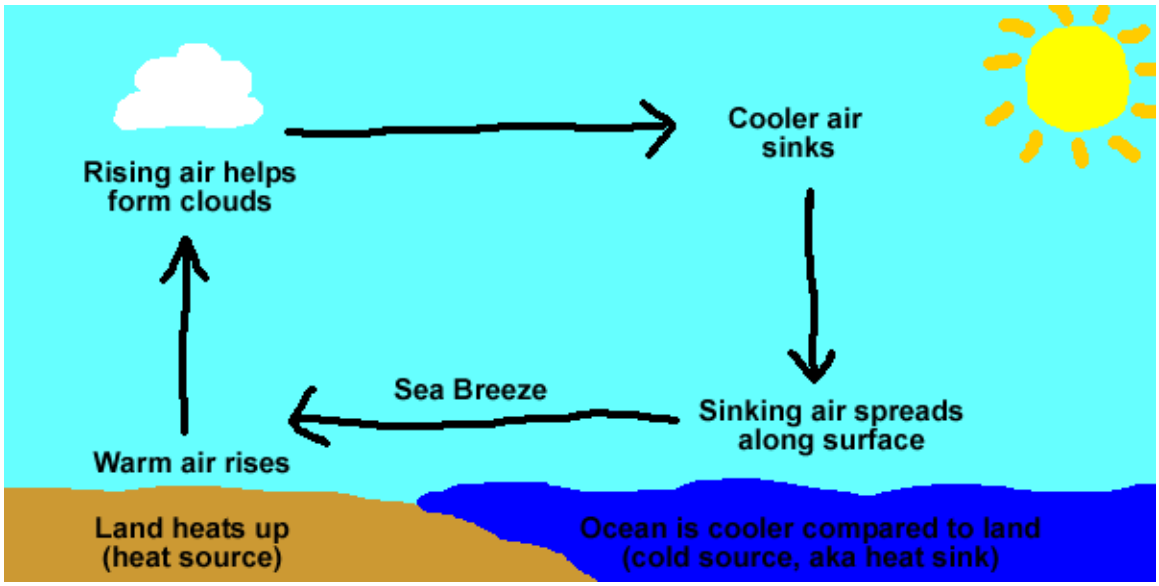

Image Source: National Oceanic & Atmospheric Administration[1]

On hot and sunny summer days in coastal areas it is common for wind speeds to pick up during the afternoon, this is called the Sea Breeze Effect. During hot sunny summer days, the land surface heats up faster than the ocean surface, increasing the difference in the temperature of the air above the land compared with the ocean. This difference in air temperature creates a difference in the density of air over land and ocean which creates a sea breeze.[2]

The Sea Breeze Effect coincides with the time of day that electric demand is at its height.

III. Predictions of Sea Breeze Effect on offshore wind farms in Northeast

Cape Wind's Environmental Notification Form, dated November 15, 2001, contained the following statement, "*Preliminary energy production estimates for the Project suggest that production will coincide with the electricity demands of Cape Cod and the Islands. During the Summer months, production will be greatest during the late afternoon and early evening hours when consumption is at its peak.*"

In 2005, GE Energy Consulting produced a report commissioned by the New York State Energy Research and Development Authority (NYSERDA) entitled, "*The Effects of Integrating Wind Power on Transmission System Planning, Reliability, and Operations*". The NYSERDA Report compared energy production from hypothetical new land-based wind farms in upstate New York and offshore wind farms south of Long Island. The NYSERDA Report found that offshore wind production would have an effective capacity four times higher than land based wind production because "*The higher effective capacity [of offshore sites] is due to the daily wind patterns peaking several hours earlier in the day than the rest of the [land] wind sites and therefore being much more in line with the [electric] load demand.*"[3]

IV. Data Results from Cape Wind Scientific Data Tower

Photo: Cape Wind Scientific Data Tower located on Horseshoe Shoal, Nantucket Sound

In 2002 Cape Wind received a permit from the US Army Corps of Engineers to locate a scientific data tower on Horseshoe Shoal in Nantucket Sound to gather data on oceanographic and atmospheric conditions. This 198' tower has been gathering wind speed and wind direction data continuously from 2003 to the present. This data can be viewed real-time on Cape Wind's website.[4]

The managers of New England's electric grid, the Independent System Operator of New England (ISO-NE) maintain a page on their website titled "*Top Ten Demand Days*", that lists the ten dates that experienced the highest electric demand in the history of New England and what the total New England electric demand was at its height on each of these days.[5]

Table 1, below compares ISO-NE Top Ten Demand Days with analysis from Cape Wind's Scientific Data Tower on what Cape Wind's power production would have been during those times. *Note, Cape Wind would produce 420 megawatts (MW) at full capacity and is expected to produce 182 megawatts in average wind conditions.*

Table 1. Comparison of Cape Wind Scientific Data Tower Wind Speed Data and ISO-NE Top Ten Electric Demand Days

Rank	Date	Time	ISO-NE total NE Demand, MW	Wind Speed Meters per Second	Cape Wind Production, MW
1	8/2/06	2PM	28,127 MW	10.80	339 MW
2	8/1/06	5PM	27,467 MW	10.11	293 MW
3	7/18/06	3PM	27,332 MW	10.78	344 MW
4	8/3/06	2PM	27,122 MW	8.89	201 MW
5	7/27/05	3PM	26,885 MW	12.90	420 MW
6	7/19/05	3PM	26,736 MW	9.37	235 MW
7	7/17/06	5PM	26,727 MW	9.96	281 MW
8	6/27/07	3PM	26,264 MW	12.5	419 MW
9	8/5/05	3PM	25,983 MW	11.84	407 MW
10	7/26/05	5PM	25,555 MW	9.89	276 MW

Cape Wind's average production during the hour of peak electric demand of the Top Ten Demand Days would have been 321 megawatts, 76% of Cape Wind's total production potential, had the offshore wind farm been in operation.

V. Implications of Findings

The addition of an average of 321 megawatts of clean wind energy entering the electric grid at the Barnstable sub-station on Cape Cod during times of greatest electric demand would improve electric reliability, reduce regional pollutant emissions (during times prone to bad air quality), reduce the clearing price of electricity when electricity prices are at their height, and provide the region greater energy independence.

A. Improved Electric Reliability

On August 2, 2006, the record electric demand day in New England, NSTAR was experiencing such tight electric supply on Cape Cod that it requested the emergency backup generators at the Massachusetts Military Reservation to be turned on to free up an additional 2-3 megawatts of electricity.[6] Had Cape Wind been in operation that day it would have been supplying 339 megawatts to that portion of the electric grid, improving electric reliability.

B. Environmental Benefits

Most of these Top Ten Electric Demand Days also coincided with warnings from the EPA of bad air quality. When hot summer conditions coincide with extremely high electric demand, more fossil fueled power generators get turned on, including some of the region's oldest, least-efficient, and most polluting units, increasing the amount of air pollution going into the air. Cape Wind's addition of an average 321 megawatts during these conditions would reduce the need for these inefficient and highly polluting power units to operate, thereby improving air quality.

In approving Cape Wind's application to connect to the Massachusetts electric grid, the Massachusetts Energy Facilities Siting Board noted that, "*Overall, the Siting Board concludes that the air quality benefits of the wind farm are significant and important for Massachusetts and New England*".

Hot summer conditions increase demand for electricity largely due to increased use of air conditioning to keep indoor air temperatures comfortable. An unfortunate irony of this situation is that increased use of air conditioning and the resulting increased electric demand also increases the amount of fossil fuel electric generation that increases the quantity of greenhouse gas emissions responsible for global warming. In the long run, turning up the air conditioning now will make the air hotter in the future, provided the electricity continues to be generated by carbon emitting fossil fuel sources. Clean energy projects like Cape Wind provide needed electricity and reduce emissions of greenhouse gas emissions caused by electric demand. In its recent Certification of the Cape Wind Final Environmental Impact Report, the Massachusetts Executive Office of Environmental Affairs noted that Cape Wind's impact on reducing greenhouse gas emissions was similar to taking 175,000 cars off the road each year.[7]

Cape Wind's production of clean wind power during hot summer conditions also comes without the need to use water. Most electric generation facilities in Massachusetts consume substantial quantities of water even during summer conditions when water shortages exist.

C. Reduced Cost of Wholesale Electricity

Times of greatest electric demand also coincide with some of the highest prices for electricity on the spot wholesale electricity market. These prices are set by the marginal

operating costs of the most expensive units required to operate at any given time. Renewable energy projects, like Cape Wind, reduce the clearing price of electricity in these markets by providing electricity at a very low marginal cost. The Massachusetts Energy Facilities Siting Board estimated that Cape Wind would reduce wholesale electricity costs by $25 million dollars per year in New England by displacing the highest price electric units that would otherwise have needed to operate without Cape Wind.

D. Greater Energy Independence

Unlike coal, oil and natural gas, wind is an indigenous energy resource in Massachusetts and New England that does not need to be imported from other regions and countries. By providing utility-scale wind power, Cape Wind would represent the region's first substantial step toward energy independence.

VI. Cape Wind and Cold Winter Conditions

Cape Wind's production is also strong during the other time of the year when weather conditions can create challenges to electric reliability – extreme cold. New England depends upon natural gas power plants for 40% of its electricity generation. During cold winter conditions demand for natural gas from the heating sector grows and less natural gas is available for generating electricity.

In June, 2004, the US Department of Energy (DOE) prepared a study, *Natural Gas in the New England Region: Implications for Offshore Wind Generation and Fuel Diversity*, that examined a three-day severe cold snap in January, 2004, during which rolling blackout conditions in New England were contemplated by the electric grid manager due to the lack of availability of natural gas for power plants. The DOE study noted that Cape Wind's data tower was reporting the offshore wind farm would have been operating at full capacity during most of that three-day period, improving regional electric reliability.[8]

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[1] http://www.prh.noaa.gov/hnl/kids/seabreeze.gif
[2] http://www.srh.weather.gov/srh/jetstream/ocean/seabreezes.htm
[3] http://www.nyserda.org/publications/wind_integration_report.pdf
[4] http://capewind.whgrp.com/
[5] http://www.iso-ne.com/nwsiss/grid_mkts/demnd_days/index.html
[6] http://www.boston.com/business/technology/articles/2006/08/03/sweating_it_out_at_nstar/
[7] http://www.mass.gov/envir/press/capewind/capewind_sec_remarks.pdf
[8] http://www.capewind.org/downloads/DOE_Wind_Analysis.pdf