

**Comparison of Peak Wind-Energy Production in Central New Mexico
with Peak Electrical Consumption in Arizona and New Mexico**

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Throughout the U.S., state-mandated renewable energy targets are driving the development of renewable electric generation and the large transmission facilities necessary to connect this renewable power to often distant energy markets. The SunZia Southwest Transmission Project proposes to connect wind-generated electricity in New Mexico with energy markets in Arizona and California. This paper demonstrates a negative correlation between peak wind-energy production in New Mexico and peak-energy consumption in Arizona and California. The highest wind-production capacity occurs in New Mexico during the lower-use season for both states, and the lowest wind-generating capacity occurs during the highest-use season for both states.

The following examines monthly New Mexico wind data and how wind speed varies throughout the year, an indicator of potential generating capacity. This analysis is constructed from wind records obtained from New Mexico’s principal airports (Figure 1) and from the Corona Ranch weather station (Figures 2 and 3), which is closest to the area of wind-power generation in New Mexico.

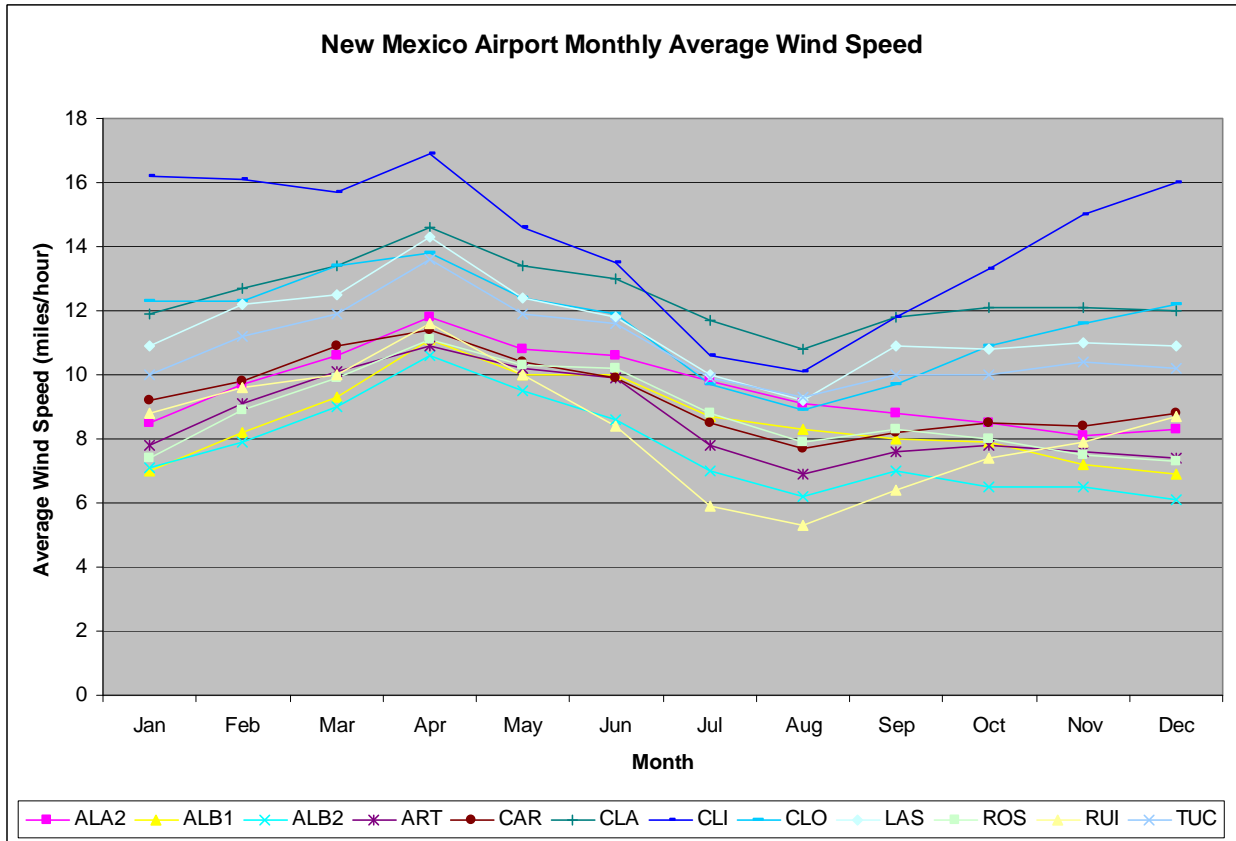


Figure 1. Seasonal wind patterns in New Mexico. Wind speeds are graphed for New Mexico airports east of the Rio Grande River on the plains.¹ The New Mexico wind-generating area is located in the east-central part of the state, so these patterns correlate with seasonal variations of the generation area. (For further data, see accompanying spreadsheet “New Mexico Airport Data.”)

For all airports, April has the highest average wind speed and August has the lowest, although wind speed tends to be fairly flat from August through November. The average drop in wind speed from the high in April to the low in August is about 35%, quite significant.

It is important to understand, however, that wind-powered electrical generation is dependent not on the speed of wind, but on its pressure, and that wind pressure varies as the square of wind speed. In this case, the average drop in pressure (and consequently in potential electrical generation capacity) from April to August is ~56%. For the Corona Ranch area, the drop is 66.5%.

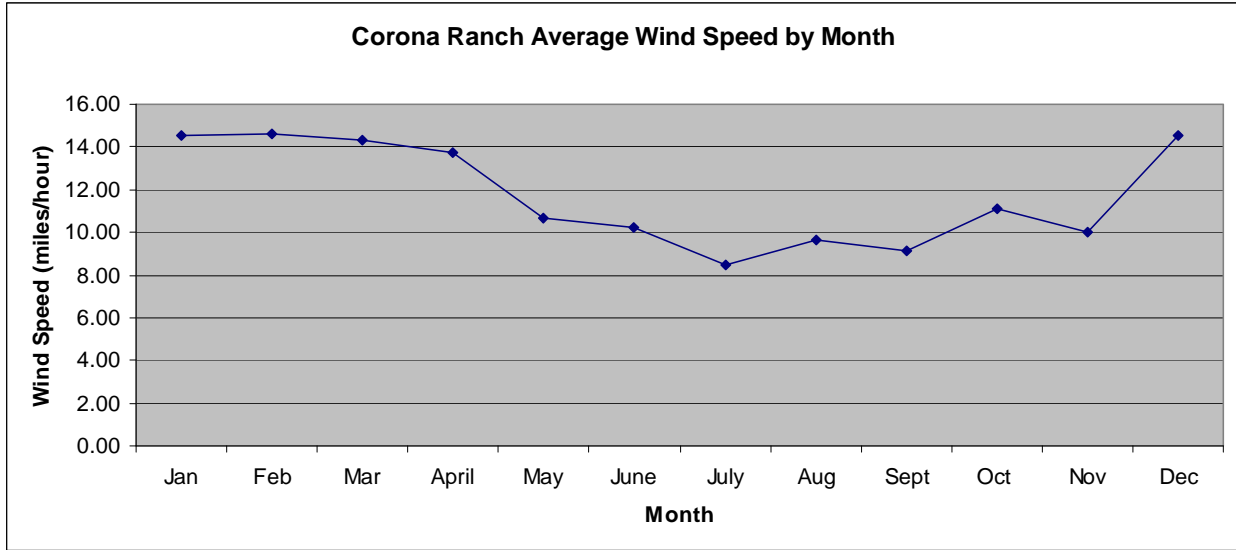


Figure 2. Wind data from the Corona Ranch weather station, the station closest to the area of generation.² Wind data from several years were combined because the data were incomplete for all years. Again, the highest wind speeds occur in the first part of the year, and the lowest wind speeds occur in July, a drop in average speed of ~42%. The resulting drop in pressure (Figure 3) (and consequently in potential electrical generation capacity) is 66.5%. (For further data, see accompanying spreadsheet “New Mexico Airport Data.”)

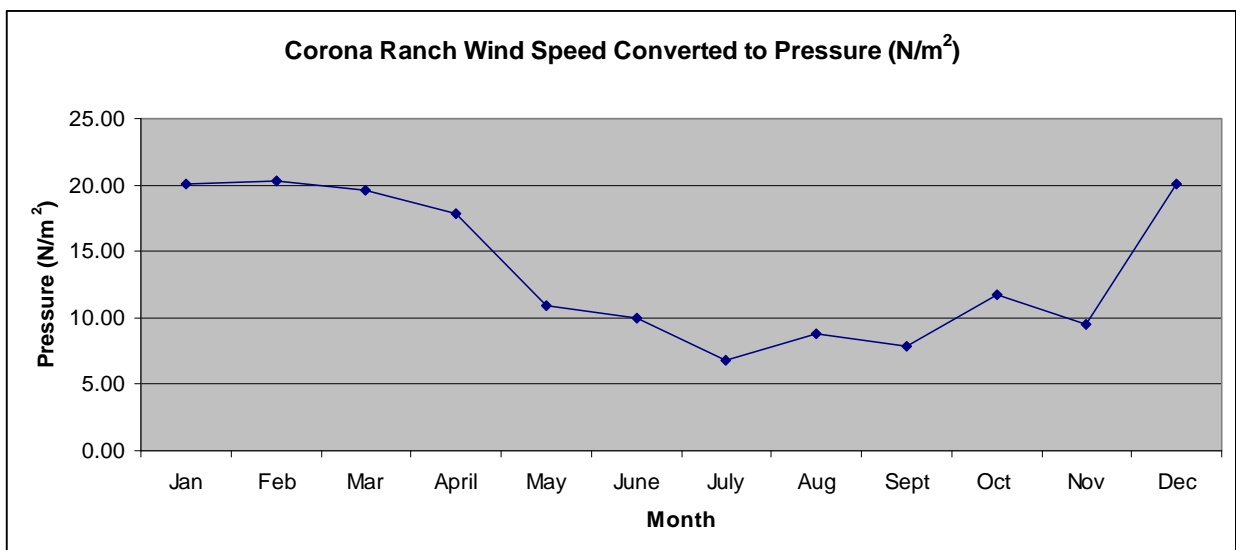


Figure 3. Corona Ranch wind speed converted to pressure, a more accurate reflection of generating capacity.

Although the maximum wind generation months in New Mexico are December through April, Figures 4–7 illustrate that maximum electrical power consumption for Arizona and California occurs during the cooling season, which peaks in mid to late July for Arizona and July/August for California.

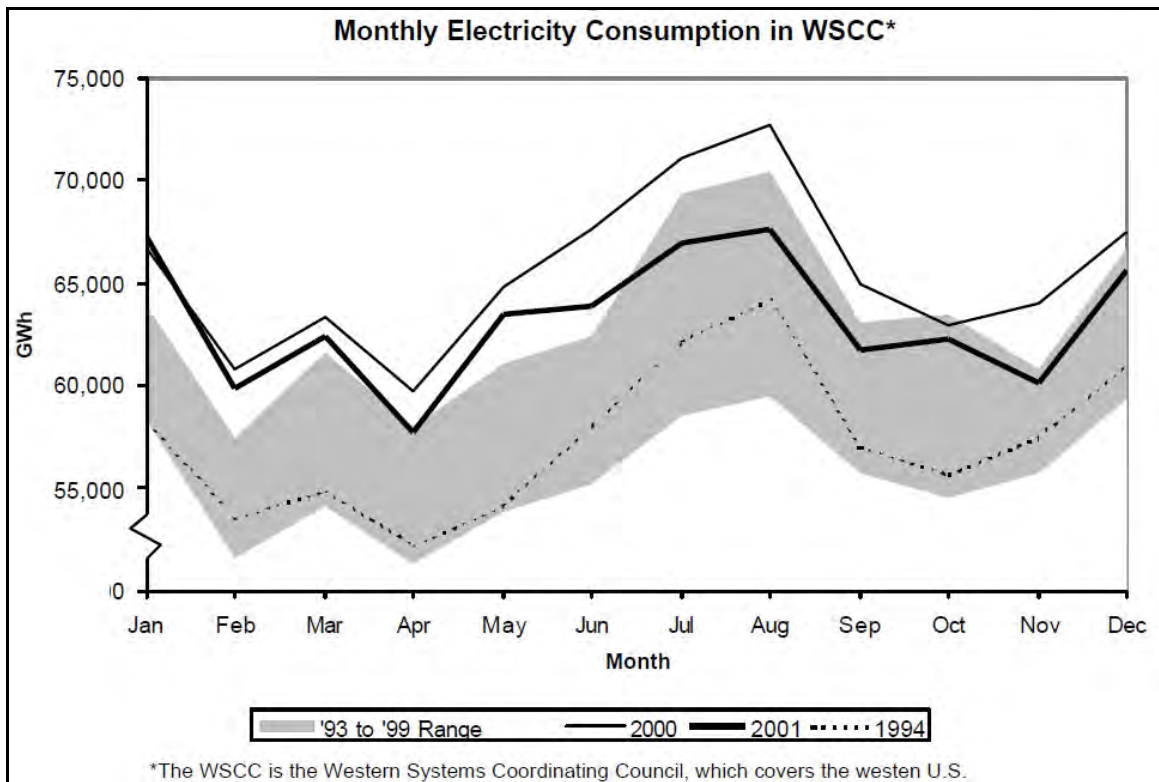


Figure 4. Combined monthly electricity consumption for the four western subsections (California/Mexico, Desert Southwest, Pacific Northwest, Rocky Mountain Region) overseen by the Western Systems Coordinating Council (WSCC).³ This shows that maximum electrical consumption is in July and August, when wind speed is at a minimum in the generating area of New Mexico.

As is apparent from Figure 7, wind-energy production in New Mexico and electrical demand in Arizona are nearly perfectly out of sync, with Arizona’s lowest usage occurring from February to April and its highest usage occurring in mid to late July. Significantly, Figure 7 also illustrates that solar-generated electricity (green line) is much closer to being in sync with demand in southwestern energy markets than wind-generated power is.

This confirms the hypothesis that peak wind-energy production in New Mexico is very much out of sync with peak electrical usage in Arizona and California, with the highest production capacity occurring in New Mexico during the lower-use season for both states, and the lowest generating capacity occurring during the highest-use season for both states. If renewable energy is to eventually provide a significant portion of energy demand, it would seem best to develop transmission networks that link areas having coordinated cycles of energy production and demand.

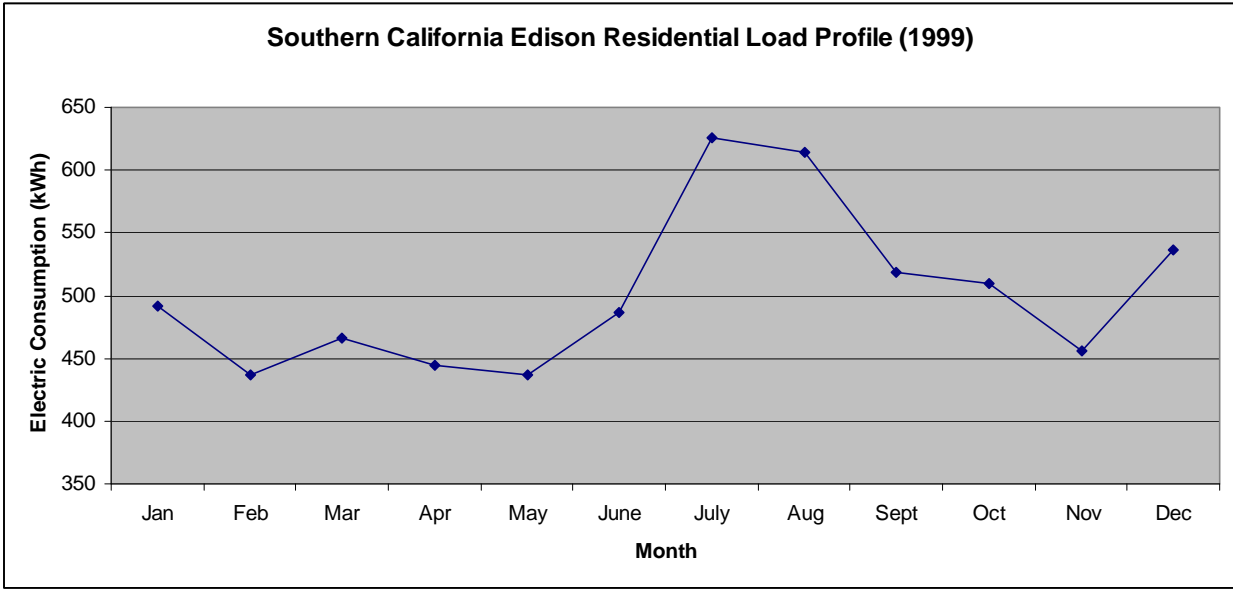
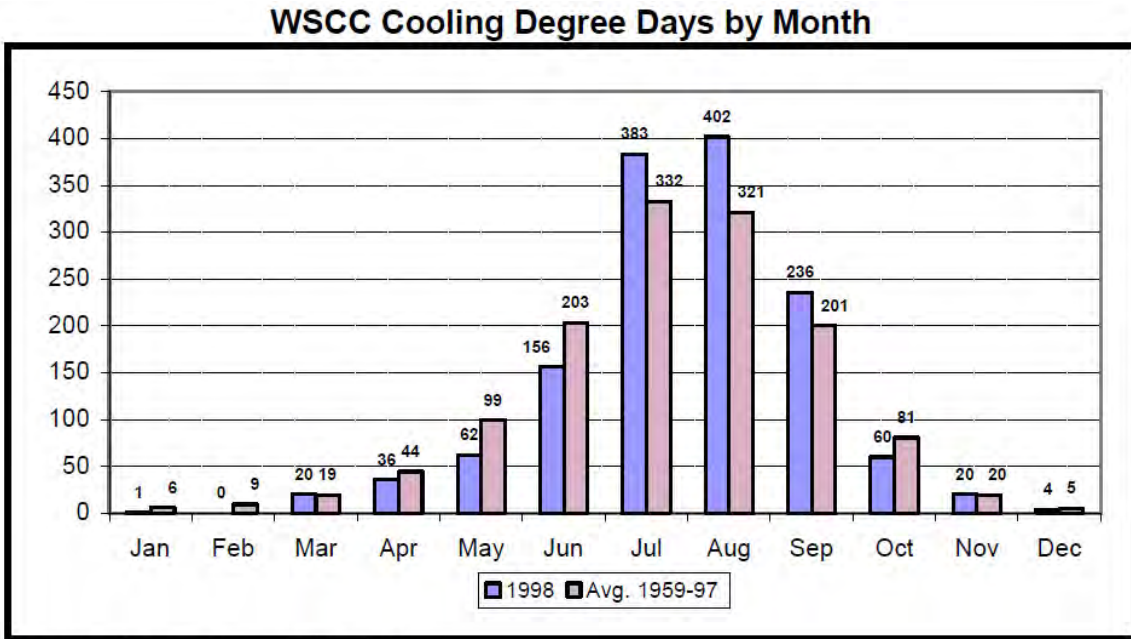


Figure 5. More specific data for electrical consumption in southern California – the principal market for New Mexico wind power – showing residential electricity consumption for Southern California Edison customers for 1999.⁴ Again, note the peak consumption during July and August.



Source: Energy Commission staff.

Figure 6. Energy-use peak for the same region in July and August, illustrated by cooling degree days by month, data that closely correlate with electricity consumption.⁵

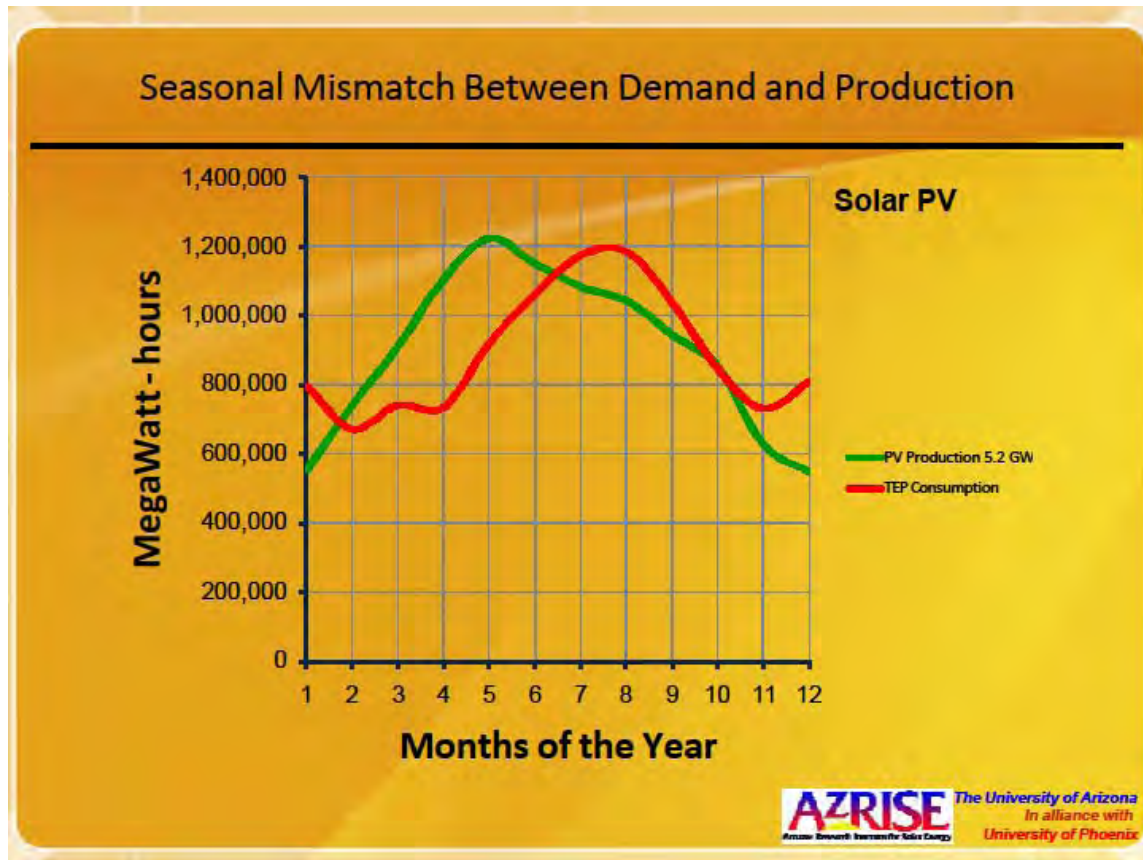


Figure 7. Seasonal variation in power demand for Tucson Electric Power Company (red line)⁶. The Phoenix profile should be very similar. The green line shows the required photovoltaic electrical generating capacity needed to match peak demand. Arizona’s solar-generating capacity tracks Arizona consumption patterns fairly closely as opposed to New Mexico’s wind-generating capacity.

¹ Airport wind data for New Mexico: <http://www.wrcc.dri.edu/htmlfiles/westwind.final.html#NEW%20MEXICO> (For all states see <http://www.wrcc.dri.edu/htmlfiles/westwind.final.html>.)

² New Mexico weather station data: <http://weather.nmsu.edu/cgi-shl/cns/uberpage.pl?selected=2>

³ *California Electricity Price Spikes: An Update on the Facts* by Susan Pope, 2002, available on-line at http://www.hks.harvard.edu/hepg/Papers/Pope_CA.price.spike.update_12-9-02.pdf.

⁴ *Review of Residential Electrical Energy Use Data* by the NAHB Research Center, Inc., 2001, available at <http://www.toolbase.org/PDF/CaseStudies/ResElectricalEnergyUseData.pdf>.

⁵ *High Temperatures & Electricity Demand, An Assessment of Supply Adequacy in California, Trends & Outlook*, A Report of the California Energy Commission Staff, July 1999. The full report is available at http://www.energy.ca.gov/reports/1999-07-23_HEAT_RPT.PDF.

⁶ *Energy Storage: The Enabler of the Use of Solar and Wind Energy* by Joseph H. Simmons and Ardeth M. Barnhart, Co-Directors AzRISE – The Arizona Research Institute for Solar Energy University of Arizona (available at <http://www.swhydro.arizona.edu/renewable/presentations/friday/simmons.pdf>).