

Wind research study has potential to diversify state's economy, provide energy to California

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These wind turbines are part of a windfarm in southwestern Wyoming, located off I-80 between Lyman and Evanston.

New transmission and generation infrastructure, relative to power generated by Wyoming's vaunted wind, would help diversify the state's economy with more high-paying jobs—both during the construction and operation phases—while providing economically priced renewable power to California, according to a recent study conducted by the University of Wyoming's [Wind Energy Research Center](#).

The report, titled "[Wind](#) Diversity Enhancement of Wyoming/California Wind Energy Projects," focuses on the importance of diversity in wind resources produced by Wyoming and California, and the [economic](#)

[benefits](#) the combination of these two wind sources could potentially provide, says Jonathan Naughton, a UW professor of mechanical engineering and director of the Wind Energy Research Center.

Wind diversity essentially means wind speeds at two locations vary differently, Naughton says. Wind that blows at high speed at one location while it blows at a low rate of speed at another, and vice versa, would be considered diverse sources of wind.

"If you can take the (wind speed) numbers (at both locations) and make them less variable by combining them, that's a good thing," Naughton says. "Characterizing diversity and demonstrating the benefits, no one has done that before."

Making [wind speeds](#) less variable, or more consistent over time, would create a more even and reliable flow of power to communities using this energy source as well as reduce the amount of time the combined production is at capacity or at zero output, Naughton says.

California is considered a leader in wind-produced electricity, but also uses a large amount of energy, including solar, Naughton says.

Wyoming, by contrast, has some of the world's best wind resources, but is a net energy exporter. This means Wyoming has an abundance of energy, which it sells to other locations that are unable to meet their own power demands.

"From a wind power production standpoint, we have been called the [Saudi Arabia](#) of wind. We have some of the best wind power in the world," Naughton says.

Report details

Naughton co-wrote the report with Thomas Parish, a UW professor of

atmospheric science, and Jerad Baker, a UW graduate student from Casper majoring in [mechanical engineering](#). The report was commissioned by the Wyoming Infrastructure Authority (WIA), which is based in Cheyenne. Created by the Wyoming State Legislature in 2004, the WIA's mission is to diversify and expand the state's economy through improvements in Wyoming's electric transmission infrastructure to facilitate the consumption of Wyoming energy in the form of wind, natural gas, coal and nuclear power, where applicable.

"The work the university did was great," says WIA Executive Director Loyd Drain. "Really and truly, it's been the centerpiece of our outreach program to California in the last six months."

The report was released to the WIA this week. It is the first in a series of four that compares the geographic diversity of Wyoming wind with wind resources in California, Colorado and Nebraska, and within Wyoming, Naughton says.

The study used one year of wind resource predicted by a weather forecasting model. In addition, specific locations were studied to show the benefits of combining the locations from both states that were predicted to have diverse wind resources. Computer analyses were compiled from sites near Rawlins, Casper, Medicine Bow, Southern Laramie Valley and Wheatland/Chugwater in Wyoming; and Tehachapi Pass, San Geronio Pass and Altamont Pass in California.

The analyses provided the following:

- Wind resources in Wyoming and California are complementary. This is due to the winds being largely uncorrelated due to their large geographic separation.

Wind diversity in the two states yields real-world benefits when specific Wyoming and California sites are combined. These include:

- Variability of the wind-generated power is reduced. This decreases the large swings observed from single power installations and simplifies integration of wind into the grid.
- For 6 gigawatts of wind split evenly between Wyoming and California, an annual savings in the \$100 million range would be realized by California ratepayers from reduced payments for "dispatchable" or make-up power that can be supplied on demand, Naughton says. Assuming the dispatchable power is derived from fossil fuels, a reduction in greenhouse gases also would occur.
- Wyoming's wind power would be available at critical times when California's wind is unavailable, and when the load on the Golden State's electric grid requires it most.

"We're not trying to compare wind to coal or natural gas. It's (wind) a wonderful way for Wyoming to use a new resource," Naughton says. "We're talking hundreds of millions of dollars for the state's economy."

While the report was commissioned by the WIA and the U.S. Department of Energy, Naughton stresses that he doesn't advocate for or against the study's findings.

"We just present the concept of diversity," he says.

Convincing California

Still, that concept may be gaining traction.

While California Gov. Jerry Brown and that state's utility officials have

stated they want to develop their own renewable sources of energy through in-state projects, Naughton says that thinking may change with time. One, Wyoming customers pay roughly 5 cents for a kilowatt-hour of power compared to the Sunshine State's rates of 20-25 cents per kilowatt-hour, according to Naughton. Rates from some rate payers on the PG&E system in California exceed 40 cents per kilowatt-hour, Drain says.

Naughton poses the question: "How much will the (California) ratepayers bear before they say 'Wait a minute? Why not buy power from Wyoming?'"

Naughton cited a 2011 study by the Western Electricity Coordinating Council (WECC) that determined that, if California met just 20 percent of its [renewable power](#) demand using wind energy from Wyoming, it would save California ratepayers about \$600 million annually. WECC is the regional entity responsible for coordinating and promoting bulk electric system reliability from Canada to Mexico, and 14 Western states in between, according to its website.

Two, Wyoming's wind power is much stronger and more consistent than California's. This is due primarily to Wyoming's elevation, topographical landscape and weather conditions, according to the Wind Energy Research Center report. A low spot in the Continental Divide, located just west of Rawlins, intensifies weather and creates high winds at several locations in the state, Naughton says.

However, it is an effort by Denver billionaire Phil Anschutz to create the world's largest wind farm that eventually may serve as the tipping point. Anschutz, who owns Anschutz Co. subsidiaries Power Company of Wyoming and TransWest Express, envisions creating the world's largest wind farm south of Rawlins, Naughton says. This wind farm, which would include about 1,000 turbines, would cost about \$6 billion.

TransWest would create 725 miles of transmission lines (at a cost of about \$3 billion) that would carry power from the Sierra Madre and Choke Cherry Wind Project on Anschutz Corporation's 320,000-acre Overland Cattle Ranch to a site south of Las Vegas, according to a recent Denver Post article. From there, a connection could be made with the California power grid to serve that state's customers, Naughton says.

Wyoming is already a net exporter of electricity and its electric lines are nearly full, so any new generation built has to go out of state, Naughton says. With this scenario, Wyoming would likely need transmission lines that would reach interconnect sites, which would then disperse the power to areas out of state, he says.

If built, [power](#) from the Rawlins wind farm would be coupled with existing Southern California wind farms such as those located in Tehachapi Pass and San Gorgonio Pass, Naughton says.

The project would provide "thousands of construction jobs" for both states combined (about 100 permanent jobs in Carbon County alone); and create a \$5 billion state and local tax base for Wyoming, as well as \$600 million to \$800 million in property, sales and user taxes over a 20-year period, according to Drain.

"I think they're (California) slowly starting to realize this can work," Naughton says.

Drain says the WIA's Board of Directors has authorized the agency to proceed with a second phase of study, to be completed on or before April 30. It will involve UW; possible contributions from a California university; and possibly the National Renewable Energy Laboratory (NREL), which operates the National Wind Technology Center in Boulder, Colo. He says Phase II would provide actual "minute-by-minute data" for wind from Wyoming, and wind and solar on the California

System Operator (CAISO) grid.

"I think the results of the Phase II study will be more compelling than Phase I," Drain says.

Provided by University of Wyoming

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