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I'm Janet Jordan from Olympia and I want to testify about alternatives to coal.

Specifically I want to bring to your attention the National Oceanic and Atmospheric Administration's study published in Nature Cimate Change* that says in the continental US, there is almost always enough wind and solar power to satisfy all of the country's energy needs, even without building any more storage. A nation-wide electrical grid would enable us to access the power sources and bring them to where power is needed. In order to minimize losses over the long distances, the grid would use direct current rather than alternating current (High Voltage Direct Current). The article says gas-powered plants could be used for backup but would not be needed often. The power would not cost more than it does now.

The article assumes the needed solar and wind facilities would be built, because once the distribution problem is solved there is no longer any reason to hesitate.

Utilities could switch over to the new grid, making changes as maintenance comes due. It would take about 15 years. By 2030 we could have a clean energy system that would produce about 80% fewer emissions than the current one. There would also be a significant savings in water use.

If UTC hesitates to require PSE to shut down Colstrip because of a lack of good alternatives, it should know that NOAA considers the new grid an excellent alternative.

~~I suggest that PSE take this seriously~~ – that it investigate how best to access the new grid as it comes into being, and make any necessary changes in its power lines. The long line going from Montana to Olympia would be a good start on such a system. Montana might also be a good source of wind and solar power; all it really needs to be effective is for Montana to be producing power when Olympia is not, which is likely when the two are so far separated.

Instead of doubling down on coal production, which makes it part of the problem, PSE could help create the new power grid which would be at least a part of the solution.

*http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate2921.html

Articles

The U.S. Could Make a Fast, Cheap Switch to Clean Energy
A new study shows that the nation could shutter coal-fired power plants by 2030, maintain a steady power supply, and save billions of dollars.
TakePart, published on-line Jan 25, 2016
By Emily J. Gertz, associate editor

Coal-fired power plants are the biggest emitters of greenhouse gases in the United States, but new research finds that existing technology could cheaply slash the nation's carbon spew nearly 80 percent by 2030.

How? By transporting renewable energy from where the sun is shining and the wind is blowing to where it is not, according to the study, which was published on Monday in the journal Nature Climate Change by scientists from the National Oceanic and Atmospheric Administration and the University of Colorado Boulder.

NOAA's highly detailed weather data show there's nearly always someplace in the 48 contiguous states where electricity can be generated by solar power stations and wind farms, even if it happens to be thousands of miles away from where it's needed.

The quandary: how to move electricity generated by that sun or wind over long distances without losing too much of it in the process.

The solution: a proven technology, called high-voltage direct current, already exists and can carry power across long distances more efficiently than alternating current, the standard power transmission mode in the U.S.

Utilities could add direct-current infrastructure to alternating-current transmission lines over the next 15 years as part of planned updates and upgrades without breaking the bank, said study coauthor Alexander MacDonald, who recently retired as director of NOAA's Earth System Research Laboratory.

"Almost everybody believes that if we go to wind and solar energy, it will be more expensive or won't be ready unless we have a big technological breakthrough" in battery storage technology, MacDonald commented. "Our study says that with existing transmission technology and use of the whole 48 states with this 'interstate for electrons,' we're ready right now to have a national system that has the same electric costs as today, with as much as 80 percent less carbon and just as reliable."

The greater reliance on wind and solar power would also cut water use for energy by 65 percent, the study found. That's because fossil fuel plants, which generate 40 percent of the nation's carbon emissions, need large volumes of water for cooling.

"Our study assumed that the existing U.S. power system, with all of its AC distribution and

usage, stays the same," said MacDonald. "Power can be taken off the HVDC network for use and put on by generation. To a power provider—let's say a utility—instead of building a coal plant, they build a connection to the HVDC network. Everything else stays the same."

To test ideas about the most cost-effective means of generating power, MacDonald and his colleagues conducted a complex mathematical analysis that combined finely detailed data on continent-wide weather patterns from 2006 to 2008 with equally detailed data on power demand for the same period.

"NOAA folks have known for some time how big weather is," said mathematician and physicist Christopher Clack of the Cooperative Institute for Research in Environmental Sciences, a collaboration between NOAA and the University of Colorado Boulder. "We built and ran a very sophisticated model that was able to take advantage of [NOAA's] exceptionally good-quality weather data to look at the situation of the grid and see if there's any way of running the grid that would incorporate a really cheap system."

The model was not designed to prioritize low carbon emissions, he said. "We tried to be completely agnostic on which technologies were picked. It turned out the most effective combination we saw was full U.S., 48-state transmission, backed up by gas when solar and wind wasn't enough."

Using the U.S. Energy Information Administration's estimate of a 0.7-percent increase in power demand annually between 2015 and 2030, the researchers found that scenarios combining wind, solar, and natural gas power with a nationwide transmission grid cut greenhouse gas emissions from 33 to 78 percent below 1990 levels.

If gas was cheaper than solar and wind, the emissions were higher. When renewables beat gas on price, emissions went down.

The cost to ratepayers was between $0.086 and $0.10 per kilowatt-hour—comparable to the actual average nationwide cost of $0.094 per kilowatt-hour in 2015 and potentially saving power customers $47.2 billion a year.

A new study shows how greenhouse gas emissions from electricity generation (left axis) could drop below 1990 levels by 2030 if wind, solar, and natural-gas power sources were connected on a nationwide grid. Electricity rates would remain comparable to what consumers paid in 2012. (Graphic: 'Nature Climate Change')

If coal-fired power was added to the mix, the cost of power dropped by just one one-thousandth of a cent, to $0.085 per kilowatt-hour. But greenhouse gas emissions went up, to 37 percent over 1990 levels.

Writing in the same issue of Nature Climate Change, Mark Jacobson, an environmental engineer at Stanford University, noted a few limitations to the study.

"Whereas the model optimizes resource location based on cost and considers several types of land use limitations, it also does not consider societal constraints on areas? of beauty that might prevent development in some of the proposed locations," he wrote. "Future work on this topic may also benefit from considering storage to eliminate the remainder of CO2 emissions."

But Jacobson concluded that without a single new technology, "the study pushes the envelope to show that intermittent renewables plus transmission can eliminate most fossil fuel electricity while matching power demand at lower? cost than a fossil-fuel-based grid."

At the recent climate accord talks in Paris, the U.S. committed to lowering its greenhouse gas emissions 28 percent below 2005 levels by 2025.

According to NOAA, the new study's findings show that the U.S. could cut its emissions 31 percent below 2005 levels within 15 years solely with changes in electricity generation.

Future cost-competitive electricity systems and their impact on US CO2 emissions
Nature Climate Change, published online January 25, 2016
http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate2921.html
Authors: Alexander E. MacDonald, Christopher T. M. Clack, Anneliese Alexander, Adam Dunbar, James Wilczak & Yuanfu Xie

Abstract [The complete article costs $32]

Carbon dioxide emissions from electricity generation are a major cause of anthropogenic climate change. The deployment of wind and solar power reduces these emissions, but is subject to the variability of the weather. In the present study, we calculate the cost-optimized configuration of variable electrical power generators using weather data with high spatial (13-km) and temporal (60-min) resolution over the contiguous US. Our results show that when using future anticipated costs for wind and solar, carbon dioxide emissions from the US electricity sector can be reduced by up to 80% relative to 1990 levels, without an increase in the levelized cost of electricity. The reductions are possible with current technologies and without electrical storage. Wind and solar power increase their share of electricity production as the system grows to encompass large-scale weather patterns. This reduction in carbon emissions is achieved by moving away from a regionally divided electricity sector to a national system enabled by high-voltage direct-current transmission.