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Climatic Impacts of Wind Power

Lee M. Miller [3] • David W. Keith • Show footnotes

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Highlights

- Wind power reduces emissions while causing climatic impacts such as warmer temperatures
- Warming effect strongest at night when temperatures increase with height
- Nighttime warming effect observed at 28 operational US wind farms
- Wind's warming can exceed avoided warming from reduced emissions for a century

Summary

We find that generating today's US electricity demand (0.5 TW_e) with wind power would warm Continental US surface temperatures by 0.24°C. Warming arises, in part, from turbines redistributing heat by mixing the boundary layer. Modeled diurnal and seasonal temperature differences are roughly consistent with recent observations of warming at wind farms, reflecting a coherent mechanistic understanding for how wind turbines alter climate. The warming effect is: small compared with projections of 21st century warming, approximately equivalent to the reduced warming achieved by decarbonizing global electricity generation, and large compared with the reduced warming achieved by decarbonizing US electricity with wind. For the same generation rate, the climatic impacts from solar photovoltaic systems are about ten times smaller than wind systems. Wind's overall environmental impacts are surely less than fossil energy. Yet, as the …rgy system is decarbonized, decisions between wind and solar should be i… …ec… …estimates of their climate impacts.

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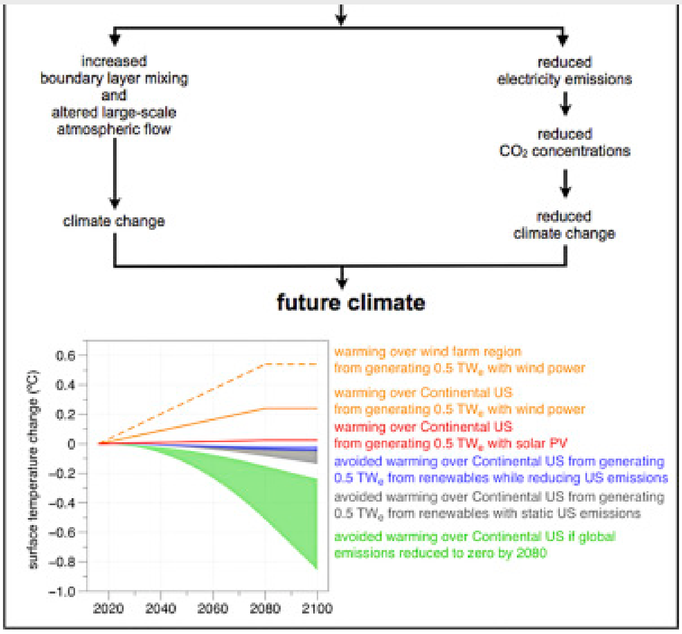

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Keywords

wind power • boundary layer • climate • decarbonization • solar photovoltaics • climate differences • long-term • emission reductions • observations • day-night differences • mechanistic • night time warming

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j_l_liebenthal • 3 months ago

Doesn't the surface warming come from the air, which should be included in the overall planet energy balance? It seems that the net change in energy is zero from that effect. Moreover, increased nighttime radiation from the warmer surface would seem to decrease the net energy of the planet.

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Redacted2nite • 3 months ago

Not sure if I understand how mixing the boundary layer air would have the same heat-trapping effect that a greenhouse gas does. I realize the ground in the wake of the turbines stays warmer due to this mixing, but does this have an effect on global climate? I don't have all the information the researchers do, but it seems that the locally accumulated heat would still dissipate during cooler weather, limited only by the atmosphere.

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