

Switching is not so simple: 100% renewable energy sources require overcapacity

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The Shepherds Flat Wind Farm is an 845 MW wind farm in the U.S. state of Oregon. Credit: Steve Wilson / Wikipedia.

Germany decided to go nuclear-free by 2022. A CO₂-emission-free electricity supply system based on intermittent sources, such as wind and solar - or photovoltaic (PV) - power could replace nuclear power. However, these sources depend on the weather conditions. In a new study published in *EPJ Plus*, Fritz Wagner from the Max Planck Institute

for Plasma Physics in Germany analysed weather conditions using 2010, 2012, 2013 and 2015 data derived from the electricity supply system itself, instead of relying on meteorological data. By scaling existing data up to a 100% supply from intermittent renewable energy sources, the author demonstrates that an average 325 GW wind and PV power are required to meet the 100% renewable energy target. This study shows the complexity of replacing the present primary energy supply with electricity from intermittent renewable sources, which would inevitably need to be supplemented by other forms of CO₂-free energy production.

Intermittent sources are, by definition, unsteady. Therefore, a back-up system capable of providing [power](#) at a level of 89% of peak load would be needed. This requires creating an oversized power system to produce large amounts of surplus [energy](#). A day storage to handle surplus is ineffective because of the day-night correlation of surplus power in the winter. A seasonal storage system loses its character when transformation losses are considered; indeed, it only contributes to the power supply after periods with excessive surplus production.

The option of an oversized, intermittent renewable-energy-sources system to feed the storage is also ineffective. This is because, in this case, energy can be taken directly from the large intermittent supply, making storage superfluous. In addition, the impact on land use and the transformation of landscape by an unprecedented density of wind convertors and transmission lines needs to be taken into consideration. He also warns of the risk that it will intensify social resistance.

More information: Friedrich Wagner, Surplus from and storage of electricity generated by intermittent sources, *The European Physical Journal Plus* (2016). [DOI: 10.1140/epjp/i2016-16445-3](https://doi.org/10.1140/epjp/i2016-16445-3)

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