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Assessing the impact of future dunkelflaute events on the European electricity grid using generative deep learning

Felix Strnad and Nicole Ludwig ▶

The European electricity power grid is transitioning towards a renewable energy system. This transition is characterized by an increasing share of renewable energy sources, such as wind and solar power. However, the intermittency of these energy sources poses a challenge to the grid's stability. So-called Dunkelflaute events, i.e., periods of low wind and solar power generation, are of particular concern, as they can lead to a shortage of electricity supply.

In this study, we investigate the impact of dunkelflaute events on the European power grid.

We do this in three steps. First, we analyze historical reanalysis data to identify past dunkelflaute events and estimate their impact on the power grid.

Next, we compare this to actual power generation data to validate our findings.

Finally, we use current generative deep learning frameworks to create multiple future scenarios of dunkelflaute events in a warming world and assess the ability of the European power grid to cope with them. Our results underline the importance of a well-connected and flexible power grid to ensure a stable electricity supply.

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