



video series *Practical Engineering*.

In an article and corresponding YouTube video, Hillhouse explained how connecting solar power to the electrical grid is much more complicated than people realize and creates more issues than just weather intermittency for power production. In short, stable grids require a delicate balance between electricity supply and demand and require generators to produce power at certain frequencies.

Spain's planned phase-out of nuclear power, announced in December 2023, could have contributed to the outage, said Yolanda Moratilla, chair of the Energy and Natural Resources committee at the Engineering Institute of Spain. She has been warning the government of outage risks for a while now, since the country's phase-out of coal and reduction in nuclear leaves the grid too reliant on combined-cycle natural gas units to fill in when solar and wind don't deliver enough energy.

Sánchez criticized nuclear as “no more resilient than other sources” and said heavier reliance on nuclear energy would have led to a “much slower” recovery, because nuclear plants also went off line early in the outage and took longer than other sources to get back up to full power.

But the difference is that the nuclear power plants were shut down as a safety precaution due to loss of off-site power and had to ascend their large power loads gradually back onto the grid. When a grid has a stable, steady source of baseload power—nuclear, for example—it is less reliant on intermittent, unpredictable sources of power, making the chance of a massive outage (and the need to voluntarily shut down power plants) far less likely.

Four of Spain's five operating reactors were on line at the time of the blackout and proactively shut down due to loss of off-site power.



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