

Can Demand Response Help Us Achieve 100% Renewable Energy?

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A recent study published in the Journal of Power Sources has proposed that a mix of wind and solar energy production, along with energy storage technology and a standby supply of fossil fuel could create a 99.9% renewable energy grid by 2030. The study, titled “[Cost-minimized combinations of wind power, solar power and electrochemical storage, powering the grid up to 99.9% of the time](#)”

by Cory Budischack et al, investigates not only the issue of a renewable energy grid, but also minimizing the cost associated with renewable energy. The possibility of up to 99.9% renewable energy capacity is promising, but the study almost ignores demand response, and that could provide the extra .1%.

[Demand response](#) (DR) involves consumers curbing their energy use, or implementing distributed generation, to relieve stress on the electric grid when supply falls short. DR programs are already in use all over the country, and successfully prevent blackouts and brownouts every year. The added benefit of employing DR resources rather than fossil fuel generation is that DR is less costly than operating peaking plants. The focus of Budischack et al

in the study was to keep costs to a minimum, so it seems DR may be a more fitting resource to consider.

The study models several different combinations of solar, wind, and batteries incorporated into a 72GW grid system based on PJM Interconnection data from 1999-2002. Potential output of wind and solar energy is estimated using weather data sampled from within the PJM territory. The study directly addresses the problem of intermittent renewable energy generation by employing a mix of wind and solar power. The result, according to the model, is renewable energy supply with very few gaps in generation. [Energy storage technology](#), such as fuel cells and grid-scale batteries can be used to fill any gaps in generation that do arise. This creates an almost entirely reliable and renewable electric grid. According to the models presented by Budischak et al, supply would fall short only about 9-72 hours over four years. The authors suggest fossil fuel fired standby generation will fill this supply shortage, but this could prove to be more expensive than simply reducing electricity demand. At the very end of the article, Budischack et al note “maintaining old fossil plant [sic] may be uneconomic if rarely used, in which case, other existing mechanisms – such as demand management, interruptible rates, or preloading storage from lower capacity fossil – could be used to retire old fossil plants.” Since this study focuses on ways to implement a renewable grid at the lowest cost possible, DR may be the ideal resource to meet the needs of a renewable grid that falls short only a few hours per year.

Whether or not [demand response](#) can supply the capacity needed to prevent a blackout or brownout in Budischak et al’s virtual renewable grid is still questionable. It is not only a matter of how often a renewable electric grid may fall short of supply, but also the amount of energy that would need to be conserved to keep the grid stable. Energy storage can keep this situation to a minimum by storing excess energy when generation exceeds demand, and discharging energy when demand is high, but there is a limit to how much energy can be stored. In the study’s scenario where solar, wind and storage produced 99.9% of PJM’s energy, only 17MW of fossil fuel generation was needed, an amount easily met by DR resources.

This study presents an optimistic view of how our electric grid may function by 2030. The study’s most exciting calculation is that the renewable grid’s cost to consumers will be no more than [what we pay for electricity](#) today. It would take sweeping changes in government policy and private industry for a shift to 100% renewable energy to be realized, but most experts agree that it must happen eventually. 2030 may not be the year we reach 100% renewable electricity generation, but there is no doubt that renewable energy will soon make up a large part of our

energy resource pool. Demand response is a clean energy tool that can ensure our grid maintains reliability even when those resources reach their maximum generating capacity. Perhaps, with diverse energy assets and technology at our disposal, a 100% renewable energy future can be achieved sooner than we think.

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