The Home-Based Battery Storage Fantasy

Malp/Adobe Stock

By Jonathan Lesser
11/27/2024 Updated: 11/27/2024

Commentary

According to a recent article published in The Conversation, installing millions of storage batteries distributed through the grid—in homes, businesses, and local communities—coupled with wind and solar generation, can avoid investments in new transmission infrastructure. But unless installing those batteries is accompanied by physically disconnecting from the grid, or consumers are willing to forgo reliable electricity, this claim is yet another example of electricity "magical thinking."

Electricity customers, both residential and industrial, need to be aware of this home-based battery storage fantasy.

First, batteries store electricity; they don't generate it. But the move towards electrifying the U.S. motor vehicle fleet, along with electrifying space and water heating, will double electricity consumption. Although some of the additional electricity needed may come from distributed sources such as rooftop solar, green energy advocates claim that most of the needed electricity will be generated at large-scale wind and solar facilities located far from cities and towns.

The article also claims, "[w]e could get by with fewer transmission lines if we store more solar and wind power for later." But delivering the additional electricity needed will require building new transmission lines, regardless of how much battery storage is installed in homes and in local communities. Moreover, local distribution systems—the poles and wires running down streets—will also have to be upgraded to handle the additional loads.

Second, the costs of building sufficient battery capacity (to say nothing of the costs of additional wind and solar generation) to ensure homes and local communities do not suffer from extended blackouts will be prohibitive.

The numbers tell the story.

In the United States, a typical residential household consumes around 10,800 kWh annually, or about 30 kWh per day. Of course, the amount varies depending on the size of home, the region of the country, and the season of the year. With electrified space and water heat, some regions of the country where electricity demand now peaks in summer will see demand peak in winter, while existing winter-peaking regions will see winter demand spike even further.

According to a U.S. Department of Energy model, a heat pump in a typical home will consume about 5,500 kWh annually. That alone represents a 50 percent increase in electricity use. Charging a typical EV adds another 4,300 kWh annually. In total, those will add almost 10,000 kWh of consumption annually, roughly doubling current consumption to about 60 kWh per day, although the increase will be greatest in winter when heating loads peak.

Supplying the additional electricity while ensuring the same level of service reliability (i.e., no extended outages or limiting consumers' access to electricity because of insufficient supplies) will require enough battery storage to provide electricity at night and over multi-day periods when there is little wind and sun available to recharge those batteries. Although the article recommends using consumers' EVs to supply electricity, few consumers will likely wish to wake up to an uncharged EV and an inability to travel, especially if there is no stored electricity available to recharge their EVs.

Using the U.S. consumption averages, if existing local distribution systems can serve today's average load of 30 kWh/day, then enough battery storage must be built to supply the remaining 30 kWh. and, more importantly, the peak power demand of electric heat pumps and EV chargers. A typical Level 2 home EV charger, for example, can draw 20 kilowatts (kW). A heat pump can draw 7 kW.

The largest Tesla Powerwall, which is designed for home use, provides a maximum of 11.5 kW of power and 13.5 kWh of storage under ideal conditions. (When temperatures fall, so does battery capacity and efficiency.) Hence, at least three Powerwall units would be required to provide a typical home with sufficient electricity to supplement existing grid capacity. For one million homes, that means three million Powerwall units providing a maximum of 40.5 million kWh (40,500 megawatt-hours) of battery storage.

At a cost of around $12,000 installed, that translates into a cost of $36,000 per home. The United States has over 80 million single-family homes and over 130 million dwelling units. Hence, 240 million Powerwall units would be required just for single-family homes, costing almost $3 trillion. By comparison, Tesla's current manufacturing capacity is 700,000 units per year. Thus, outfitting all single-family homes with them would require almost 350 years of Powerwall production. The minerals requirements would also be staggering and would require mining billions of tons of ore for the necessary lithium, copper, cobalt, and other metals.

In theory, an electric system could be designed to provide reliable service using wind, solar, and battery storage. However, in reality, huge investments would still be required in new transmission and distribution lines, regardless of how many storage batteries are installed. It would also be ruinously expensive.

Ignoring physical and economic realities may be fashionable, but reality always wins in the long run. The electric grid and its components form a complex system which most of us take for granted, which enable misleading claims regarding the simplicity of electrifying everything and powering it all almost exclusively with wind, solar, and batteries. Electric utilities and planners can provide a public service by explaining why this scenario, given today's technology, isn't possible.

From RealClearWire

Views expressed in this article are opinions of the author and do not necessarily reflect the views of The Epoch Times.

Jonathan Lesser
Author

Jonathan Lesser is a senior fellow with the National Center for Energy Analytics, a senior fellow with the Discovery Institute, and the president of Continental Economics. His report,

“Green Energy and Economic Fabulism,” was published by the Global Warming Policy Foundation.

Author’s Selected Articles

The (Anti) Social Cost of Carbon

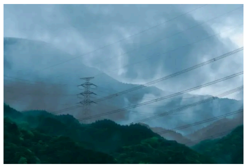
May 09, 2024

The Crippling Economic Costs of Green Energy Subsidies

Dec 11, 2023

Why ‘Net Zero’ Isn’t a Rational US Energy Policy

Apr 19, 2023



Using Electric Vehicles as Grid Storage: Another Green Fantasy

Feb 13, 2023