Democracy Dies in Darkness

CLIMATE SOLUTIONS

How a simple fix could double the size of the U.S. electricity grid

Rewiring miles of power lines could make space for data centers, AI and a boom in renewables.

By Shannon Osaka

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There is one big thing holding the United States back from a pollution-free electricity grid running on wind, solar and battery power: not enough power lines.

As developers rush to install wind farms and solar plants to power data centers, artificial intelligence systems and electric vehicles, the nation's sagging, out-of-date power lines are being overwhelmed — slowing the transition to clean energy and the fight against climate change.

But experts say that there is a remarkably simple fix: installing new wires on the high-voltage lines that already carry power hundreds of miles across the United States. Just upgrading those wires, new reports show, could double the amount of power that can flow through America's electricity grid.

"This is something that could be a triple win," said Brian Deese, an innovation fellow at the Massachusetts Institute of Technology who headed the White House National Economic Council under President Biden until early last year. "A win for the electricity system, a win for utilities and a win for consumers."

Since Biden signed the Inflation Reduction Act in August 2022 — pouring hundreds of billions of dollars toward the build-out of clean energy — experts have warned that without a dramatic increase in the size of the electricity grid, most of those new wind and solar farms won't be able to plug in.

Many renewables are stuck in the "interconnection queue," a long line of projects waiting to get connected to the grid. According to Lawrence Berkeley National Laboratory, more than 1,500 gigawatts of power, mostly renewables, are waiting for approval to connect. (That's more than one-third of all the power produced in the United States.)

One of the main reasons for that long wait is that the nation builds transmission lines — those giant, high-voltage wires that carry power across large distances — extremely slowly. The average transmission line takes about 10 years to complete, and the country has been building even fewer lines recently than it did a decade ago.

Without enough power lines, there is nowhere for new solar, wind and battery power to go.

"We have to be able to integrate all this low-cost, renewable energy fast," said Amol Phadke, a scientist at the University of California at Berkeley and Lawrence Berkeley National Laboratory.

That's where replacing the country's power lines — or "reconductoring," as engineers call it — comes in.

Most of America's lines are wired with a technology that has been around since the early 1900s — a core steel wire surrounded by strands of aluminum. When those old wires heat up — whether from power passing through them or warm outdoor temperatures — they sag. Too much sag in a transmission line can be dangerous, causing fires or outages. As a result, grid operators have to be careful not to allow too much power through the lines.

But a couple of decades ago, engineers designed a new type of wire: a core made of carbon fiber, surrounded by trapezoidal pieces of aluminum. Those new, carbon-fiber wires don't sag as much in the heat. That means that they can take up to double the amount of power as the old lines.

According to the recent study from researchers at UC-Berkeley and GridLab, replacing these older steel wires could provide up to 80 percent of the new transmission needed on the electricity grid — without building anything new. It could also cost half as much as building an entirely new line and avoid the headaches of trying to get every state, city and even landowner along the route to agree to a new project.

"You're not acquiring a new right of way; you're not building new towers," Phadke said. "So it can be done much faster."

If stringing new lines is so easy — and cheap — why hasn't it been done already? Part of the problem, experts say, is that utilities profit more from big infrastructure projects. Routine maintenance or larger-scale upgrades of the electricity grid don't help utilities make a lot of cash compared with building new transmission lines.

Deese compares it to having leaky pipes in a building — building managers don't get rewarded for fixing all of a building's problems, but rather for just keeping things running as long as possible on a limited budget. "You patch and plug rather than thinking systematically," Deese said.

Duncan Callaway, a professor of energy and resources at UC-Berkeley and one of the authors of the recent study, said that many transmission engineers are not used to thinking of rewiring as one of their tools. "But it's a much faster way," he said.

Some changes are already underway to encourage this approach. For a long time, utilities had to undergo lengthy environmental reviews if they were rewiring a line longer than 20 miles. Earlier this month, the Federal Energy Regulatory Commission announced that those would no longer be necessary if utilities are simply replacing wires.

And last month, the Biden administration announced a goal to upgrade 100,000 miles of transmission line over the next five years — which could include rewiring the lines.

“We actually need stuff that can cook right now, right away,” Ali Zaidi, the White House national climate adviser, said Tuesday at a White House summit on grid modernization. “And the way to do that is by deploying grid-enhancing technologies, by reconductoring the lines that we have already strung up or buried across the country.”

This doesn’t mean that new lines don’t need to be built. “In the longer run, newer lines will play an important role,” Phadke said. But as new demand surges onto the grid in the short term, upgrading the nation’s wires could help keep clean energy flowing until those new lines can be built.

“We have the potential to achieve all of these things with just taking new technology and running it through old lines,” Deese said. “It’s pretty cool.”