Reducing risk and avoiding disaster – creating grid 2.0

March 15 2021, by Dale Willman

Lines taking electricity to homes in Holmes County, Ohio. Credit: Dale Willman

It's hard to imagine a world without electricity. It powers elevators that allow us to build up, rather than out. Electricity keeps our homes at the right temperature. It helps to purify the water that we drink, and

sometimes the air that we breathe. We use electricity for our phones and computers. And given the continuing growth of the Internet of Things, electricity demand will grow for many years to come. But as demand increases, so do the assaults to the system that delivers that energy—the power grid.

Severe weather is a primary driver of power outages. According to a recent report by the Department of Energy, weather-related outages alone have cost the country between $18 and $32 billion a year on average since 2003. According to economists in Texas, the recent winter storm that hit that state could end up costing as much as $200 billion—more than Hurricanes Harvey and Ike. Wildfires out west also create havoc to electric distribution systems. Power cuts during California's wildfire season in 2019 are estimated to have cost the state as much as $2 billion.

Aging infrastructure is also a problem for the electric system. The grid is a mix of connections and agreements across state lines that uses sometimes archaic technology to survive, and its architecture is in need of a drastic overhaul. A report by the Pew Charitable Trusts suggests that a lack of investment in upgrading the power grid is going to cause more power outages in the future.

All of this was discussed in a recent webinar for journalists as part of the Resilience Media Project, which is a part of the larger Initiative on Communication and Sustainability at the Earth Institute of Columbia University.

Melissa Lott is the director of research for the Center on Global Energy Policy at Columbia University. She says the grid is complex, and it's made up of much more than just power lines. "When we talk about the grid, your mind can go to just the wires. So, transmission wires, these really big things that take the electricity from power plants to closer to

our homes, and then the smaller wires that we call distribution wires that actually take that electricity to our homes and to the final point where we consume it." But that's just part of what makes up the grid. "It's actually talking about power plants that put the electricity in, then the wires that move it. And there's all different types of steps there and then the end-use customers."

Power plants today also rely on many more fuel sources than just coal, which was a staple of electricity production for years. And that can add to the complexity of the grid. Some plants have switched to natural gas, which caused problems during the recent Texas storm when some gas wells froze. There are also biomass plants—they use material from plants or animals to generate electricity. And of course, renewable energy from wind and solar.

Renewable energy is important to help reduce greenhouse gas emissions from energy production. But deploying renewable sources adds to the challenges facing the grid. Consumers who produce electricity through solar panels on their rooftops are sometimes putting electricity into the system, and other times taking it out. This shifting demand/production method, says Lott, makes the grid even more complicated.

Meanwhile, energy companies and the government have not kept up on maintenance and expansion of the grid at the levels needed to keep it robust.

So, all these factors—increased complexity from fuel sources, aging infrastructure, too little investment—has, says Lott, created problems for energy in the U.S. "Spoiler alert, we're not doing so great."

And the pandemic didn't help, says Jeanne Fox, a former commissioner of the New Jersey Board of Public Utilities. "The economy is going to gradually get better. But a lot of low- and middle-income people cannot

afford to pay their electric bills now."

Damage caused by Hurricane Irene as it passed through the Adirondacks of upstate New York in 2011. Credit: Dale Willman

So how can the grid be made more resilient, and more equitable? Emily Chasan is the director of communications at Generate Capital, and is a former reporter covering energy issues for Bloomberg. She says the grid used to rely on large power plants located in central areas of the country. Now the grid needs to change, to accommodate renewable energy sources that are more dispersed. "We haven't really focused that much

on upgrading the grid so that it can handle all this movement and change in the way we're producing electricity." And she says the grid needs to be ready for an ever-growing list of ways power can be produced and stored. "You can think years down the line that you might be able to plug your electric car into your house and have it be a generator instead of getting a diesel generator."

But in order to get to the grid of the future, Melissa Lott says we need to plan better for a period of transition. That plan will include a "three-legged stool" system of generation that can create strong reliability for the grid. The first leg is renewables. While variable generation from wind and solar can make distribution more difficult, they also provide an energy that does not require fuel. The second leg would provide a steadier, more consistently reliable supply of electricity. "This can be nuclear, this can be big hydro, this can be natural gas with carbon capture and storage…." The final leg of the stool is energy storage—but not just batteries for your flashlights. Devices such as the Tesla Powerwall can also be used to supply your home with electricity in case of a short power outage.

Lott says operators can also re-think how they allocate power when a crisis does occur. In Texas, where she lives, Lott says during the recent winter storm, some industries continued to have power while many homes around them went dark. It would be cost effective, she says, to pay some industries that use immense amounts of electricity to reduce their energy consumption for a few days in order to keep homes warm. This process is called 'demand-response," and Lott says there are already examples of this method being used by some utilities on a daily basis. "You at your home might do this by having a thermostat that is controlled remotely by your utility and they say, hey, in the summer we're going to pay you like ten dollars to let us cycle your air conditioner on and off for thirty minutes (when needed)."

All these ideas are being considered as planners discuss the future of the energy grid. But whatever the grid of the future may look like, experts say targeted investment in grid modernization and resilience will reduce costs over time—saving the economy billions of dollars and reducing the hardship experienced by millions of Americans when extreme weather strikes.

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