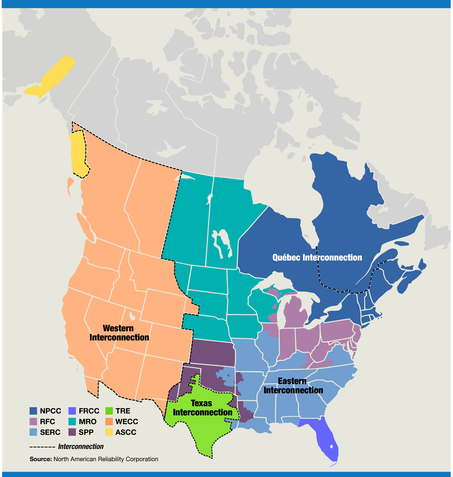
Three Charts about the Electric Grid

Interconnected power systems help support one another. Isolated systems—like the one in Texas—are vulnerable to outages.

BY JEFFREY WINTERS

When the Texas power grid was under stress from extreme weather earlier this year, one contributing factor was its relative isolation from the rest of the U.S. electrical system. That raised questions of just how the grid is put together and whether new power plants might be added to relieve the strain. Texas isn't the only state or provincial entity that runs a power grid separate from the continent-spanning interconnections, but it may be the most vulnerable.

North American Regional Reliability Councils and Interconnections

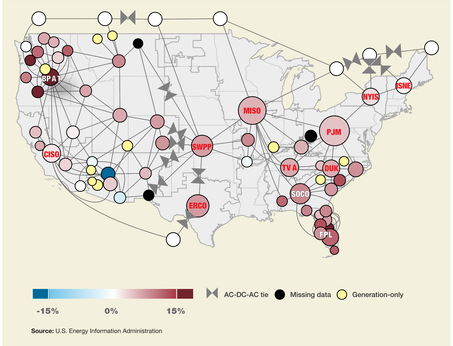


Source: North American Reliability Corporation

The structure of the North American grid is a little confusing. There are regional transmission organizations (RTO), which are independent, membership-based, nonprofit organizations that manage the market for wholesale electric power. (Independent system operators do the same thing, but just in one state.) The sharing of electricity across large areas is managed by the North American Electric Reliability Corporation (NERC); While there are large areas that don't have RTOs, almost all of the United States and Canada are managed by one of NERC's regional reliability councils, which themselves are part of one of four large, interconnected power grids: Western, Eastern, Texas, and Quebec Interconnections. All the electrical lines within an interconnection are in phase. It's possible to move power from one interconnection to another, but it involves using a high-power ac-to-dc-to-ac transformer.

Connections between Regional Transmission Organizations

U.S. Change in Demand from Prior Hour as of 6/15/2021 10 a.m. EDT (percent change)

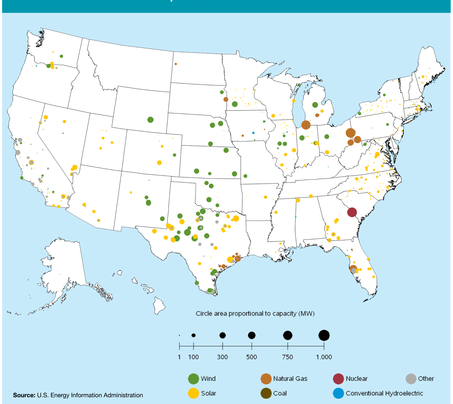


Source: U.S. Energy Information Administration

The Energy Information Administration provides near real-time data on the power flows within and between RTOs and other power providers. The graphic shown here is for a morning in mid-June when power demand was beginning to ramp up. The thing to note is the number of connections between RTOs. The Midwest ISO (MISO) and PJM Interconnection both have many connections to other power providers, meaning they can purchase electricity from them if needed. Even Quebec has connections to surrounding RTOs, which makes sense as its power system is built to export electricity. The Texas grid (listed as ERCO) is connected via dc lines to only one North American RTO as well as Mexico, which means when the Texas grid is stressed, it has very few options other than service disruptions.

Utility-Scale Generating Units Planned to Come Online

April 2021 to March 2022



Source: U.S. Energy Information Administration

One option to increase reliability is to build more baseload generating capacity. But wind and solar power is much cheaper to build than other power sources on the basis of kilowatt-hours delivered over their operating lifetime, so that is what utilities and others are planning to add. This map from the EIA shows where in the United States utility-scale generating units will come online between April 2021 and April 2022. Aside from a few gas-fueled power plants in the East-Central U.S. and a long-delayed nuclear power plant in Georgia, all the added capacity will be wind and solar power. When wind and solar power is curtailed, interconnected grids can bring in power from elsewhere. For Texas, that's a lot harder.

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