

# Transmission for a Clean Energy Grid

Rob Gramlich

Grid Strategies, [www.gridstrategiesllc.com](http://www.gridstrategiesllc.com)

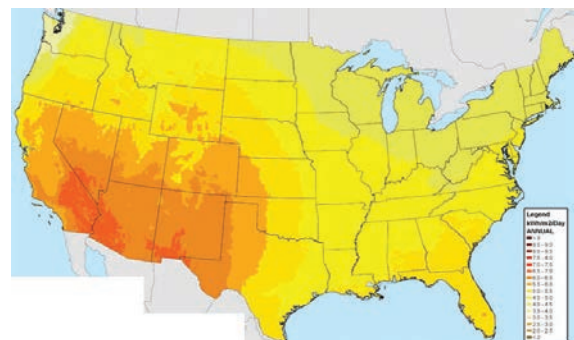
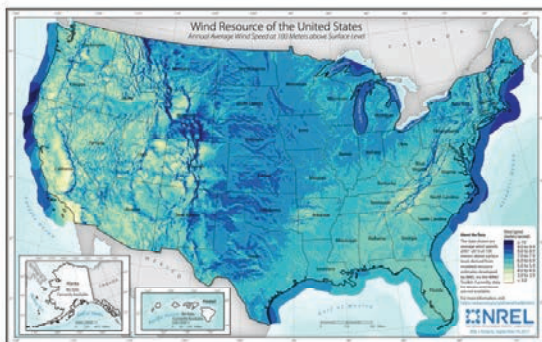
Americans for a Clean Energy Grid, [www.cleanenergygrid.org](http://www.cleanenergygrid.org)

WATT Coalition, [www.watt-transmission.org](http://www.watt-transmission.org)



## Transmission and Renewable Energy Inescapable physical properties

1. Best onshore wind and solar far from load. 88% in 15 central states
2. Regional exchange allows system balancing with higher penetration
3. Transmission provides flexibility and optionality in supporting the grid as generators retire, system inertia declines, and extreme weather events become more intense



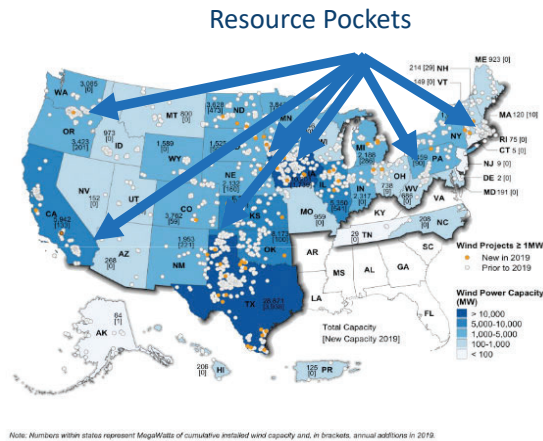
NREL Wind (left, 100m height) and Solar (right) Resource Maps

<https://windexchange.energy.gov/maps-data/319> , [https://www.nrel.gov/gis/images/map\\_pv\\_us\\_annual10km\\_dec2008.jpg](https://www.nrel.gov/gis/images/map_pv_us_annual10km_dec2008.jpg)



# Generation is Stuck in Interconnection Queues

- 844 GW of generation – 90% renewables, storage, and hybrids stuck in queues, end of 2020

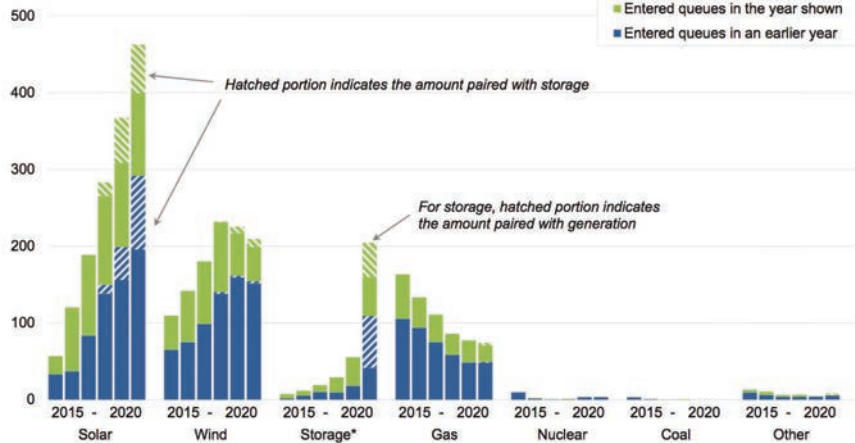


Note: Numbers within states represent Megawatts of cumulative installed wind capacity and, in brackets, annual additions in 2019.

Source: AWEA WindIQ, Berkeley Lab

Wind Project Locations

Capacity in Queues at Year-End (GW)



Projects Entering Interconnection Queues



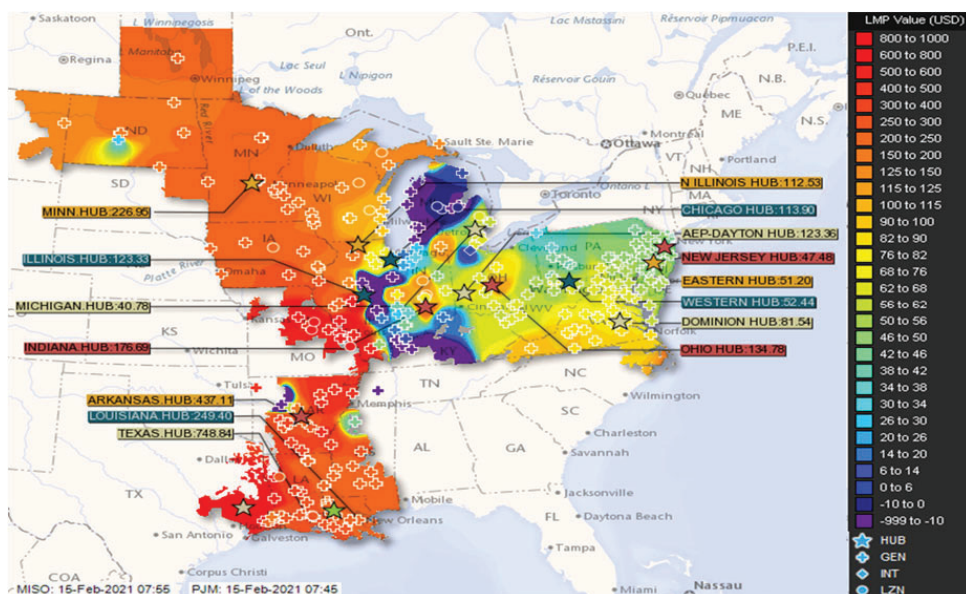
3

# Interregional Transmission Keeps the Lights On in Winter Storm Uri Feb 2021

MISO imported 13 GW, ERCOT only 0.8 GW (East to West flow)

Eastern polar vortex incidents in 2014, 2018 served by Midwest power (West to East flow)

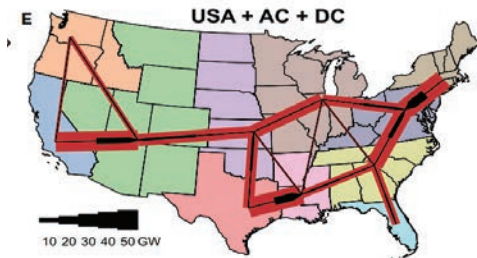
For transmission planning and cost allocation—beneficiaries are on both sides



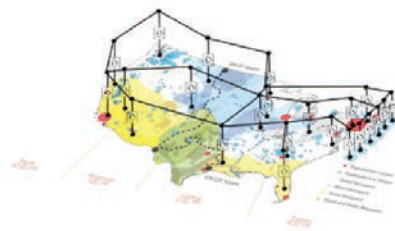
# Low-cost decarbonization requires large scale transmission

10s of GWs of power transfer back and forth across and between regions

2-3x increase in national transmission capacity



[https://www.cell.com/joule/fulltext/S2542-4351\(20\)30557-2](https://www.cell.com/joule/fulltext/S2542-4351(20)30557-2)



<https://cleanenergygrid.org/wp-content/uploads/2020/11/Macro-Grids-in-the-Mainstream-1.pdf>

5

Modeled flows NREL Seam study

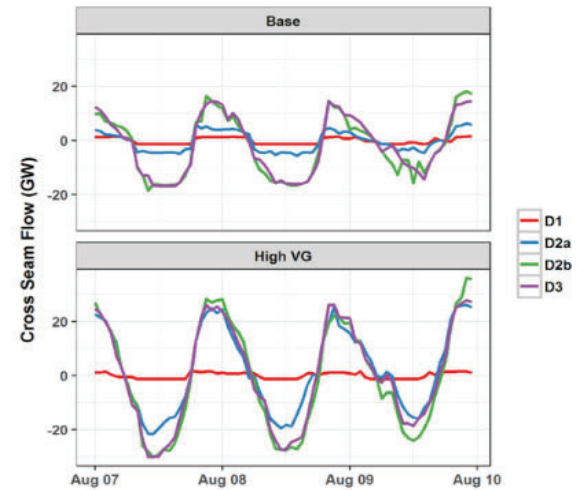


Fig. 3. Cross-seam transmission power flow (B2B and HVDC) during the coincident peak load period. A positive flow is a net export from the EI to the WI; a negative flow is a net import into the EI from the WI. Times are Eastern Standard Time.

## Transmission Enabled ½ of US Wind Capacity

Transmission plan	Wind Capacity Enabled (GW)
Tehachapi	4.5
Texas CREZ	14.5
MISO MVP	14
SPP Priority Projects, Balanced Portfolio	6
CO+ME+NV+PAC+BPA	10
Total	49

6



Find the full text of this and thousands of other resources from leading experts in dozens of legal practice areas in the [UT Law CLE eLibrary \(utcle.org/elibrary\)](http://utcle.org/elibrary)

## Title search: Transmission for a Clean Energy Grid

First appeared as part of the conference materials for the  
17<sup>th</sup> Annual Renewable Energy Law Institute session

"Macro-grid Issues: National and Regional Transmission Infrastructure Trends and  
Implications for Future Generation Project Development."