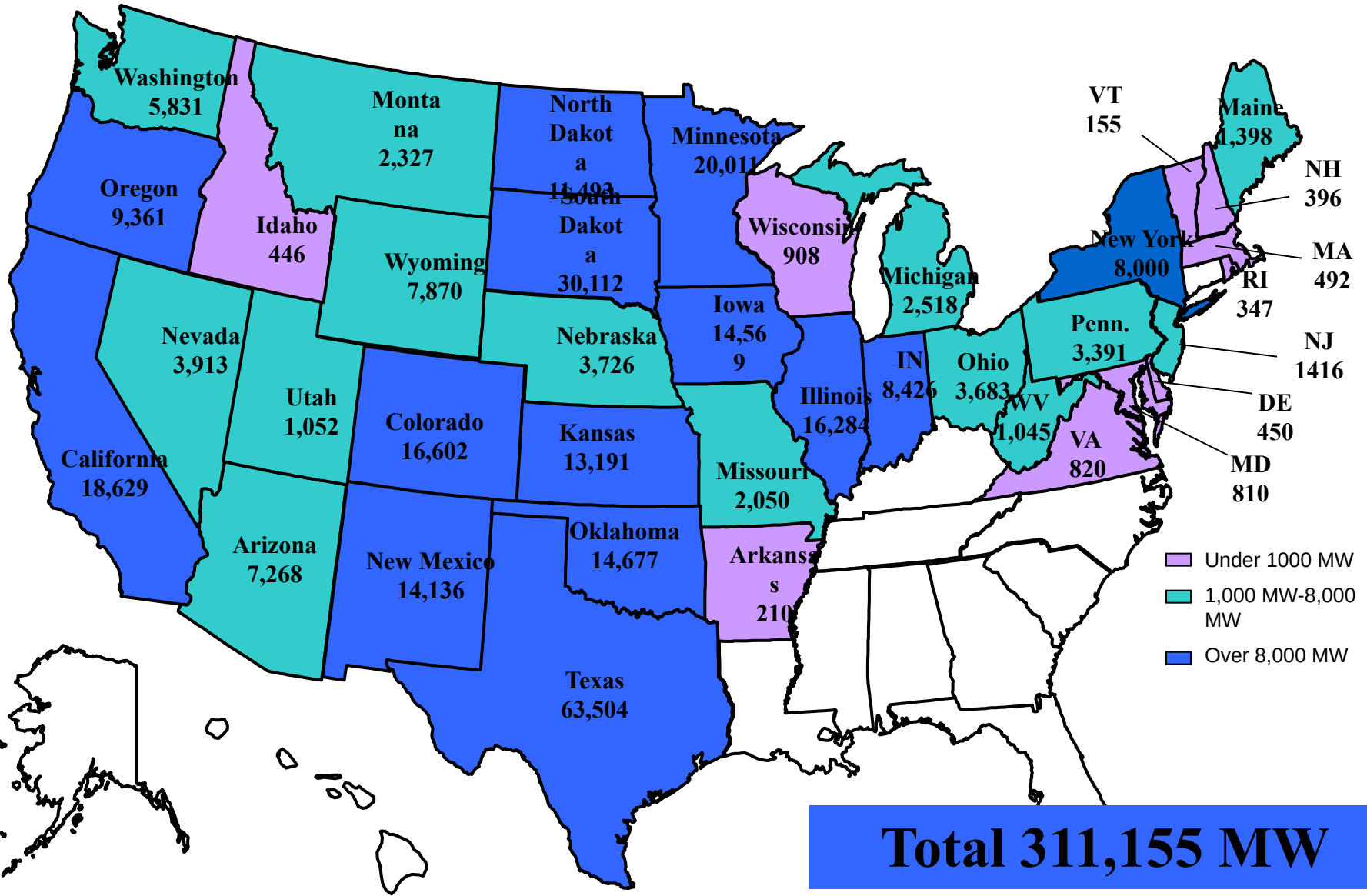


Transmission



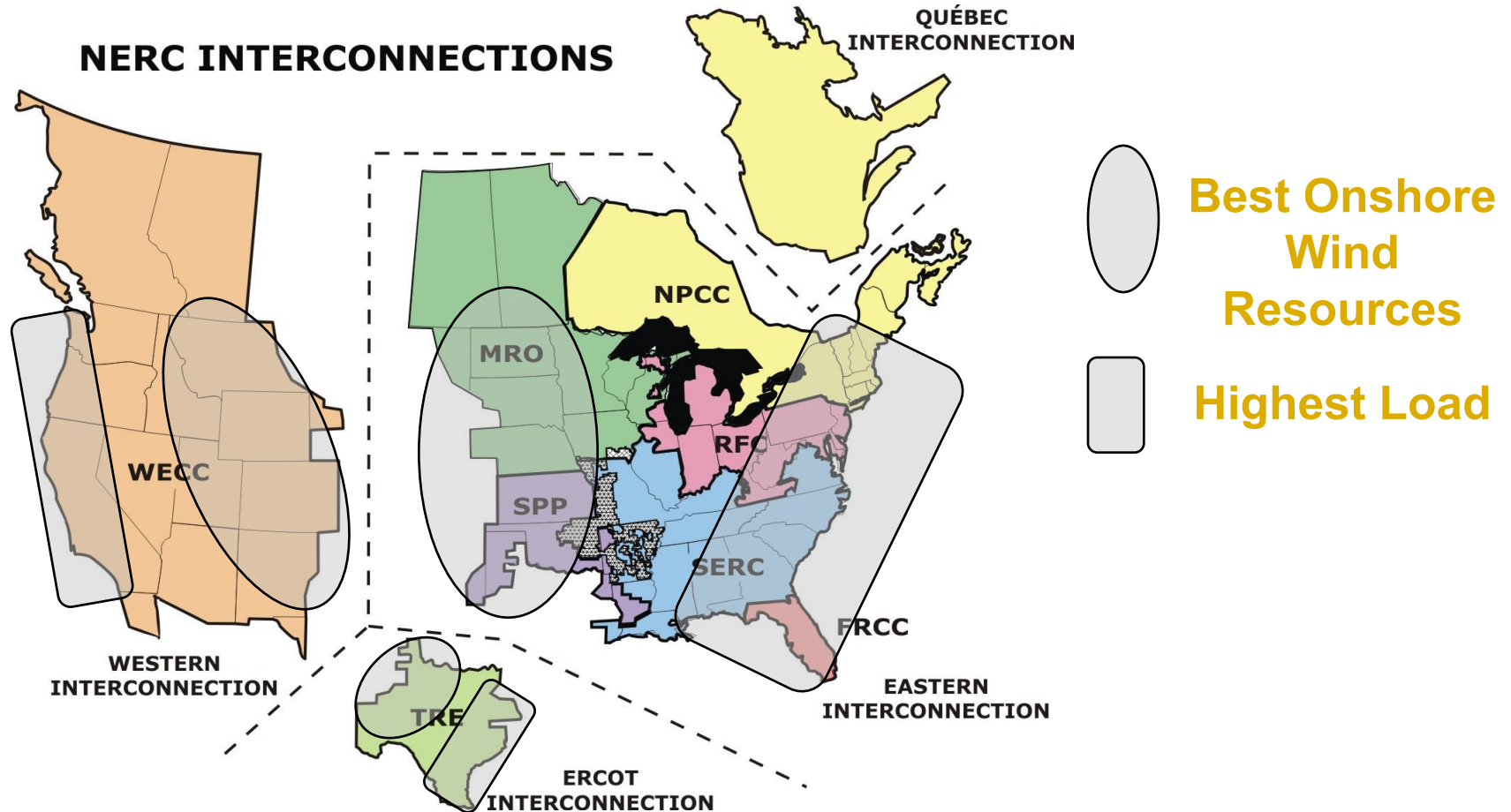
Larry Flowers
AWEA

Wind Power in Queues (MW)

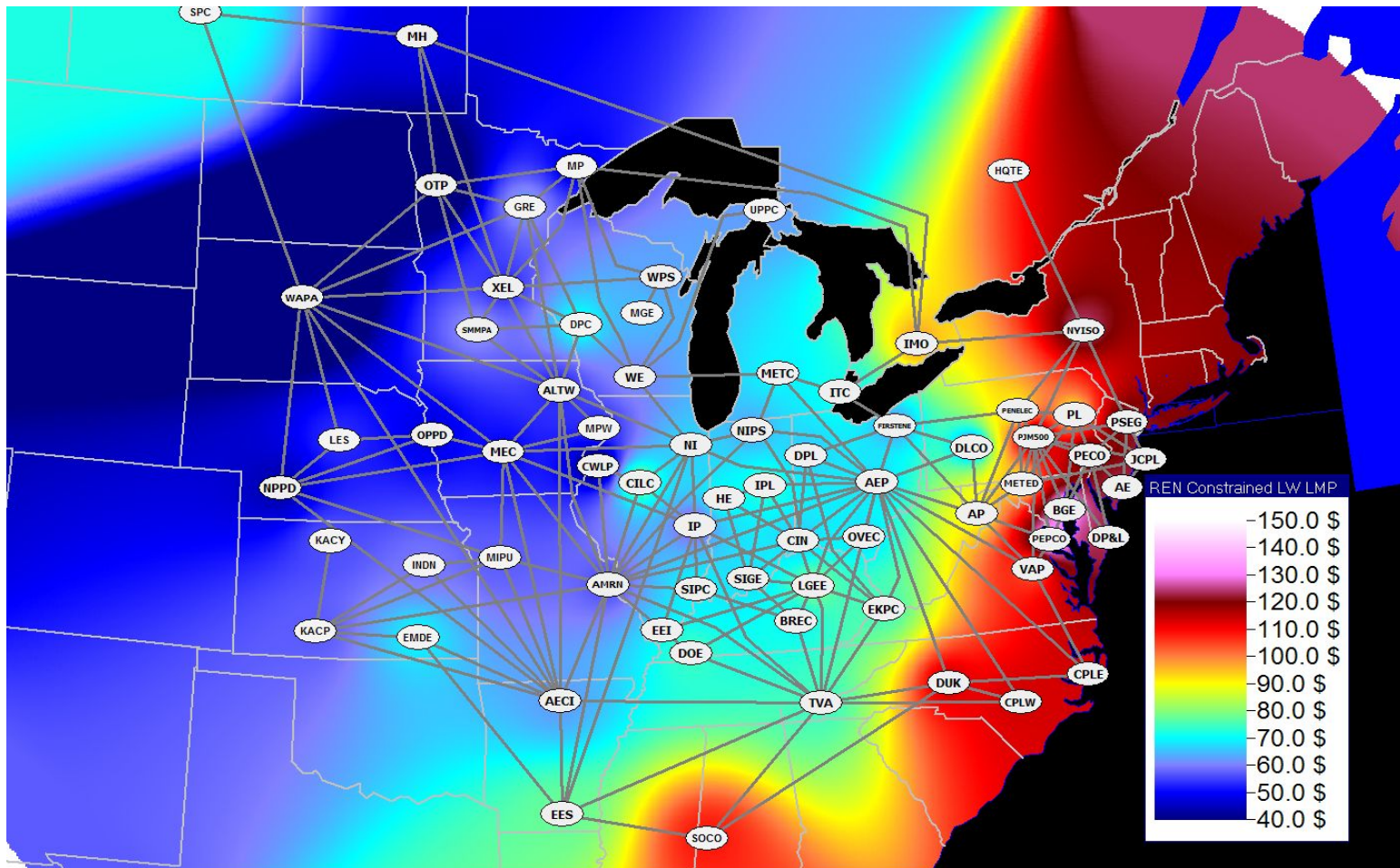


Source: AWEA

Lots of wind, Lots of load, Lots of distance



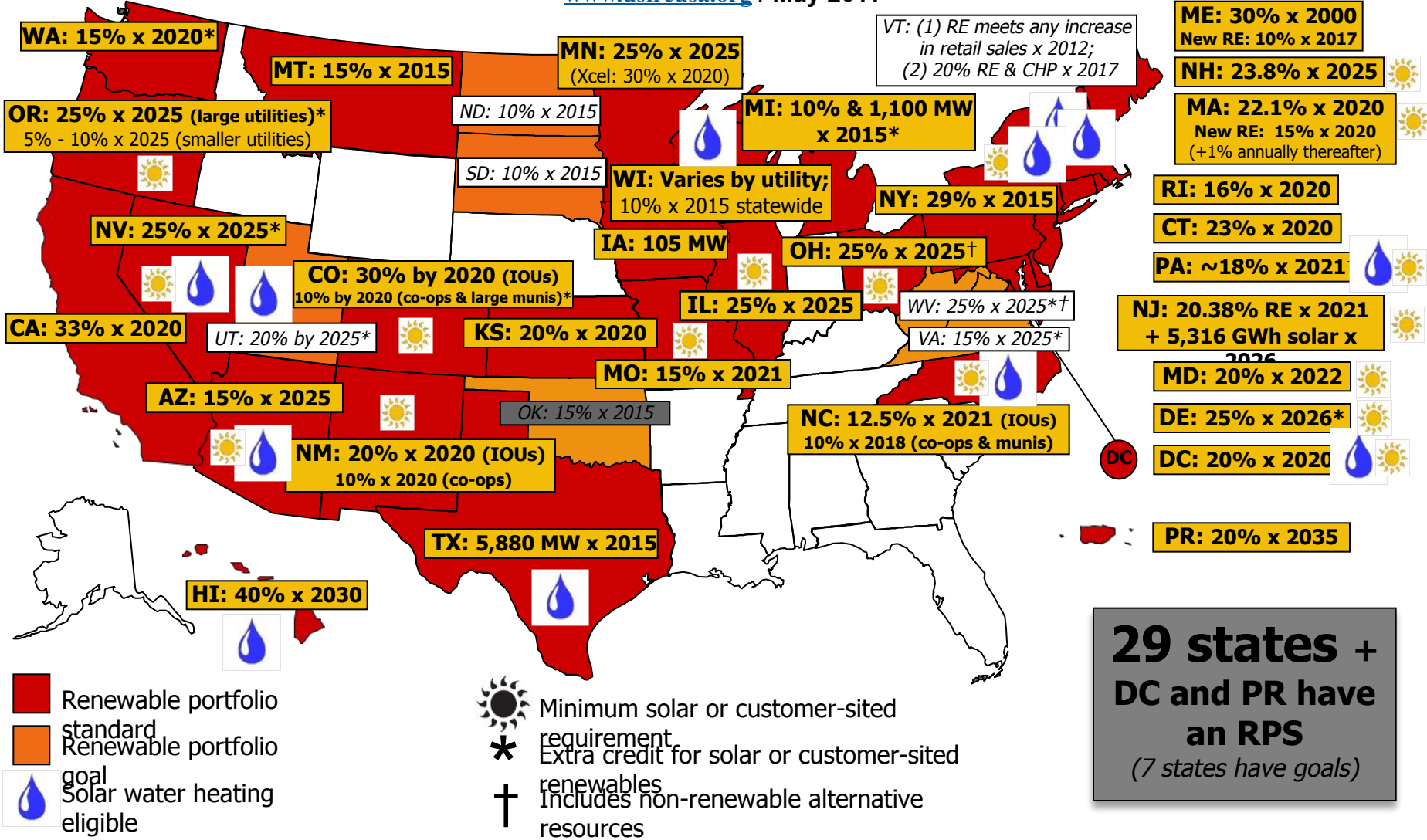
Annual Load Weighted LMP



Source: MISO

RPS Policies

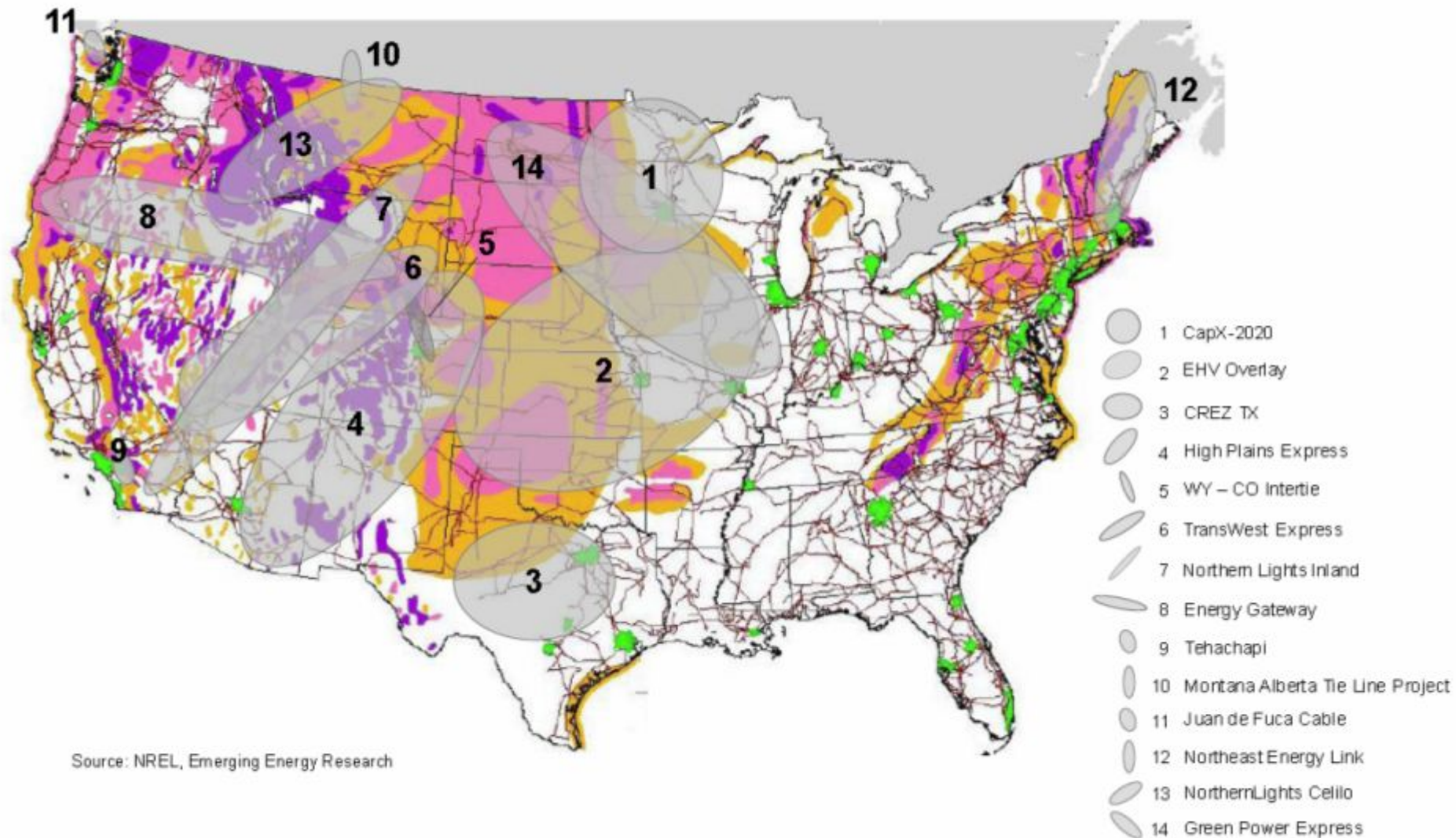
www.dsireusa.org / May 2011



29 states + DC and PR have an RPS
(7 states have goals)

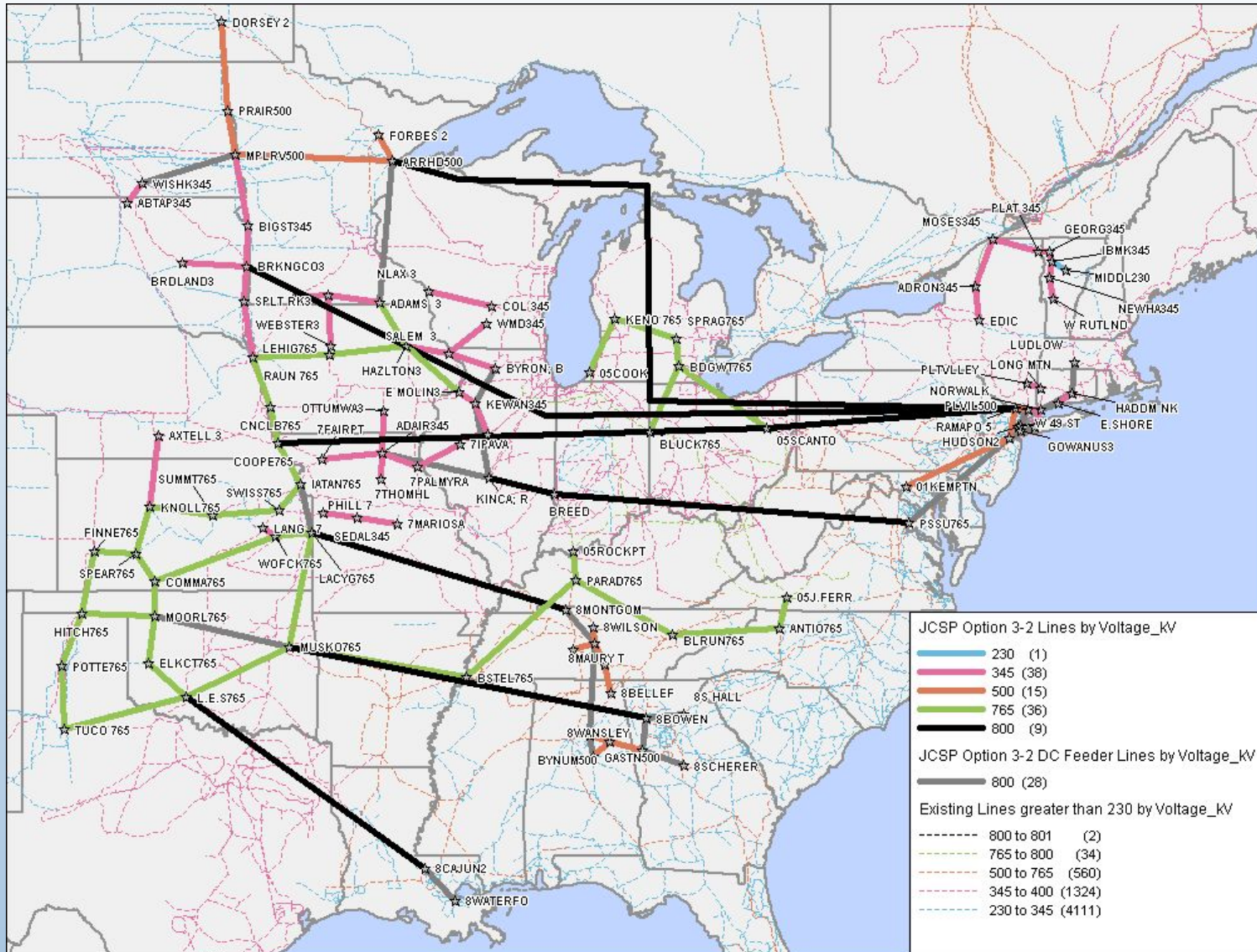
Transmission Initiatives Adapt to US Wind Growth

Transmission Project Examples

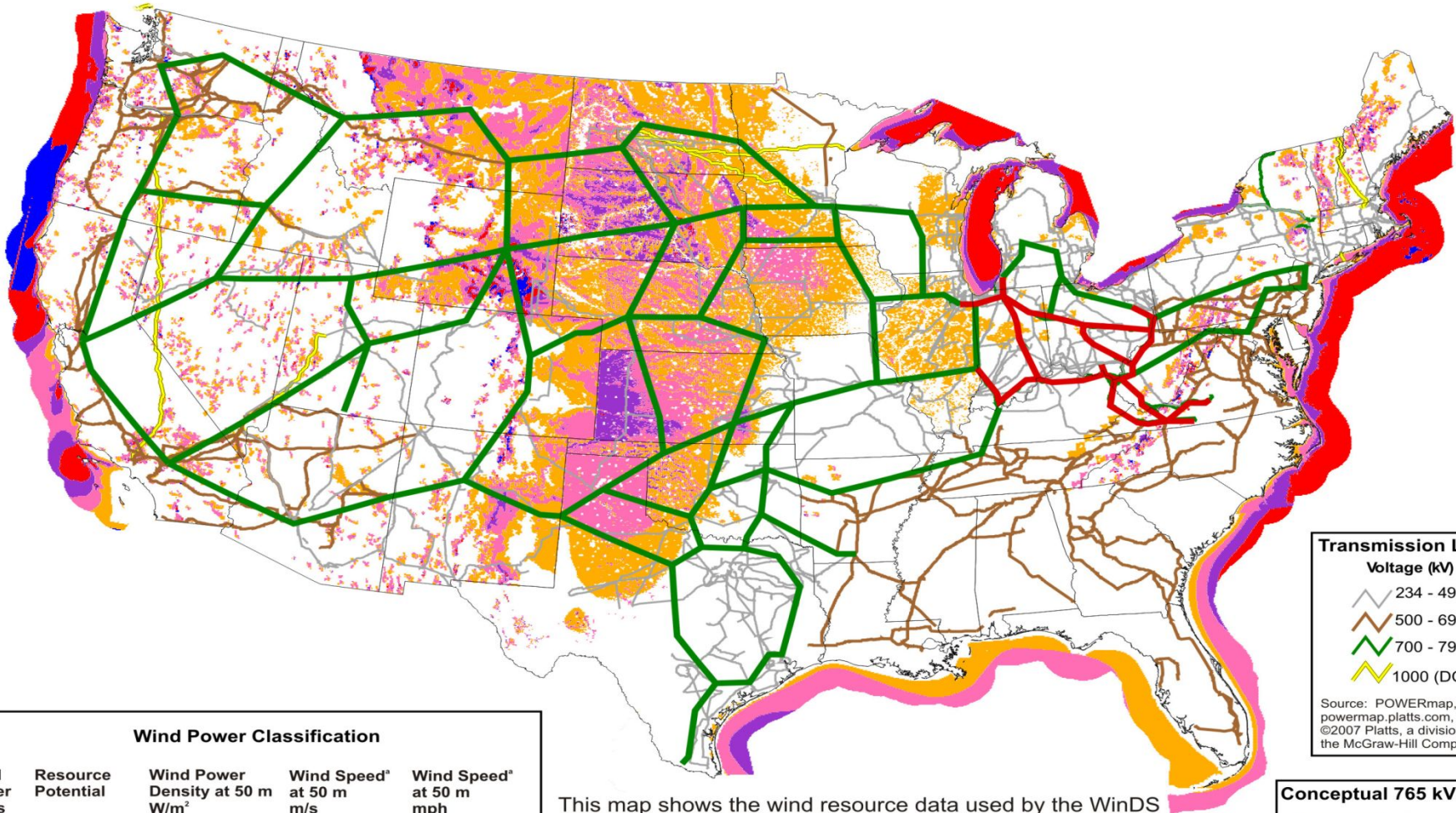


Source: NREL, Emerging Energy Research

Joint Coordinated System Plan Overlay – 20% Wind Scenario



20% Wind: Conceptual Transmission Overlay



Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m ²	Wind Speed ^a at 50 m m/s	Wind Speed ^a at 50 m mph
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

^a Wind speeds are based on a Weibull k value of 2.0

Transmission Lines Voltage (kV)

- 234 - 499
- 500 - 699
- 700 - 799
- 1000 (DC)

Source: POWERmap, powermap.platts.com, ©2007 Platts, a division of the McGraw-Hill Companies

Conceptual 765 kV Network

- Existing 765 kV
- New 765 kV
- AC-DC-AC Link

Source: American Electric Power (AEP)

This map shows the wind resource data used by the WinDS model for the 20% Wind Scenario. It is a combination of high resolution and low resolution datasets produced by NREL and other organizations. The data was screened to eliminate areas unlikely to be developed onshore due to land use or environmental issues. In many states, the wind resource on this map is visually enhanced to better show the distribution on ridge crests and other features.

Transmission Acceptance

- “If you like wind, you have to at least accept transmission” (paraphrase from Xcel COO)
- Transmission is $< 10\%$ of electricity system cost
- Relatively small amount of transmission has been built in last decade in US
- Historically, economics and utility eminent domain ruled the day
- 20% Wind: 12,000-19,000 miles of new HV transmission required
- Distributed (community) wind will not substantially reduce need for significant transmission build out

Transmission Acceptance (cont'd)

- U.S. is heavily engaged in regional transmission route options analysis & planning (e.g., EWITS, WECC, WGA, RMATS, SPP, ERCOT)
- Identification of Competitive Renewable Energy Zones (CREZ) at the state and regional level helps focus the analyses
- Federal lands corridors identified but not thoroughly vetted with stakeholders
- Several states and their utilities are active in stakeholder and community engagement (e.g., TX, CA, MN, MT)
- Some innovative approaches being taken to secure stakeholder involvement and acceptance (e.g., MATL, CA RETI, HART, CAPEX 2020); traditional stakeholder processes ineffective
- Basic approach: convince stakeholders that transmission is both needed (e.g. to meet state RPS) and transcends utility interests
- More local, more difficult
- Multi-state cooperation is critical, but politically difficult
- Economic development potentials creating inter-regional stress

Six “P’s” of Transmission

- Planning
- Permitting
- Paying
- PUC’s
- Public
- Policy