

ELECTRICITY TRANSMISSION IN THE US ENERGY TRANSITION: ISSUES AND LESSONS FOR EUROPE

8 NOVEMBER 2023 @ 3:00 PM – 4:00 PM CET

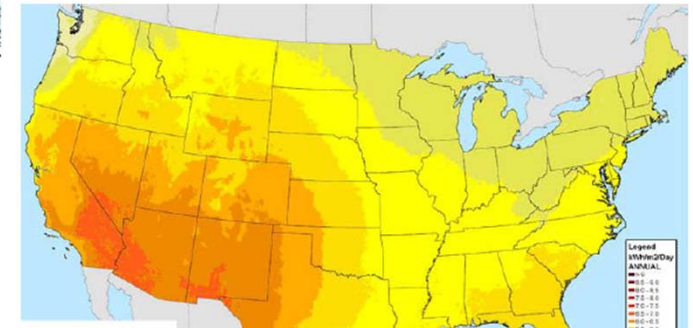
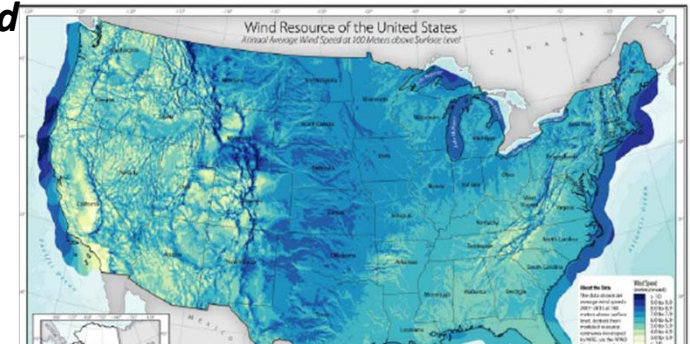
TALK • ELECTRICITY



The new episode of FSR Talks hosted by Prof. Jean-Michel Glachant welcomes Prof. [Benjamin Hobbs](#), John Hopkins University in Baltimore to discuss electricity transmission in the US and Europe. [Astrid Brunt](#), Statnett, Norway, will join the speaker as a discussant.

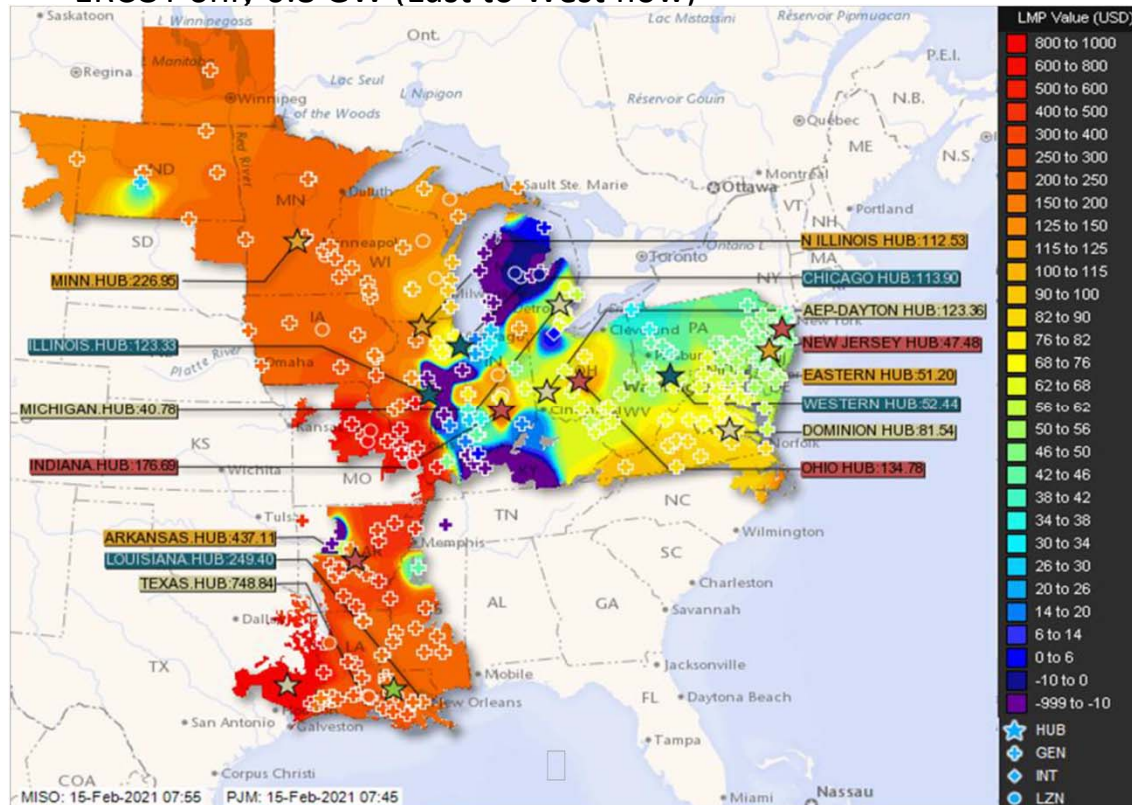
The need

Exploiting diverse wind & solar resources



Keeping the Lights On:

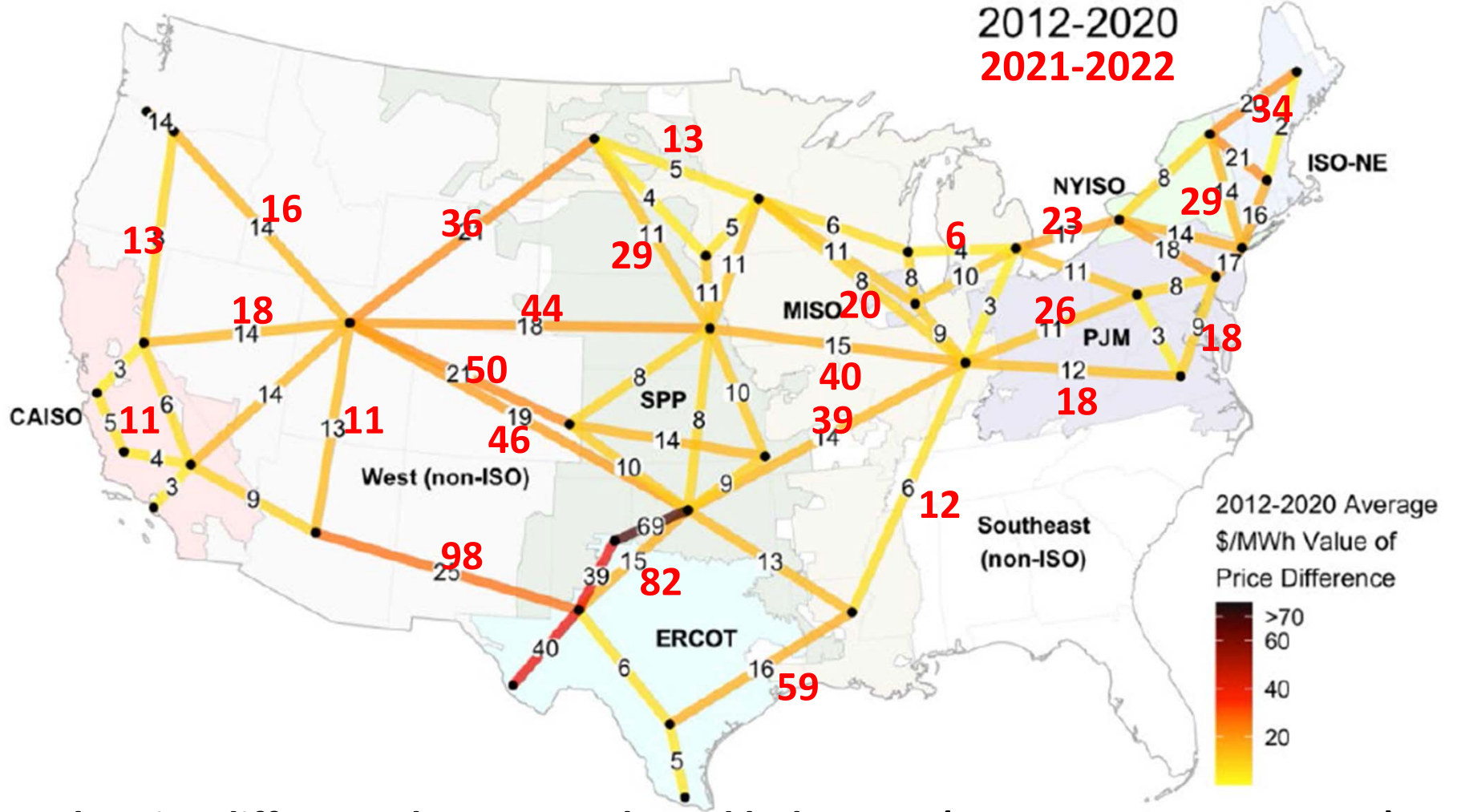
- In Winter Storm Uri (2/21), MISO imported 13 GW, ERCOT only 0.8 GW (East to West flow)



Source: R. Gramlich, Observations on winter electric reliability event in South Central U.S., <https://energycentral.com/c/gr/observations-winter-electric-reliability-event-south-central-us>, Feb. 17, 2021

<https://windexchange.energy.gov/maps-data/319> , www.nrel.gov/gis/images/map_pv_us_annual10km_dec2008.jpg ; A. Liu, B.F. Hobbs, J. Ho, et al., Co-optimization of Transmission and Other Supply Resources, National Association of Regulatory Utility Commissioners, 2013, <http://pubs.naruc.org/pub/536D834A-2354-D714-51D6-AE55F431E2AA>

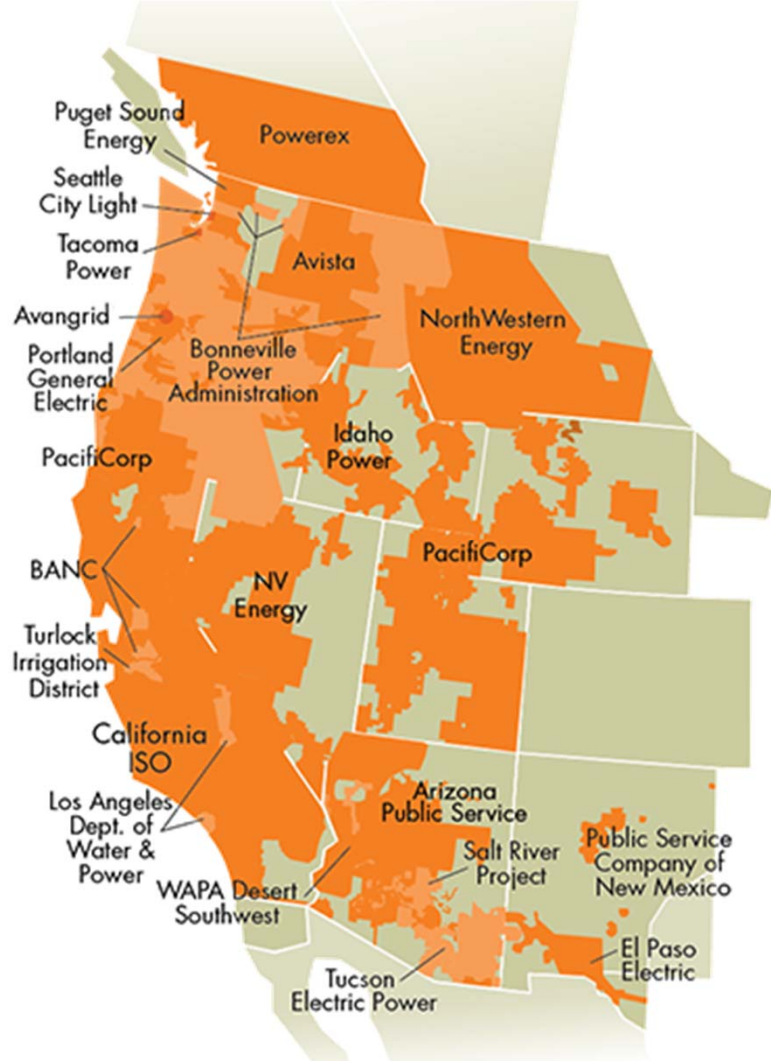
Problem 1: CONGESTION



Average hourly price difference between selected hub zones (2012-20 versus 2021-22)

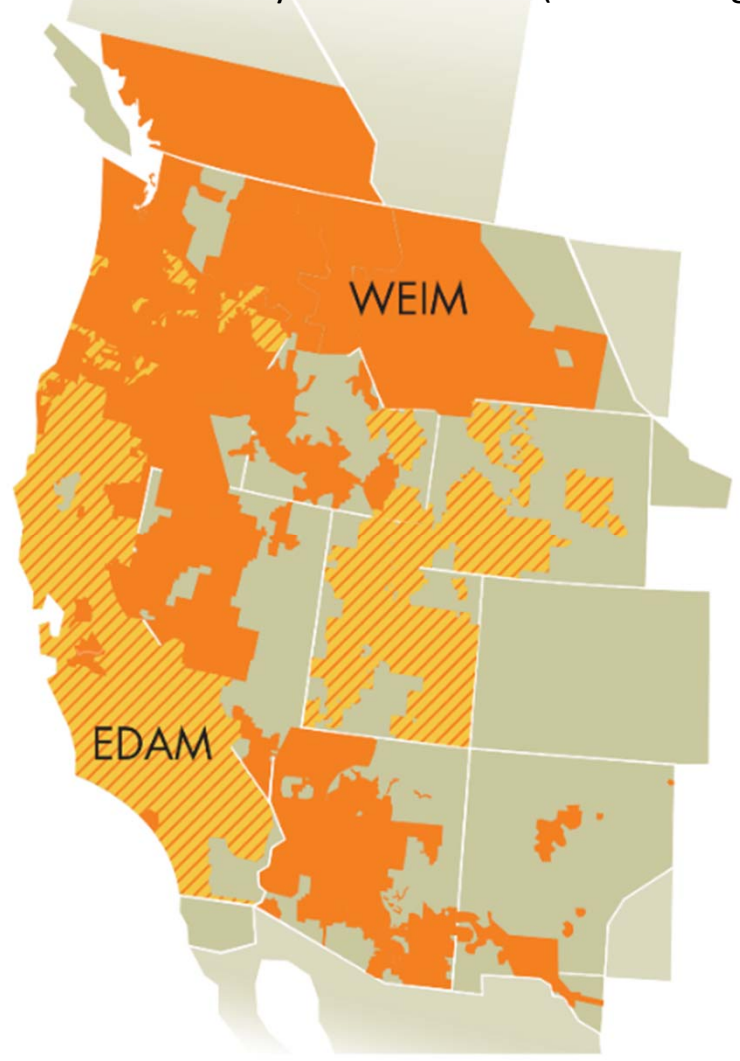
Source: USDOE, *National Transmission Needs Study*, Oct. 31, 2023

Real-Time: Western Energy Imbalance Market (WEIM)



www.westerneim.com/pages/default.aspx

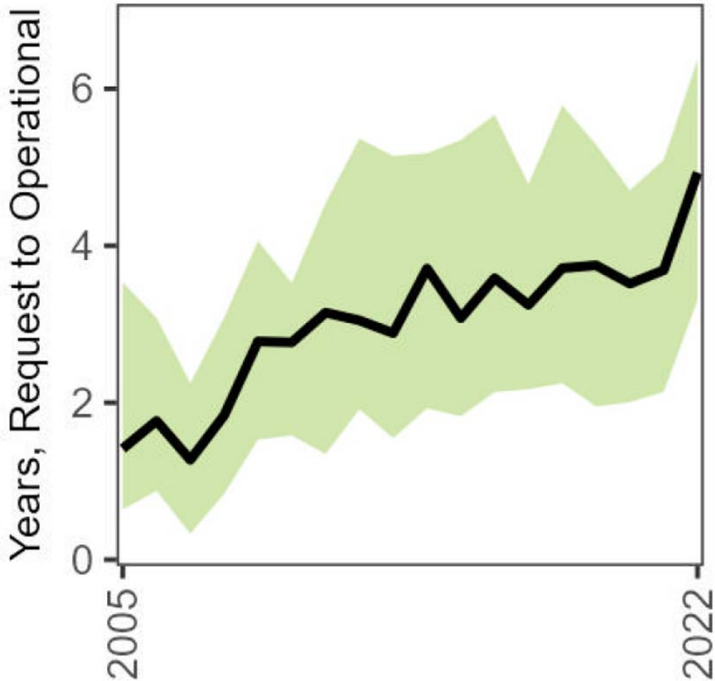
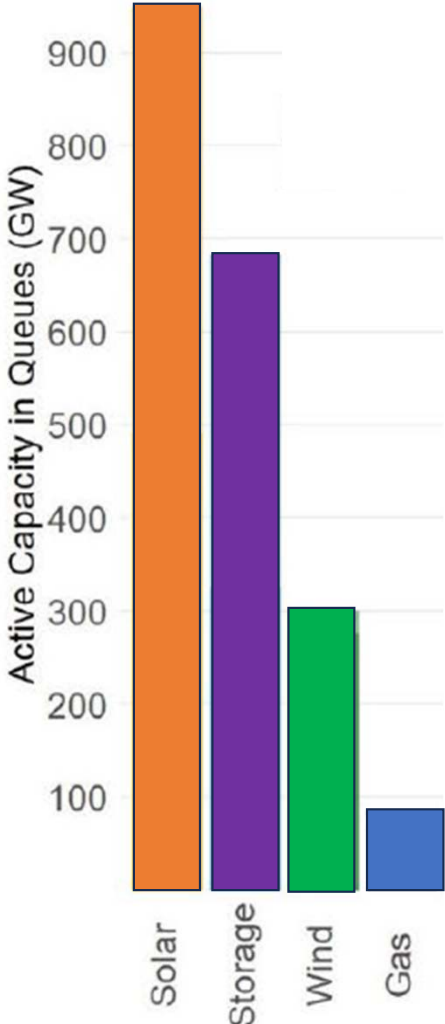
Extended Day-Ahead Market (forthcoming)



Source: CAISO, Extended Day-Ahead Market Fact Sheet

Problem 2: GEN INTERCONNECTION QUEUES

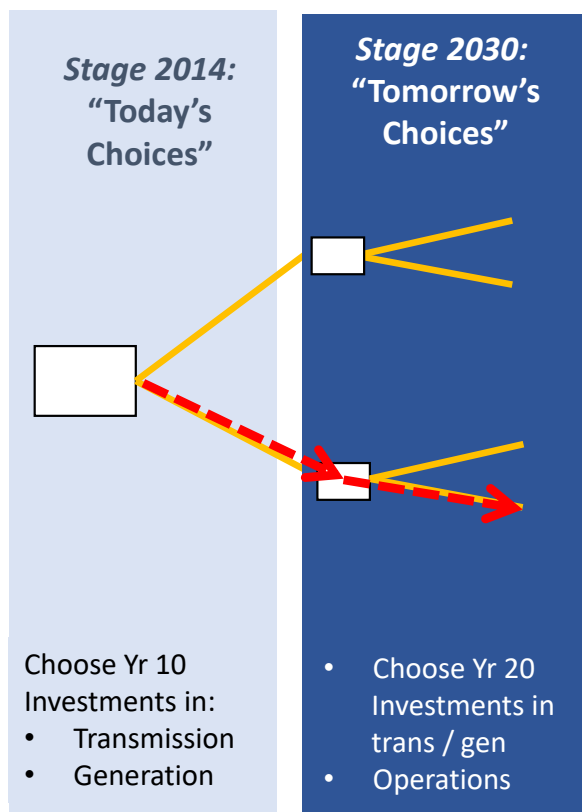
Power plants seeking transmission connection by type:
2 TW in queue (45% solar)
Cf. 1.2 TW installed capacity (44% gas)



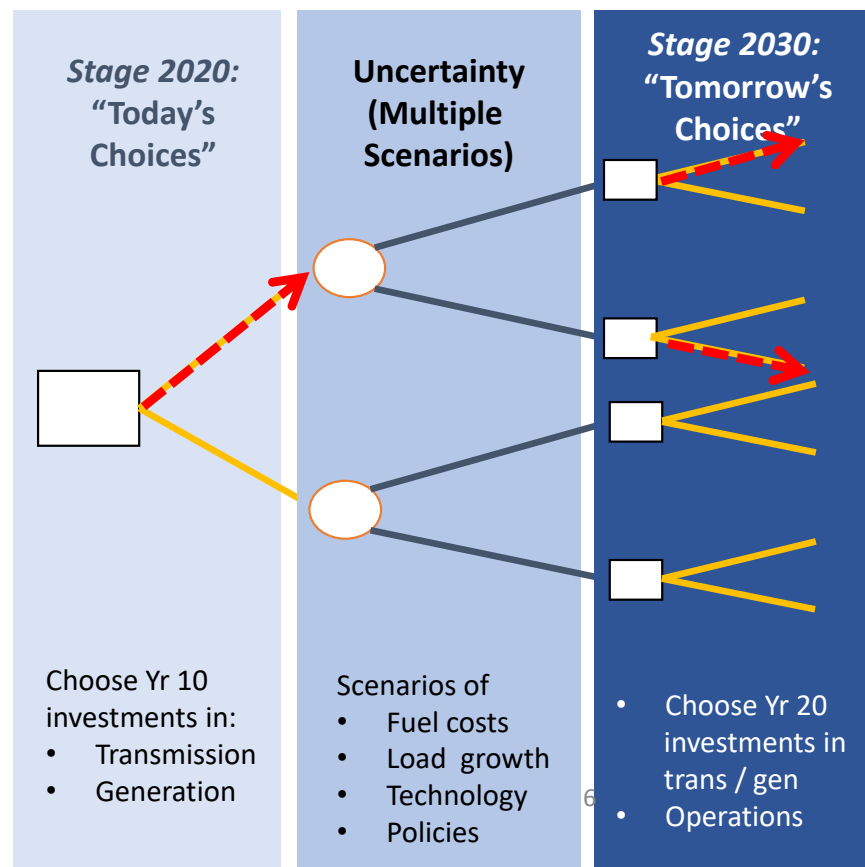
Median/interquartile range of years from generator interconnection request to operation for projects dating back to 2005

USDOE National Transmission Needs Study, Oct. 31, 2023, (Data from Lawrence Berkeley Natl. Lab.; <https://emp.lbl.gov/queues>)

JHU Stochastic Multistage Integrated Network Expansion (JHSMINE): Proactive & Robust Cooptimization

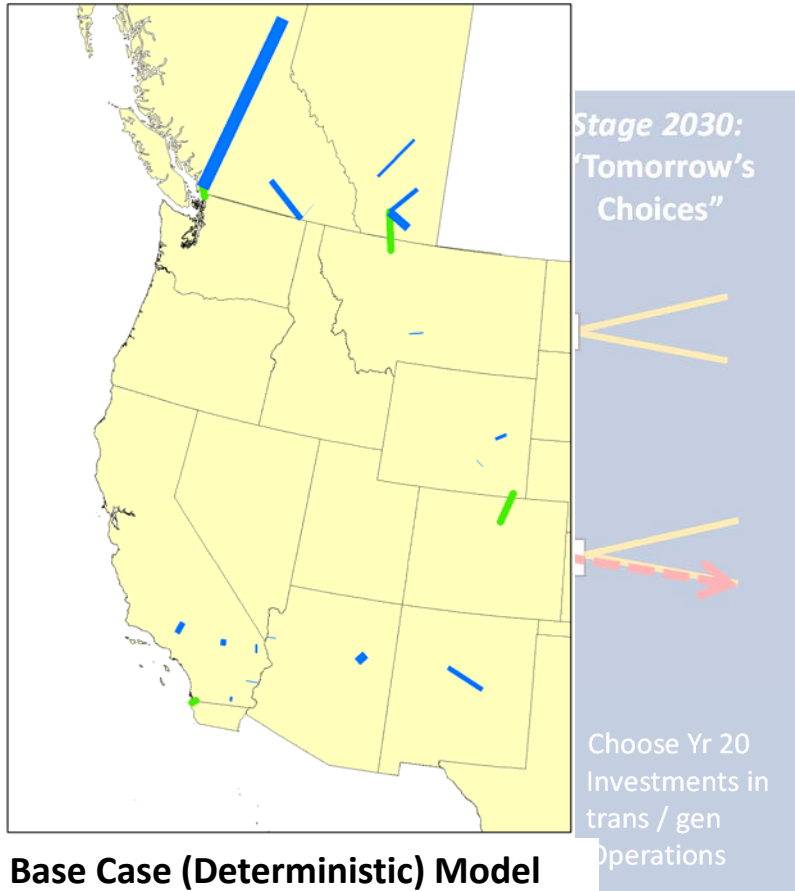


Deterministic Approach:
One model for each study case



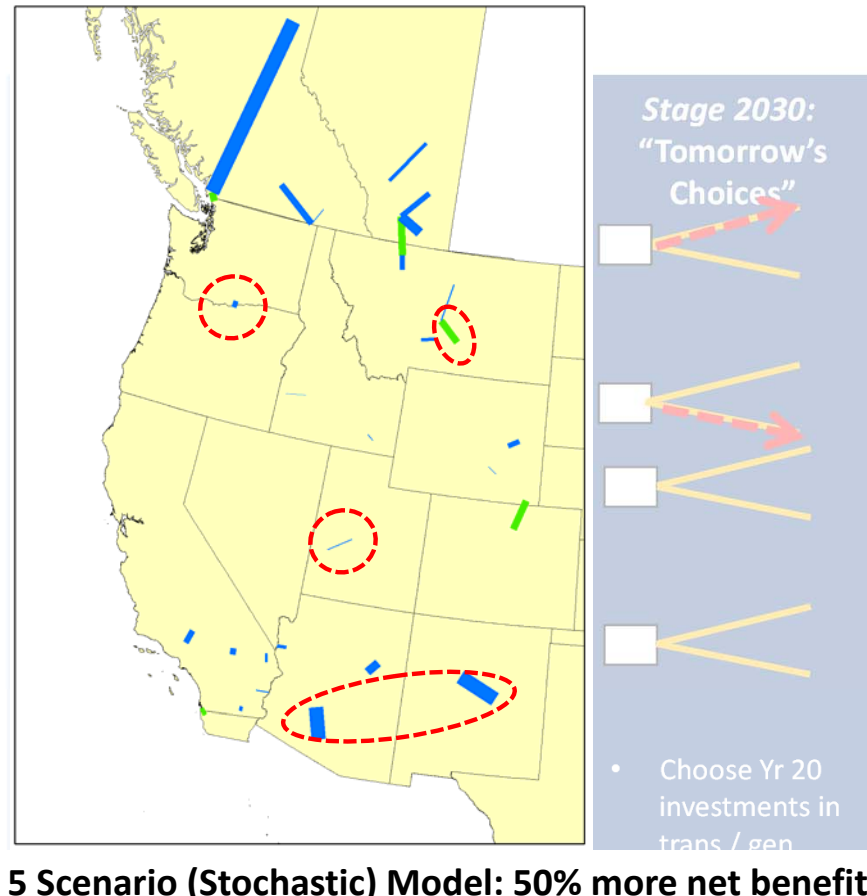
JHSMINE: Solve all cases at once in one model

JHU Stochastic Multistage Integrated Network Expansion (JHSMINE): *Proactive & Robust Cooptimization*



Base Case (Deterministic) Model

*Deterministic Approach:
One model for each study case*



5 Scenario (Stochastic) Model: 50% more net benefits

JHSMINE: Solve all cases at once in one model

Problem 3: BUILDING NEW INTERCONNECTORS

3 P's:

- **PLANNING:** Inefficient practices (see below)
- **PERMITTING:** Local veto power
- **PAYMENT:** Cumbersome cost allocation

Courtesy of Rob Gramlich

	Proactive Generation & Load	Multi-Value	Scenario-Based	Portfolio-Based ³⁰	Joint Interregional Planning
ISO-NE ³¹	✗	✗	✗	✓	✗
NYISO ^{32,33} – PPTPP only	✗ ✓	✗ ✓	✗ ✓	✗ ✓	✗ ✗
PJM ^{34,35}	✗	✗	✗	✗	✗
Florida	✗	✗	✗	✗	✗
Southeastern Regional	✗	✗	✗	✗	✗
South Carolina Regional	✗	✗	✗	✗	✗
MISO (excl. MVP, RIIA) ³⁶	✗	✗	✗	✗	✗
SPP (ITP) ^{37,38}	✗	✓	✗	✓	✗
CAISO ^{39,40} – TEAM only	✓ ✓	✗ ✓	✓ ✓	✗ ✓	✓ ✓
WestConnect	✗	✗	✗	✗	✗
NorthernGrid ⁴¹	✗	✗	✗	✗	✗

Problem 3: BUILDING: We did it 10 years ago....

Regional circuit-miles of new/upgraded transmission ($\geq 100\text{kV}$) energized by year, selected regions.

Source: DOE National Transmission Needs Study, Oct 31, 2023, data from MAPSearch Transmissiion Database (2023)



Some Lessons

- From 50 years of infrastructure design: Just building your way out of trouble is unaffordable and environmental damaging
 - *Need smart management (markets) and grid enhancing technologies too*
- Piecemeal grid extension to accommodate new projects yields the US's disastrous interconnection queue
 - *Need proactive grid planning on multiproject/regional scale*
- Balkanized US grid means we'll miss out on reliability, environmental, and economic benefits of the transition
 - *Need federal leadership to encourage regional approach*