

Montana's Energy Supply: Constraints, Opportunities, Economic Imperatives

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for the MT DEQ – US DOE Montana Energy Needs Workshop

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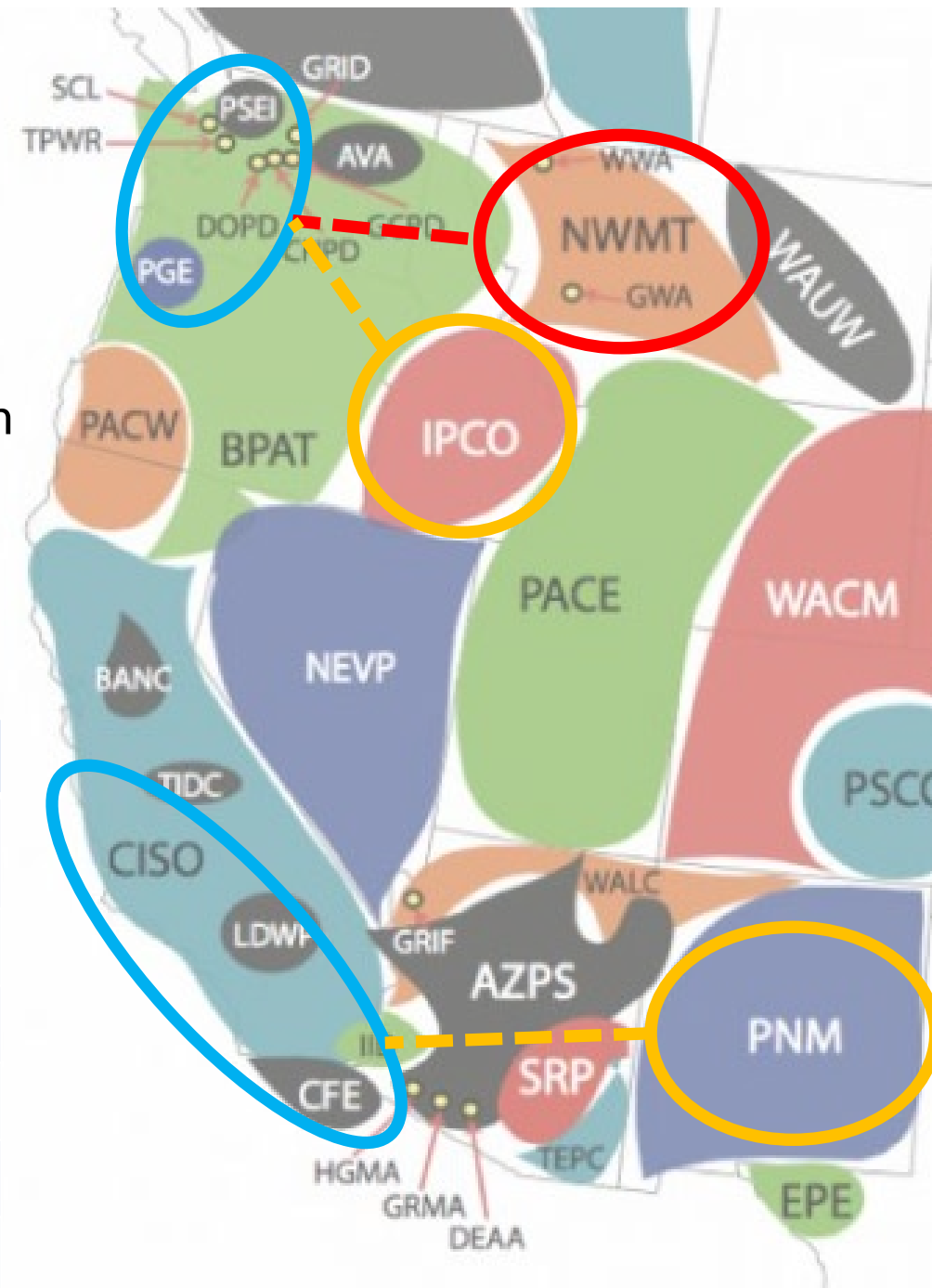
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6. Demand for Generation
7. Montana's Economic Constraints and Opportunity

Benchmarking Montana's Transmission and Resource Development

Idaho Power, PNM, NorthWestern Are Similar

- Medium-sized utilities
- Growing peak loads, with demand for industrial growth
- Participating in the real-time WEIM, and planning for DAM
- Similar geographies
- NWMT and PNM are at the edge of western interconnection
- Connected to west-wide clean energy demand
- Have abundant solar and wind resource
- Relied on coal and gas for capacity and state revenue
- Have carbon reduction goals

	IPCO	PNM	NWMT
Retail Electric Customers	639,000	486,120	398,200
Peak Load	3767 MW	2131 MW	2079 MW
Peak Load CAGR	1.8%	0.9-1.2%	0.4% (retail)
LargeLoad CAGR	1.1%	0.12%	0.23%
State Policy	None	CarbonFree 2045	None
Company Goal	CarbonFree 2045	CarbonFree 2040	Net Zero 2050



Planned Least-Cost Capacity Additions to 2042*

	IPCO	PNM	NWMT
Preferred Wind	1,800 MW	1,000 MW	0 MW
Preferred Solar	3,325 MW	2,491 MW	0 MW
Preferred S/T BESS	1,253 MW	1,842 MW	0 MW
Preferred L/T BESS	200 MW	200 MW	0 MW
Preferred DSM/EE	360 MW	219 MW	89 MW
Preferred DR	160 MW	166 MW	0 MW
Preferred Gas	261 MW	0 MW	175 MW
Preferred Coal	0 MW	0 MW	222 MW
Last Coal Exit (year)	2030	2032	2042?
New utility Tx miles	1585	554	0
New merch. Tx miles	0	1987	400

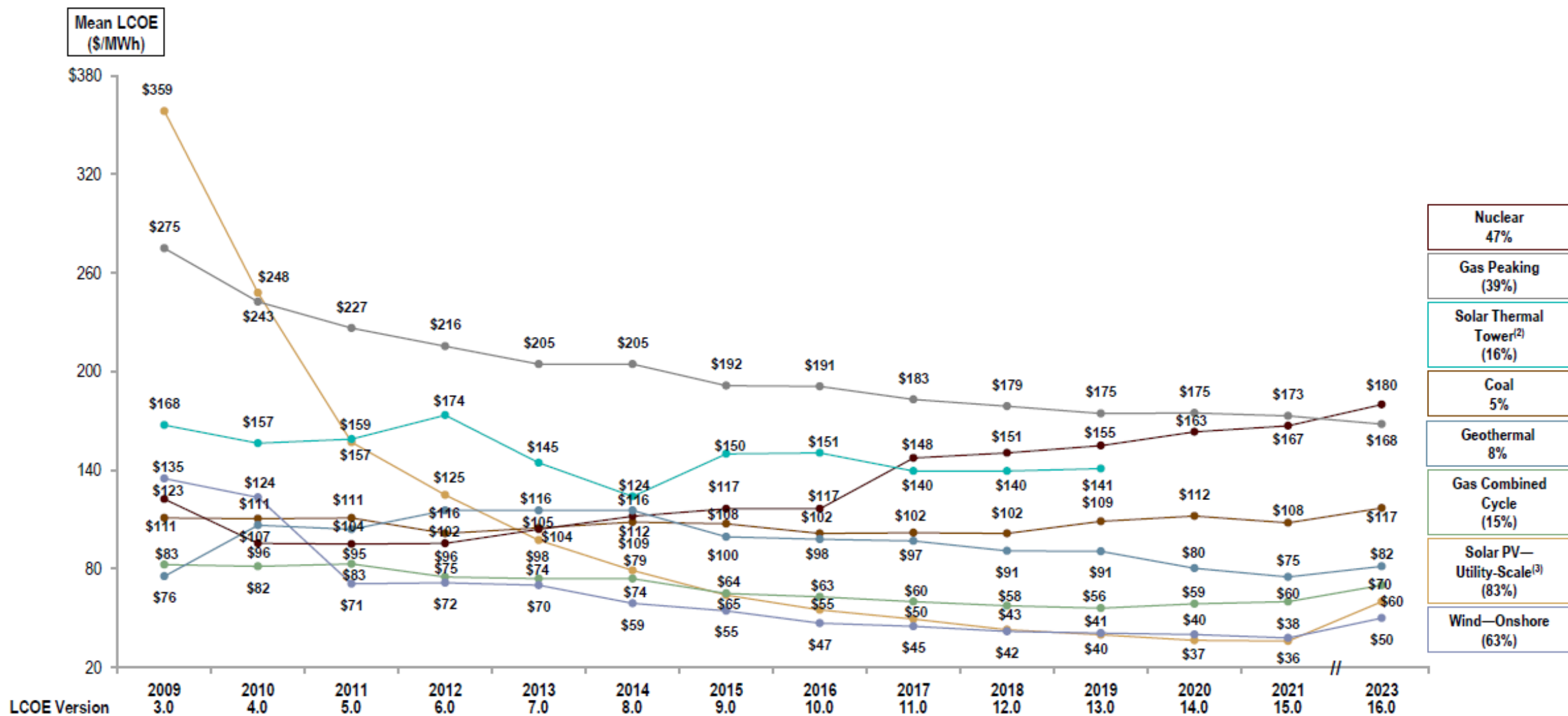
*from each organization's 2023 IRP

Resource Economics

Levelized Cost of Energy Comparison—Historical Utility-Scale Generation Comparison

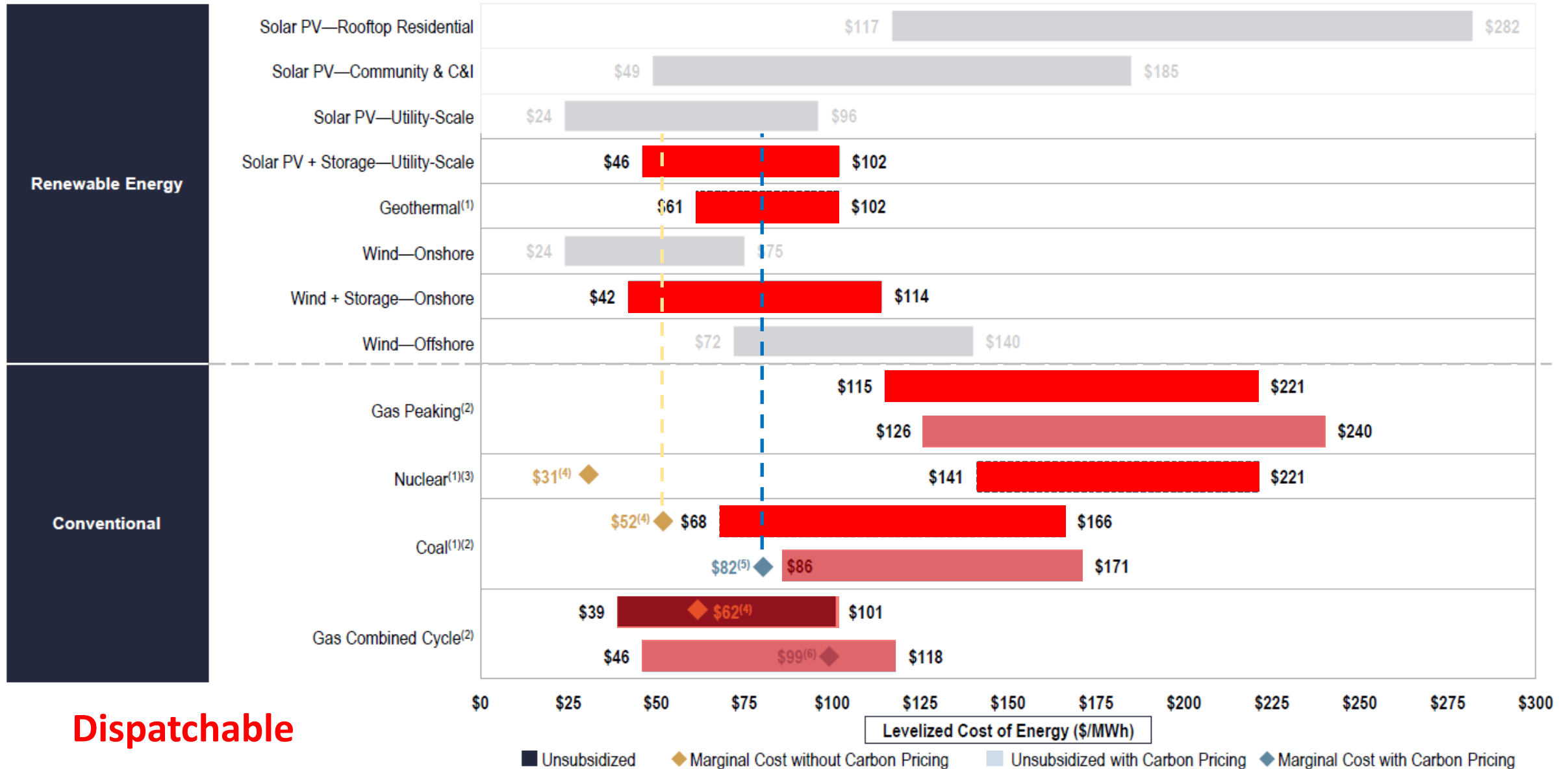
Lazard's unsubsidized LCOE analysis indicates significant historical cost declines for utility-scale renewable energy generation technologies driven by, among other factors, decreasing capital costs, improving technologies and increased competition

Selected Historical Mean Unsubsidized LCOE Values⁽¹⁾

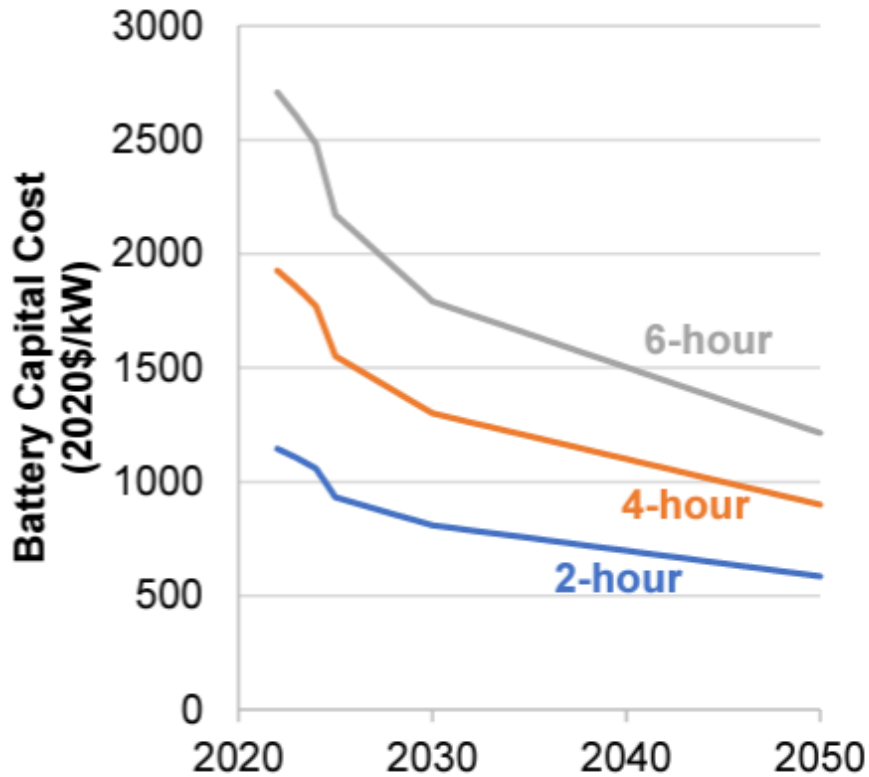


Levelized Cost of Energy Comparison—Sensitivity to Carbon Pricing

Carbon pricing is one avenue for policymakers to address carbon emissions; a carbon price range of \$20 – \$40/Ton of carbon would increase the LCOE for certain conventional generation technologies relative to those of onshore wind and utility-scale solar

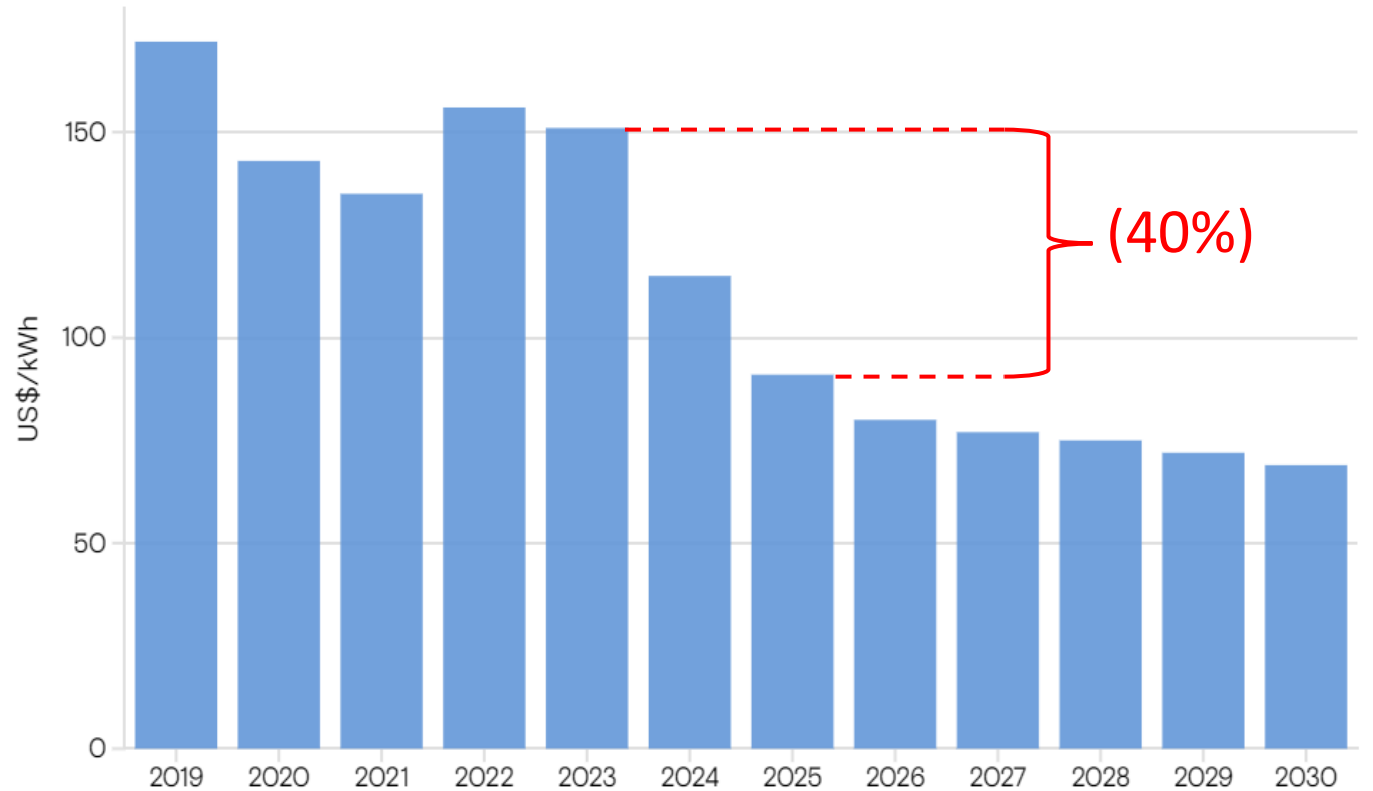


BESS Cost Declines



www.nrel.gov/docs/fy23osti/85332.pdf

Global average battery pack prices



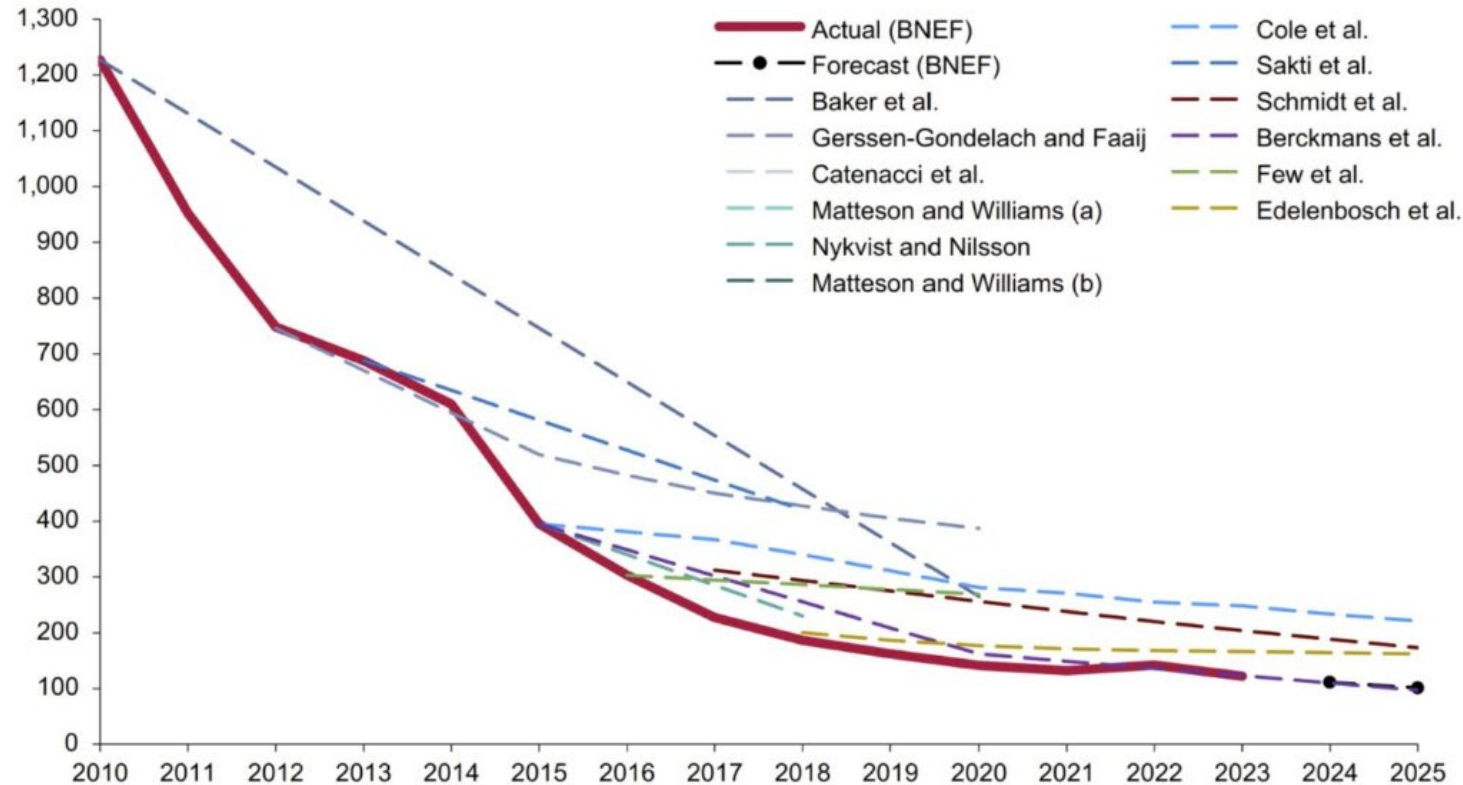
Source: Company data, Wood Mackenzie, SNE Research, BNEF, Goldman Sachs Research
2023-2030 are estimates

Goldman Sachs



BESS: History of Conservative Forecasts

Figure 13: Battery cell costs, expert forecasts vs. actuals, \$/kWh



Source: Mauler et al. (2021)⁶⁴ for expert forecasts of 2010-2018, BNEF Lithium-Ion Battery Price Survey (2023)⁶⁵ for actuals and most recent forecasts.

Long Duration Storage



KEY ADVANTAGES OF OUR TECHNOLOGY



LOW-COST

Stores energy at less than 1/10th the cost of lithium-ion battery technology.



OPTIMIZABLE

Pairs well with lithium-ion batteries and renewable energy resources to enable optimal energy system configurations.



RELIABLE

Delivers 100+ hour duration required to make wind, water, and solar reliable, year round, anywhere in the world.



MODULAR

Can be sited anywhere for utility-scale needs.



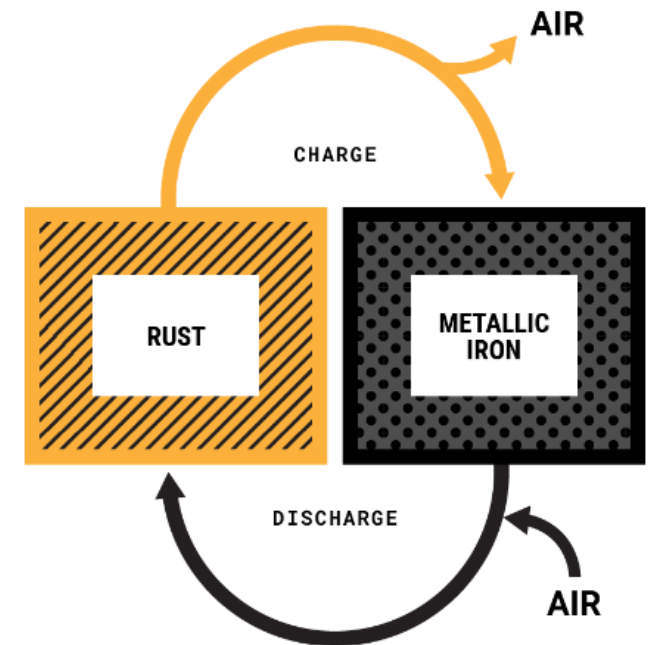
SCALABLE

Materials and designs with global scale needed for zero carbon economy.



SAFE

No risk of thermal runaway. No heavy metals. High recyclability.



Montana's Low-Cost, Renewable Resource

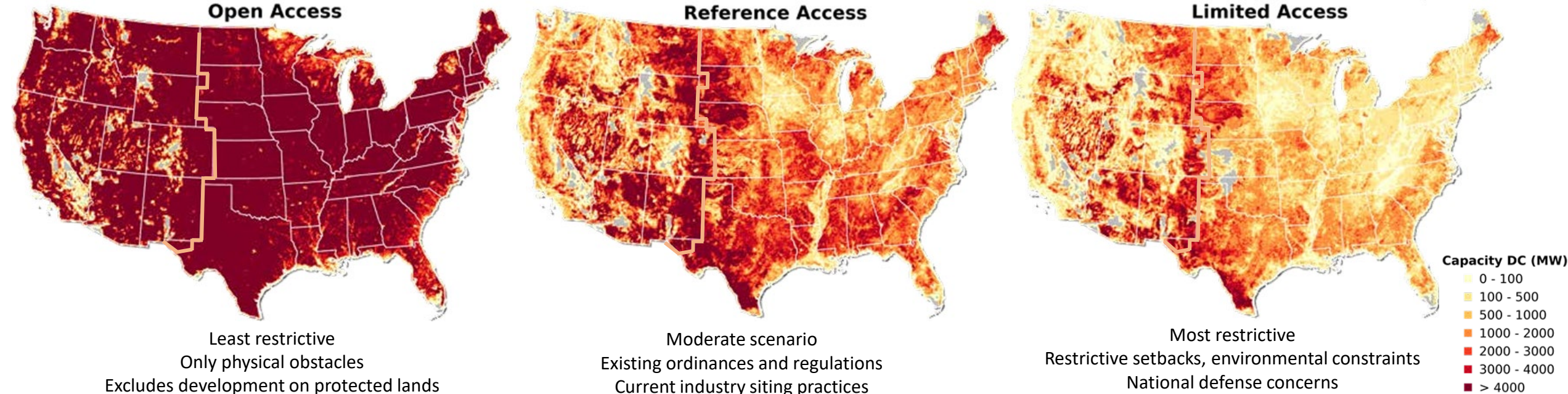


Technical Solar PV Power Potential by State: Three Scenarios

Open Access

Reference Access

Limited Access



Least restrictive
Only physical obstacles
Excludes development on protected lands

Moderate scenario
Existing ordinances and regulations
Current industry siting practices

Most restrictive
Restrictive setbacks, environmental constraints
National defense concerns

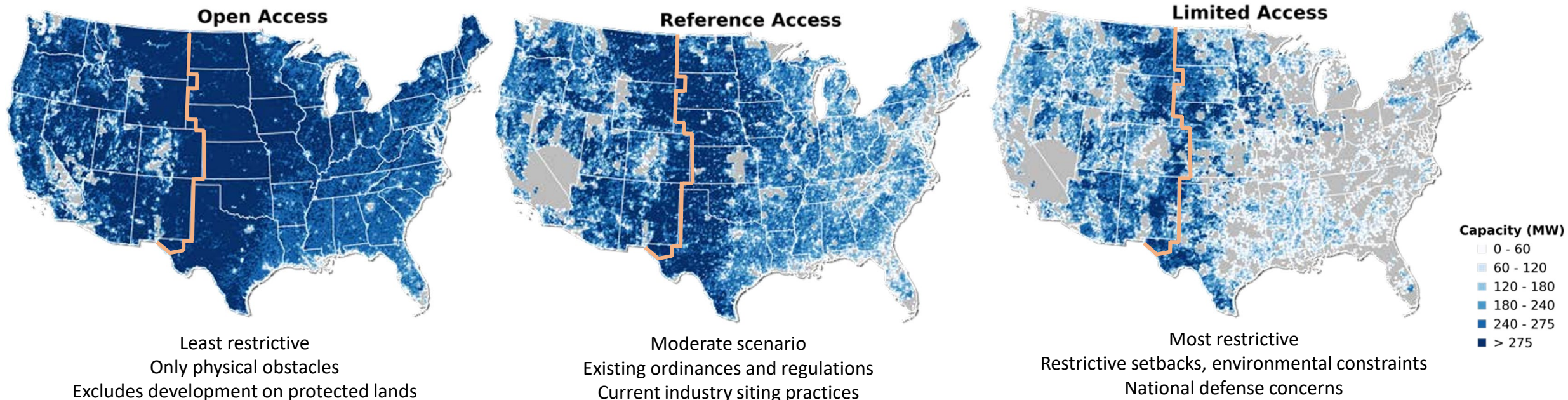
Top 5 National (GW)

Top 5 Western Interconnection (GW)

State	Open	Reference	Limited
Texas	19,934,492	11,863,654	7,217,273
New Mexico	8,634,612	6,082,309	3,780,506
Montana	10,082,812	4,930,216	2,571,479
Arizona	7,504,039	4,485,143	2,960,982
Wyoming	6,504,139	3,523,107	2,031,701

State	Open	Reference	Limited
New Mexico	8,634,612	6,082,309	3,780,506
Montana	10,082,812	4,930,216	2,571,479
Arizona	7,504,039	4,485,143	2,960,982
Wyoming	6,504,139	3,523,107	2,031,701
Nevada	6,481,153	3,353,530	2,112,311

Technical Onshore Wind Power Potential by State: Three Scenarios



Top 5 National (GW)

State	Open	Reference	Limited
Texas	1,426,314	1,226,190	669,600
Montana	791,148	699,078	544,152
New Mexico	629,202	582,216	461,628
Arizona	539,172	474,252	411,012
Wyoming	507,924	410,100	339,030

Top 5 Western Interconnection (GW)

State	Open	Reference	Limited
Montana	791,148	699,078	544,152
New Mexico	629,202	582,216	461,628
Arizona	539,172	474,252	411,012
Wyoming	507,924	410,100	339,030
Colorado	471,474	402,468	264,072

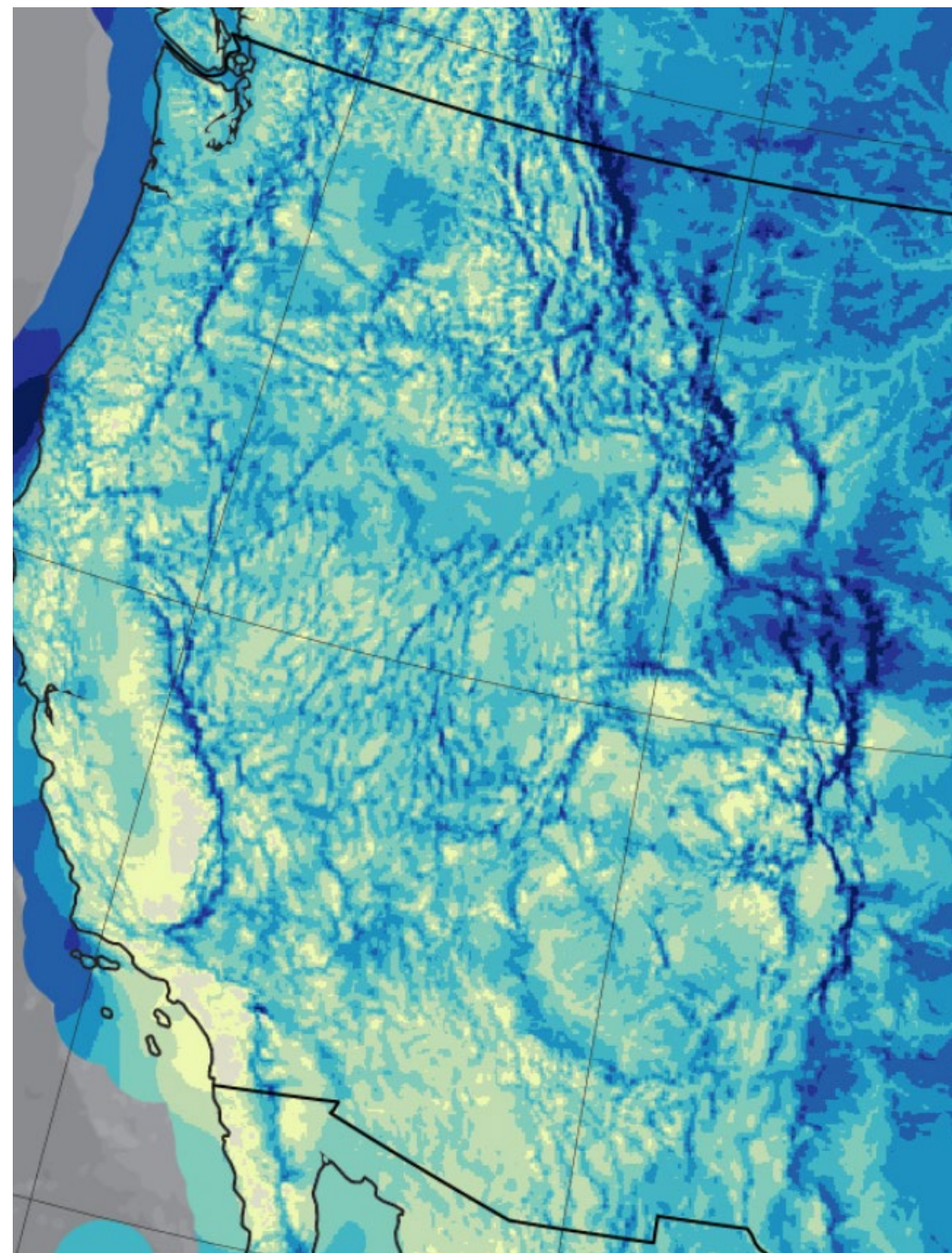
Why is Montana Wind So Valuable?

- Abundant, over a large geography
- High capacity factor
- Exceptionally diverse to WA Gorge and WY wind
- Close to coastal load centers

Why has Texas installed 40+GW and Montana only <2GW?

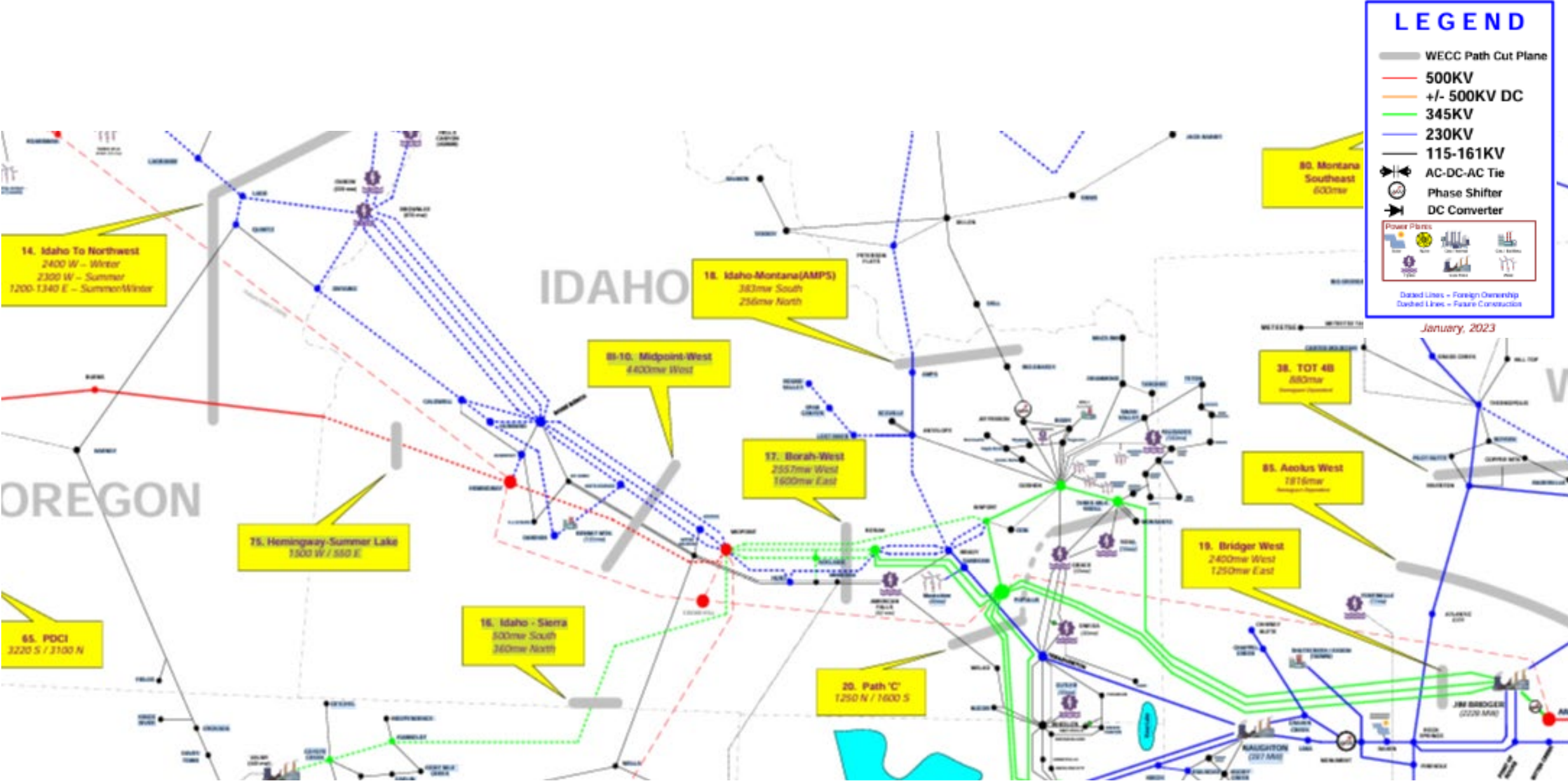
Why is so little additional wind development planned in Montana?

Let's look at transmission...

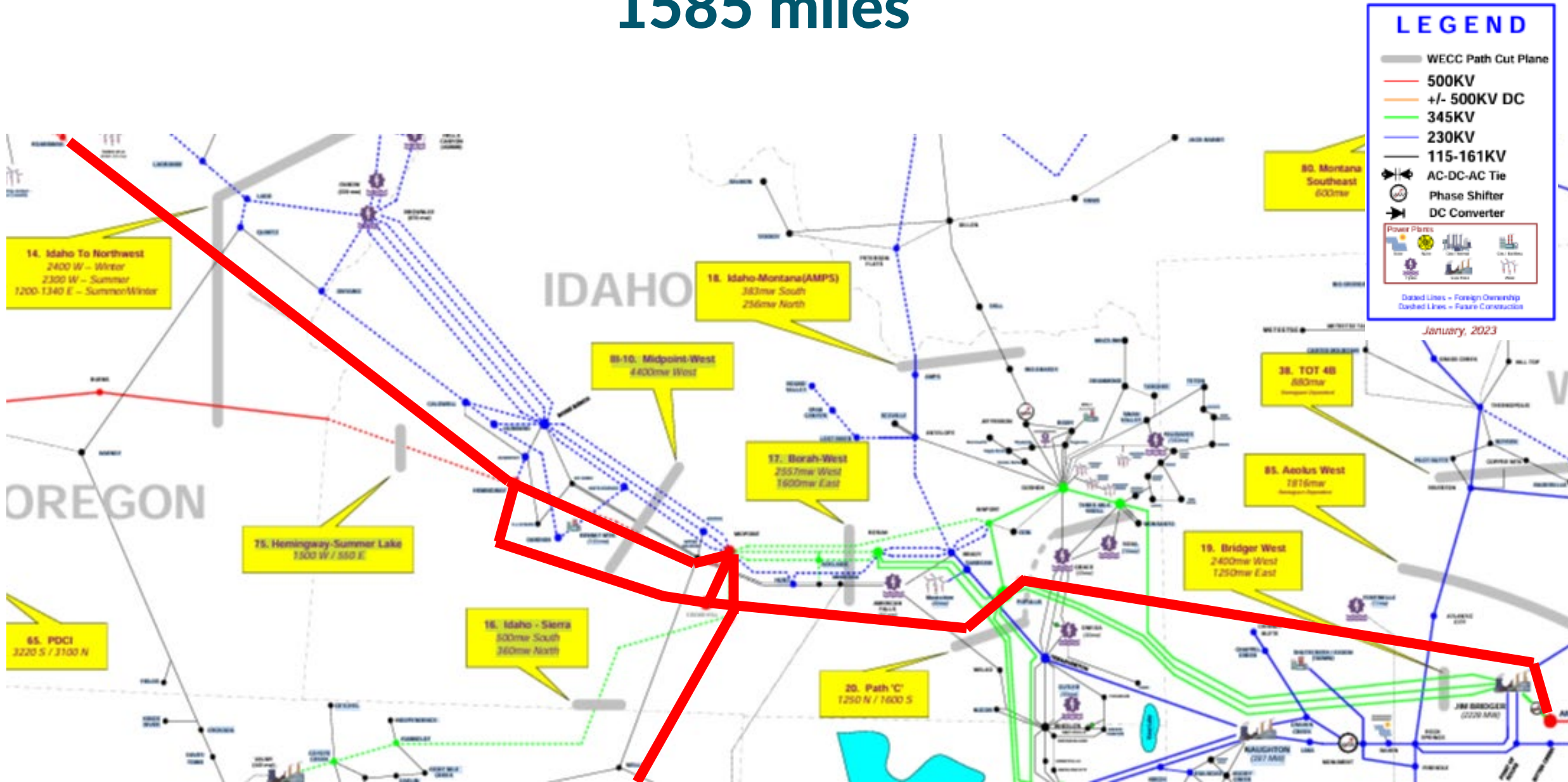


Transmission Development

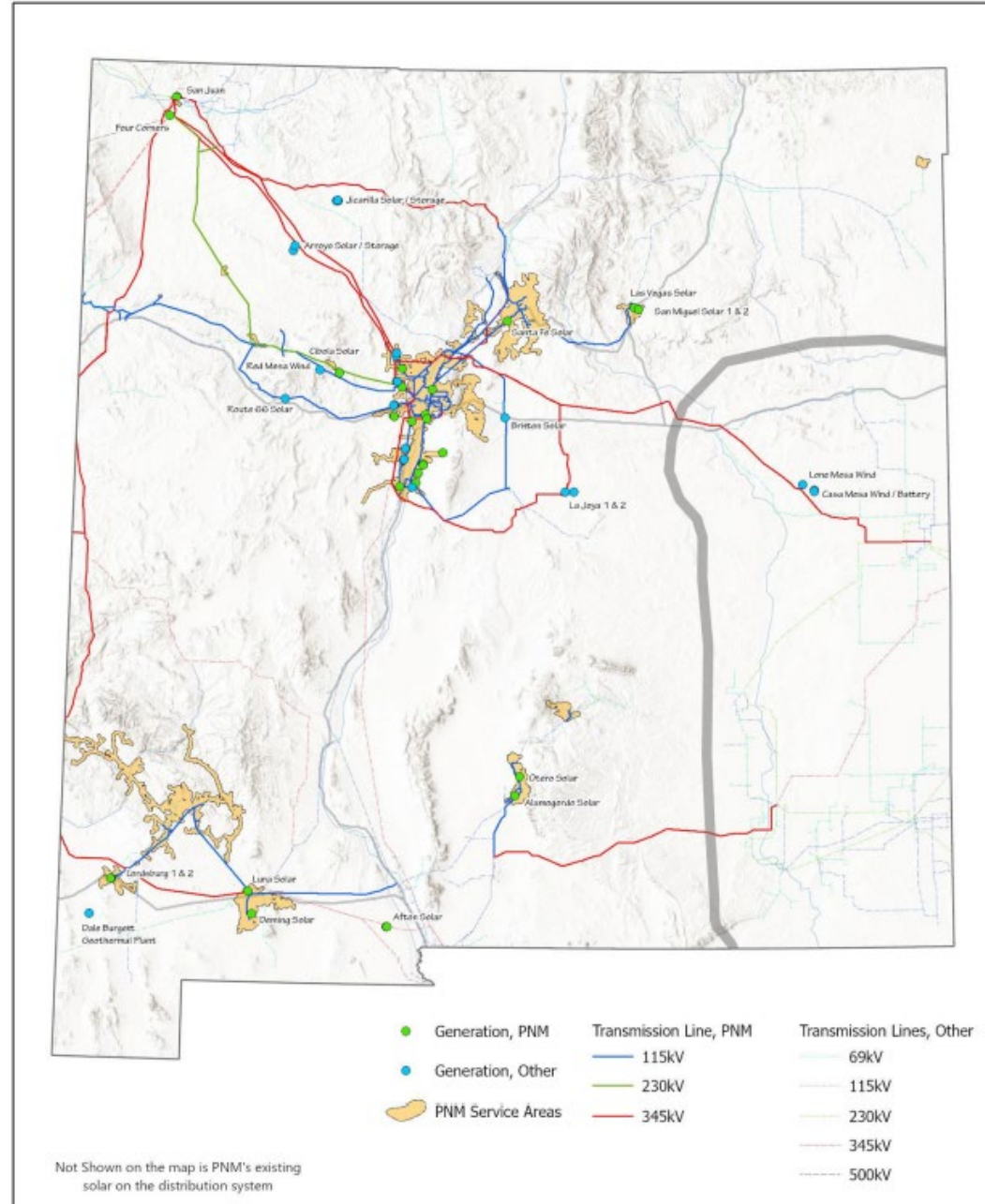
Idaho Transmission



Idaho Transmission with New Planned Lines 1585 miles

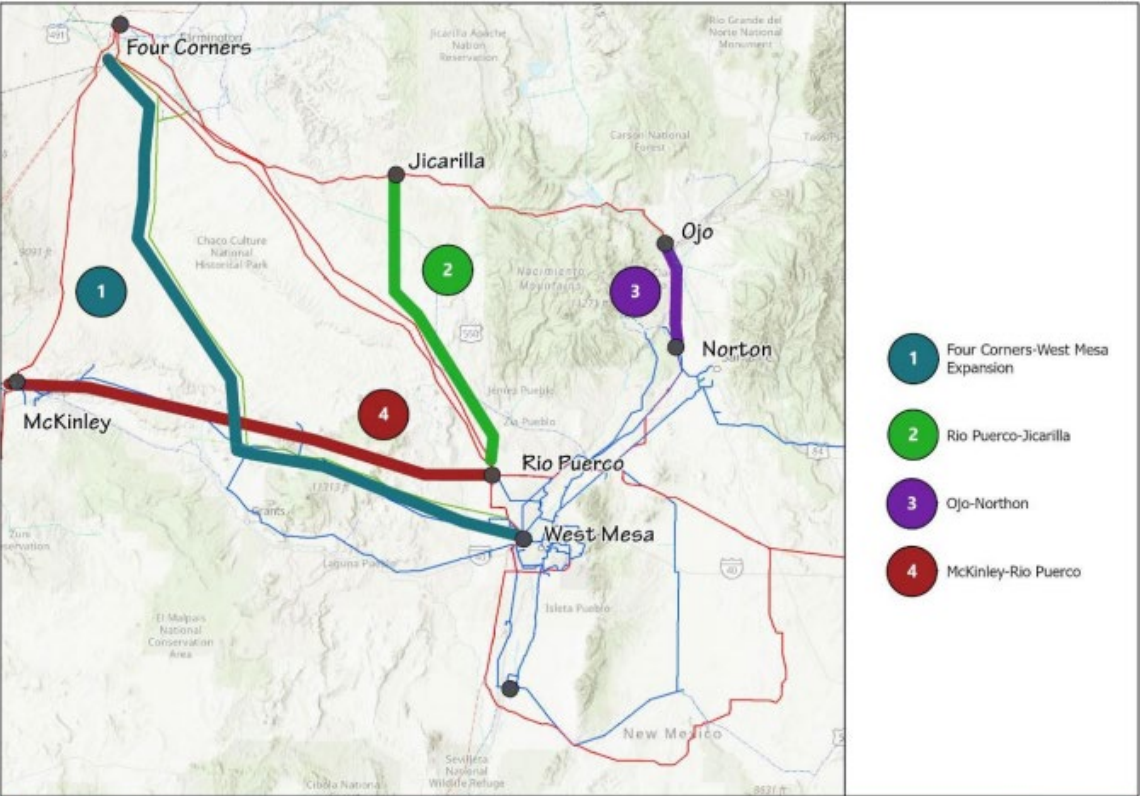


New Mexico Transmission



New Mexico Transmission with New Planned Lines 2541 miles

PNM-Planned Transmission Expansion



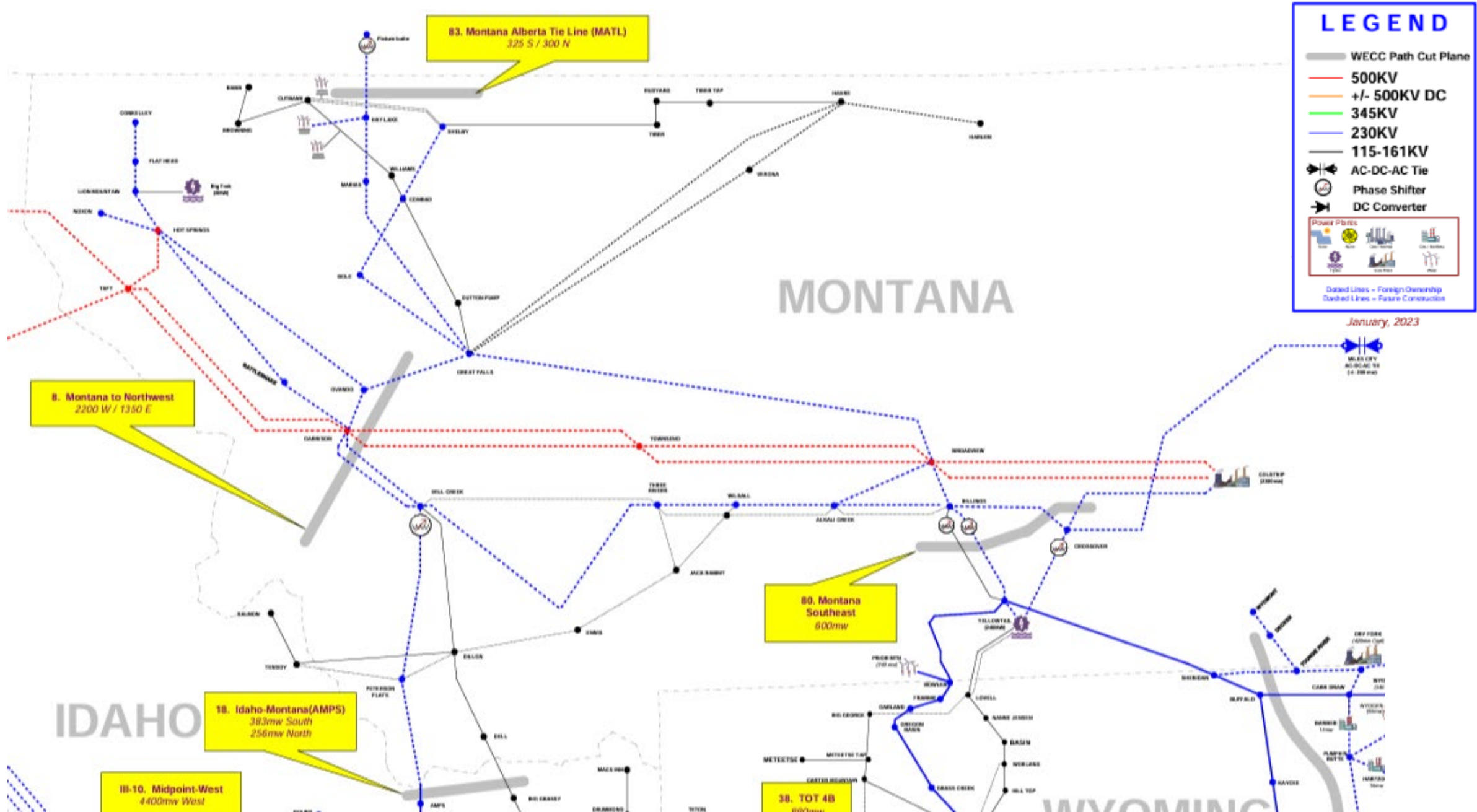
- 1 Four Corners-West Mesa Expansion
- 2 Rio Puerco-Jicarilla
- 3 Ojo-Norton
- 4 McKinley-Rio Puerco

Merchant-Planned Transmission Expansion

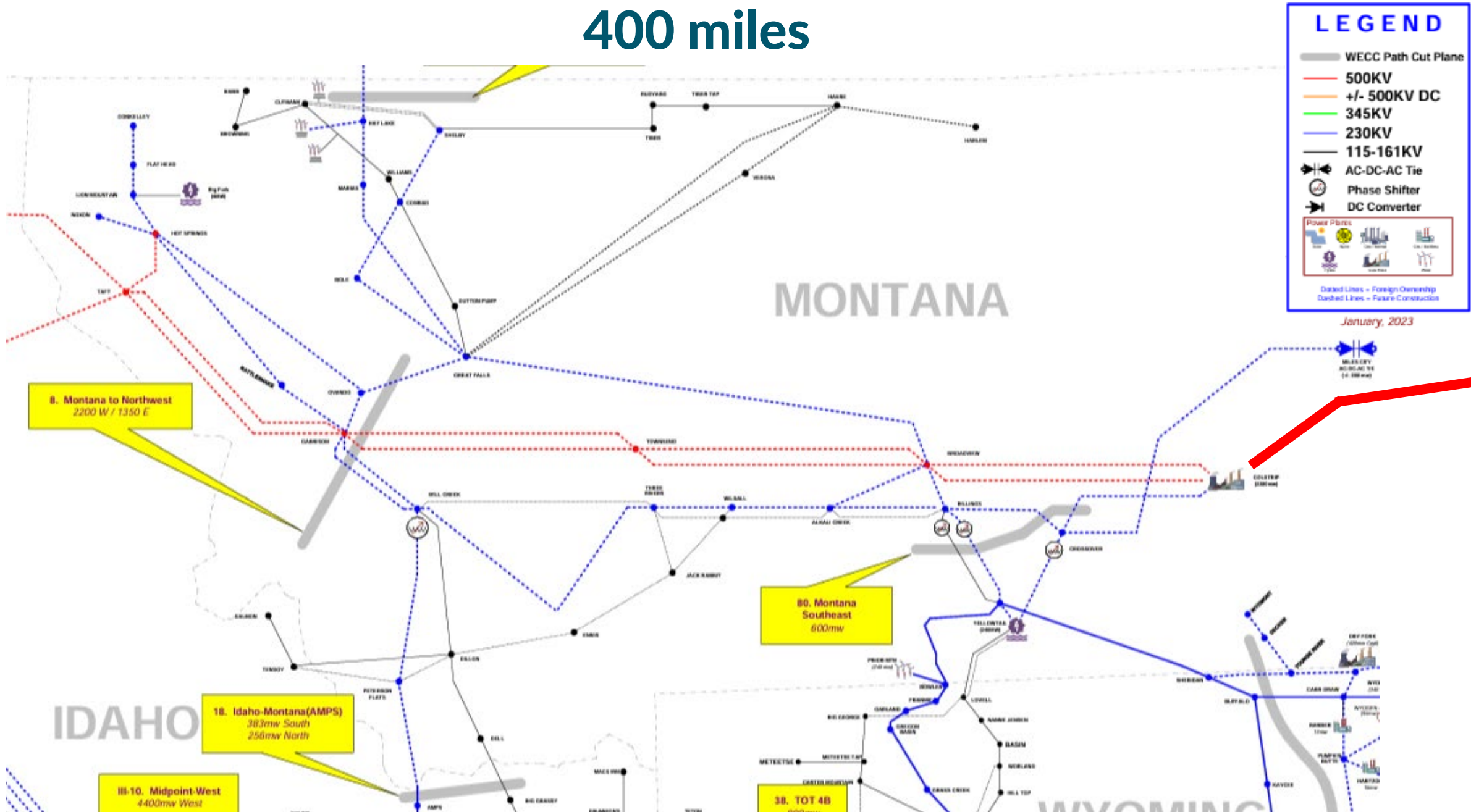
- Western Interconnect 345 kV (In-Service)
- Mora Line 345 kV/115 kV
- Southline 345 kV
- Sun Zia 525 kV (DC)/RioSol 500 kV (AC)
- Vista Trail 345 kV
- New Mexico North Path (DC)



Montana Transmission



Montana Transmission with New Planned Lines 400 miles

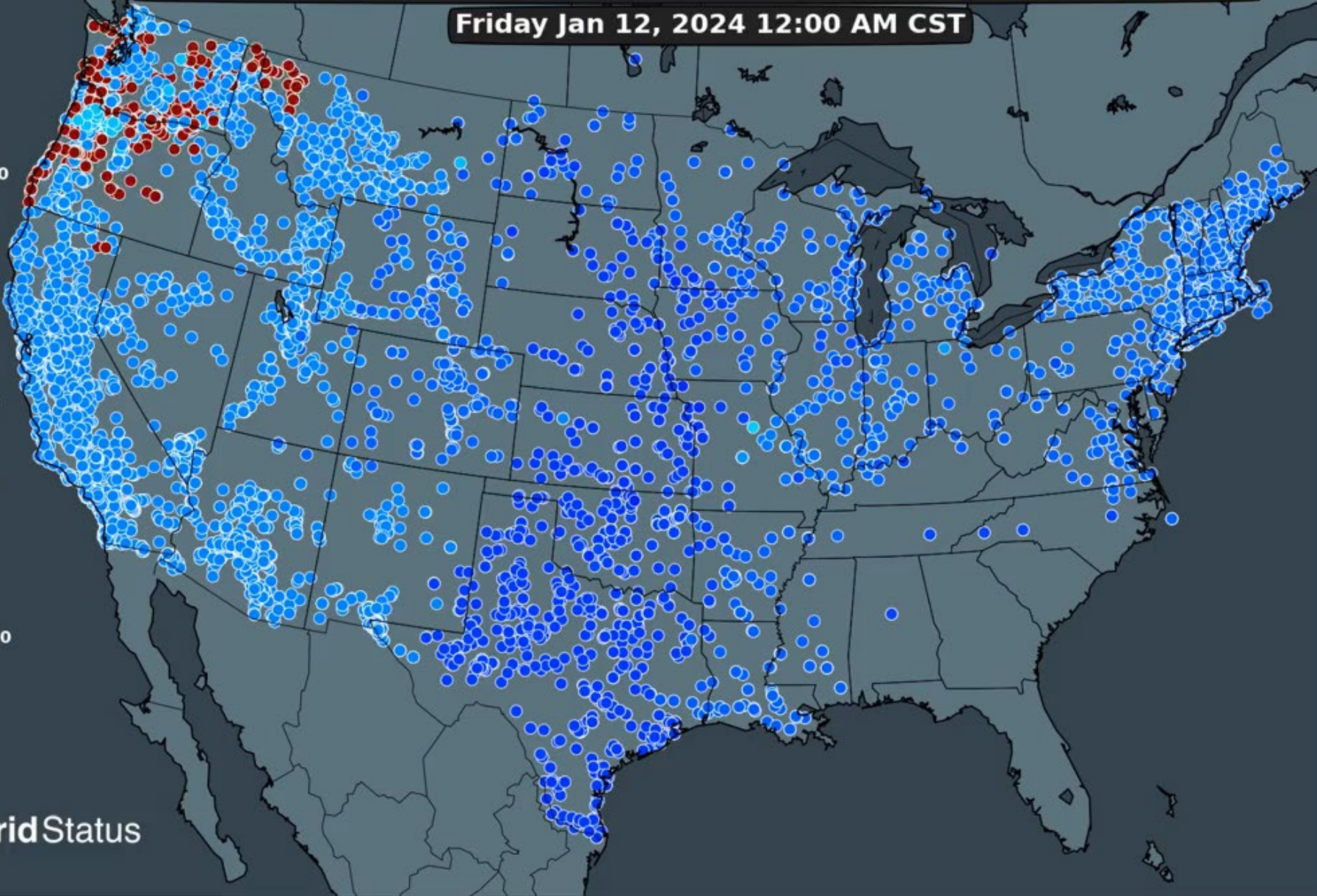


Demand for Transmission

Real Time Wholesale Electricity Prices January 12th to the 14th

Friday Jan 12, 2024 12:00 AM CST

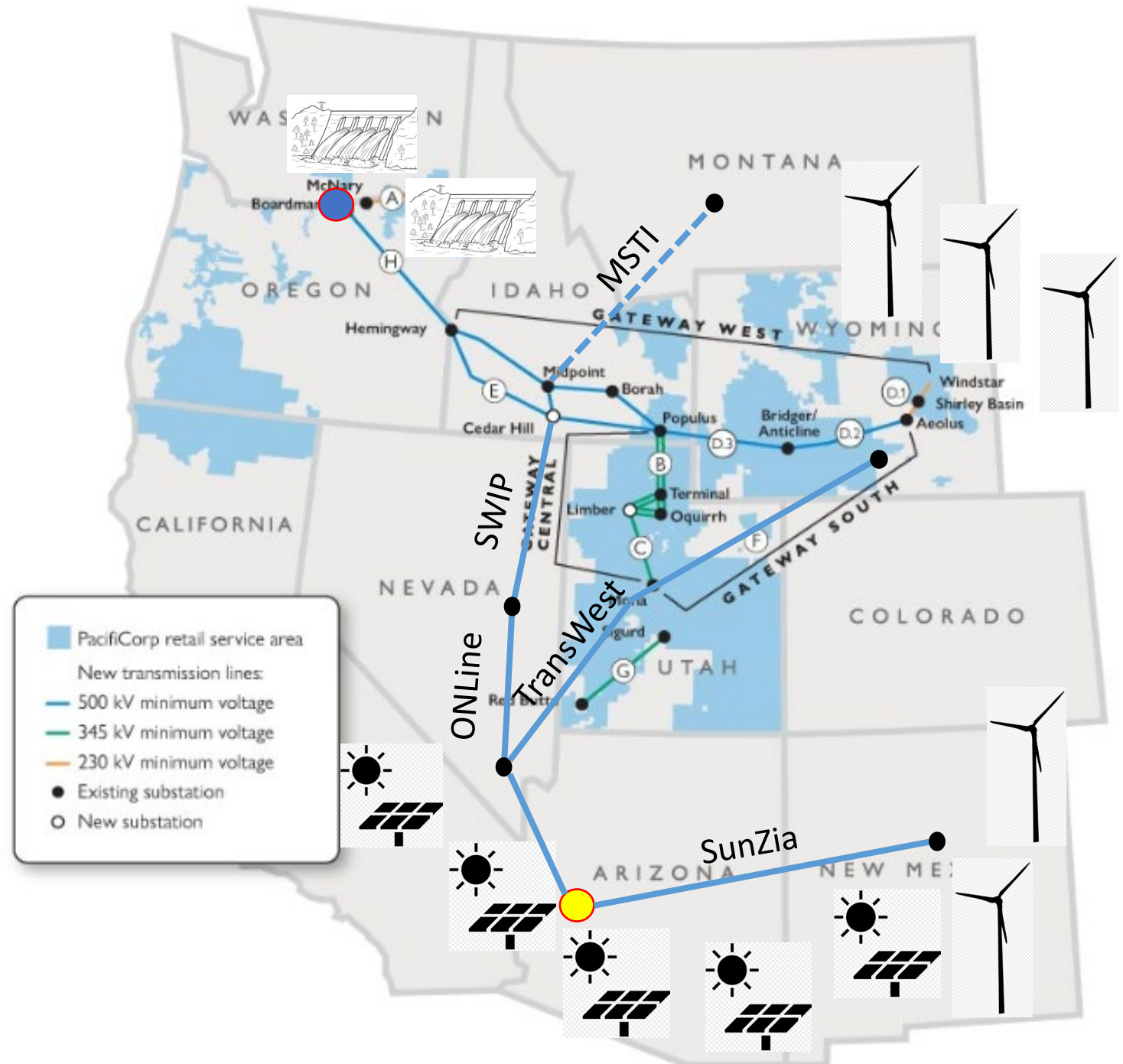
\$/MWh



Enabling Geographic Diversity

 Mid-Columbia Trading Hub
Winter Storm Heather Avg Price: **\$886**

 Palo-Verde Trading Hub
Winter Storm Heather Avg Price: **\$140**



2014-2023 Cumulative Interconnection Queues

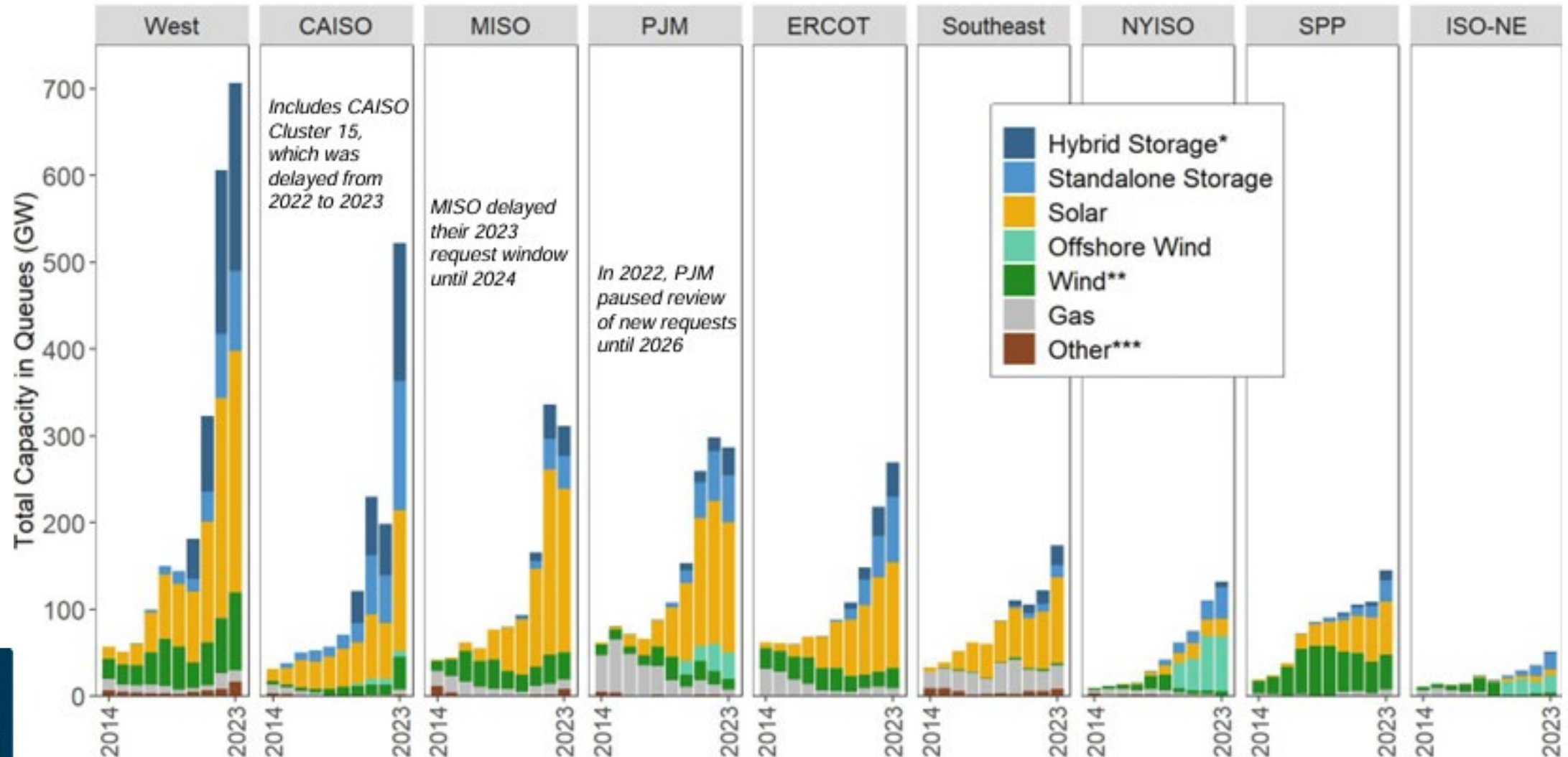
MT 2023 Queue Capacity

22,349 MW

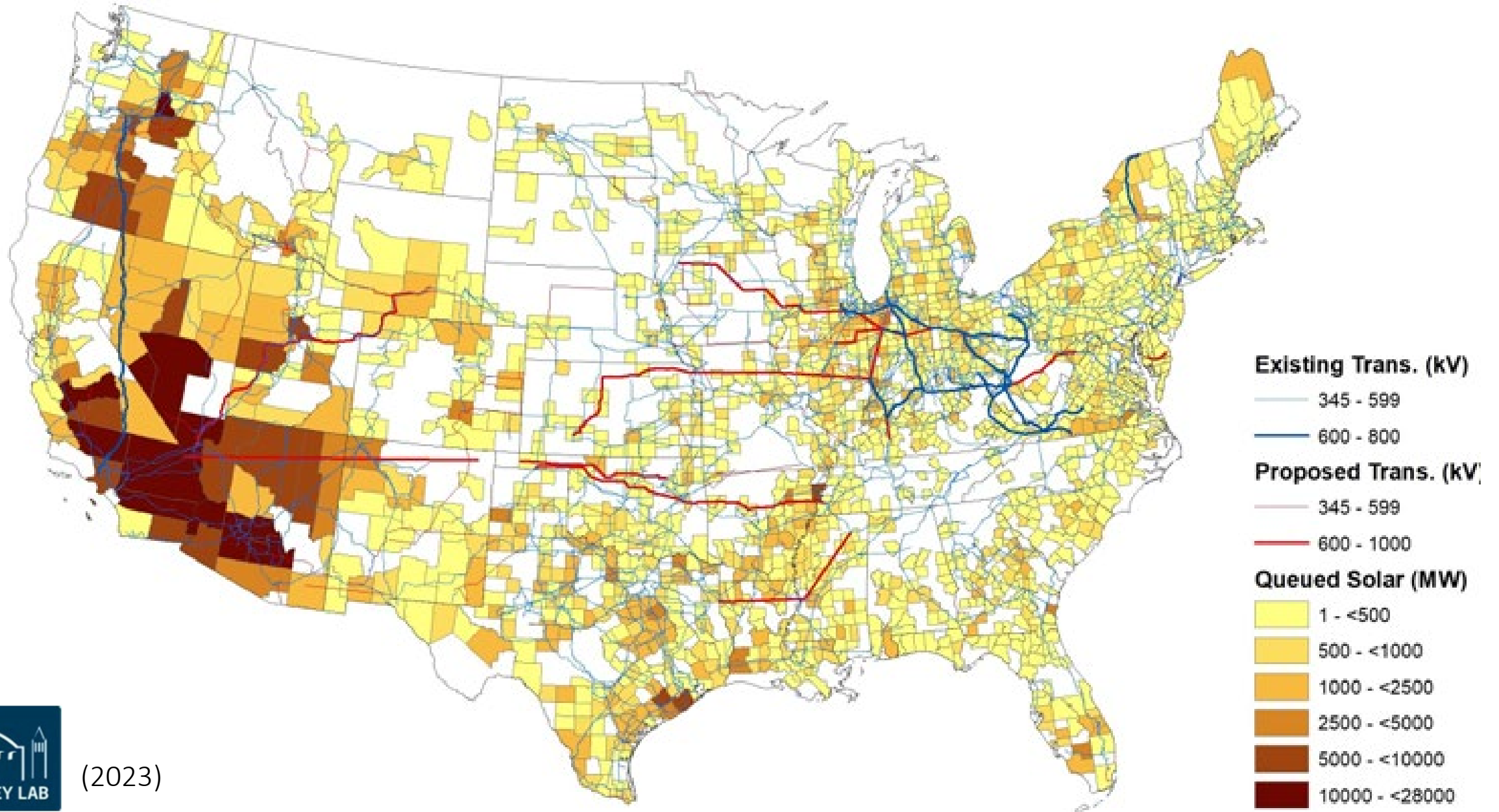
96% renewables

S&P Global

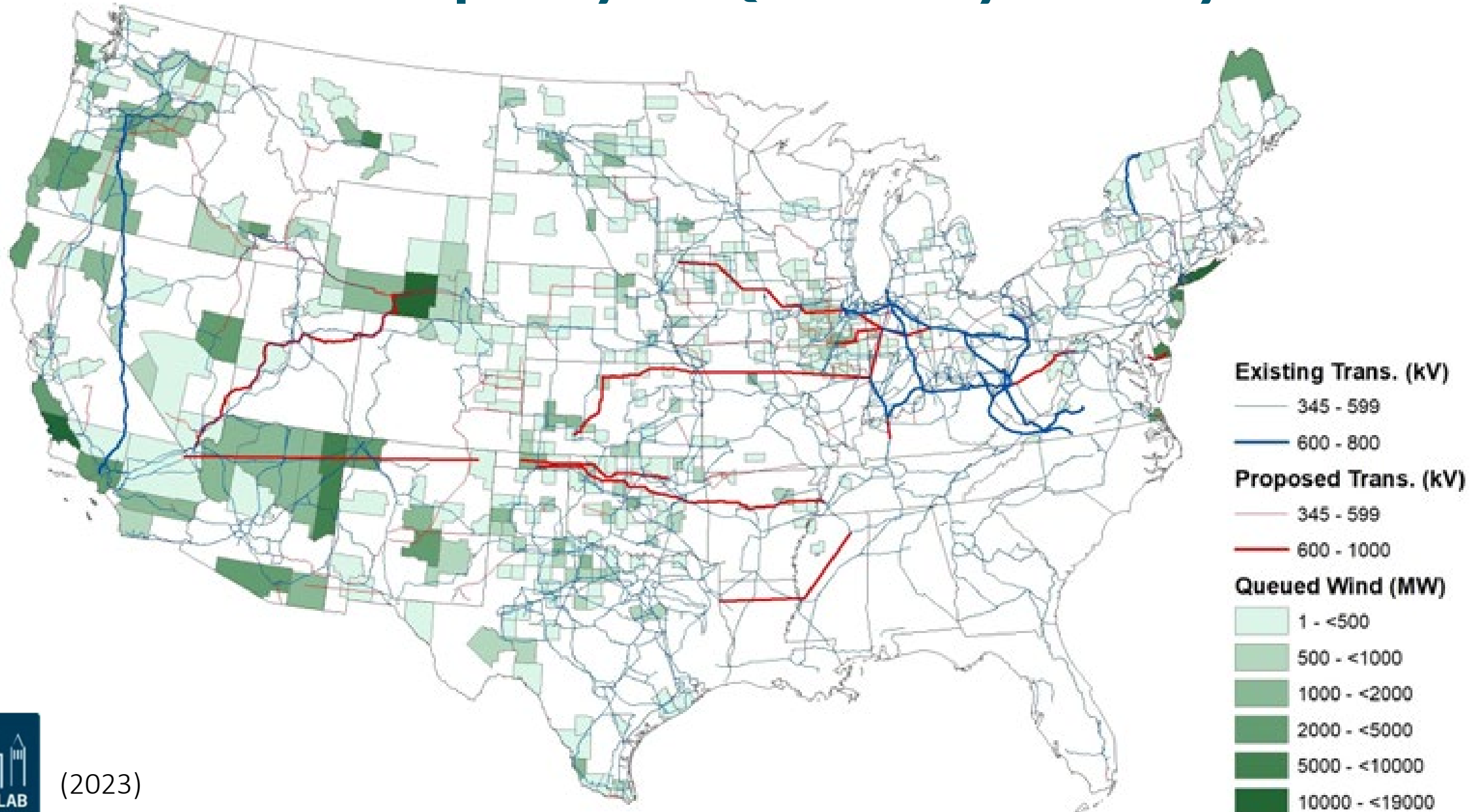
Market Intelligence



Solar Capacity in Queues by County

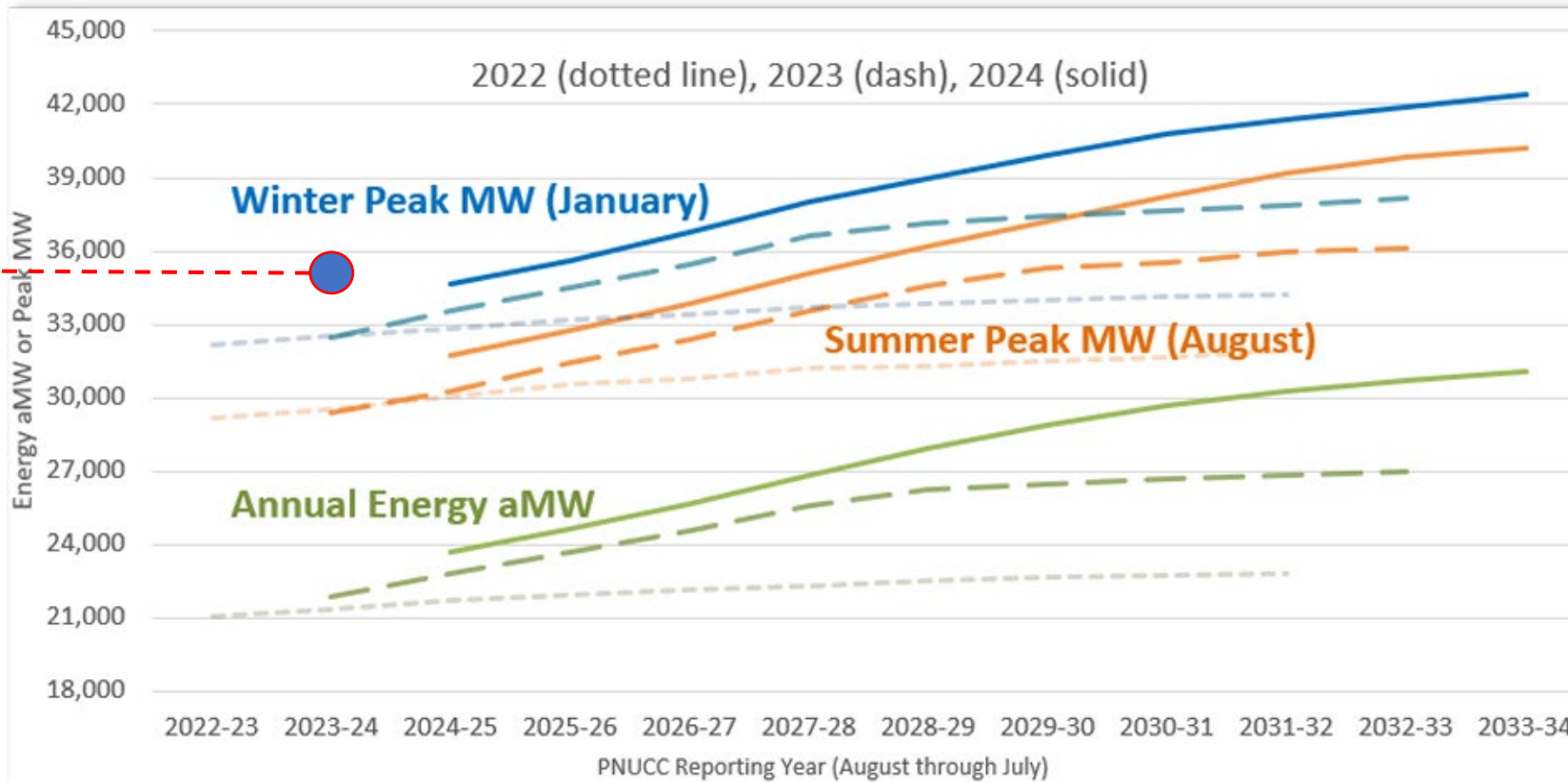


Wind Capacity in Queues by County



Demand for Generation

2024-2034 Northwest Regional Forecast



Jan 13, 2024
35,594 MW

Growth Rates	Energy		Summer Peak		Winter Peak	
	5 year	10 year	5 year	10 year	5 year	10 year
2024 Forecast	4.0%	3.1%	3.2%	2.7%	2.9%	2.3%
2023 Forecast	3.8%	2.4%	3.3%	2.3%	2.7%	1.8%
2022 Forecast	1.2%	0.9%	1.4%	1.0%	1.0%	0.7%



Montana's Economic Constraints and Opportunity

Montana's Constrained Industrial Load

“We did everything in our power to return profitability to the polysilicon business in Butte, however, forecasts for sustained high electricity costs that are outside of our control necessitated this decision [to shutter the polysilicon business]”

REC Silicon CEO Kurt Levens
February 7, 2024

We are looking at doubling our energy costs with a very limited number of possible suppliers once our contracts are up.

Montana Resources
February 22, 2024

“We would like to receive a larger response to our choice electric supply RFPs and are especially interested in receiving those responses from renewable sources. We believe additional transmission resources would improve the number of potential suppliers, as well as improve our potential for acquiring a renewable power supply.”

Sibanye Stillwater VP Heather McDowell
April 30, 2024

Montana Farms

Count

2017 = 27,000



(10%)

2022 = 24,250

Avg Size

2017 = 2,150

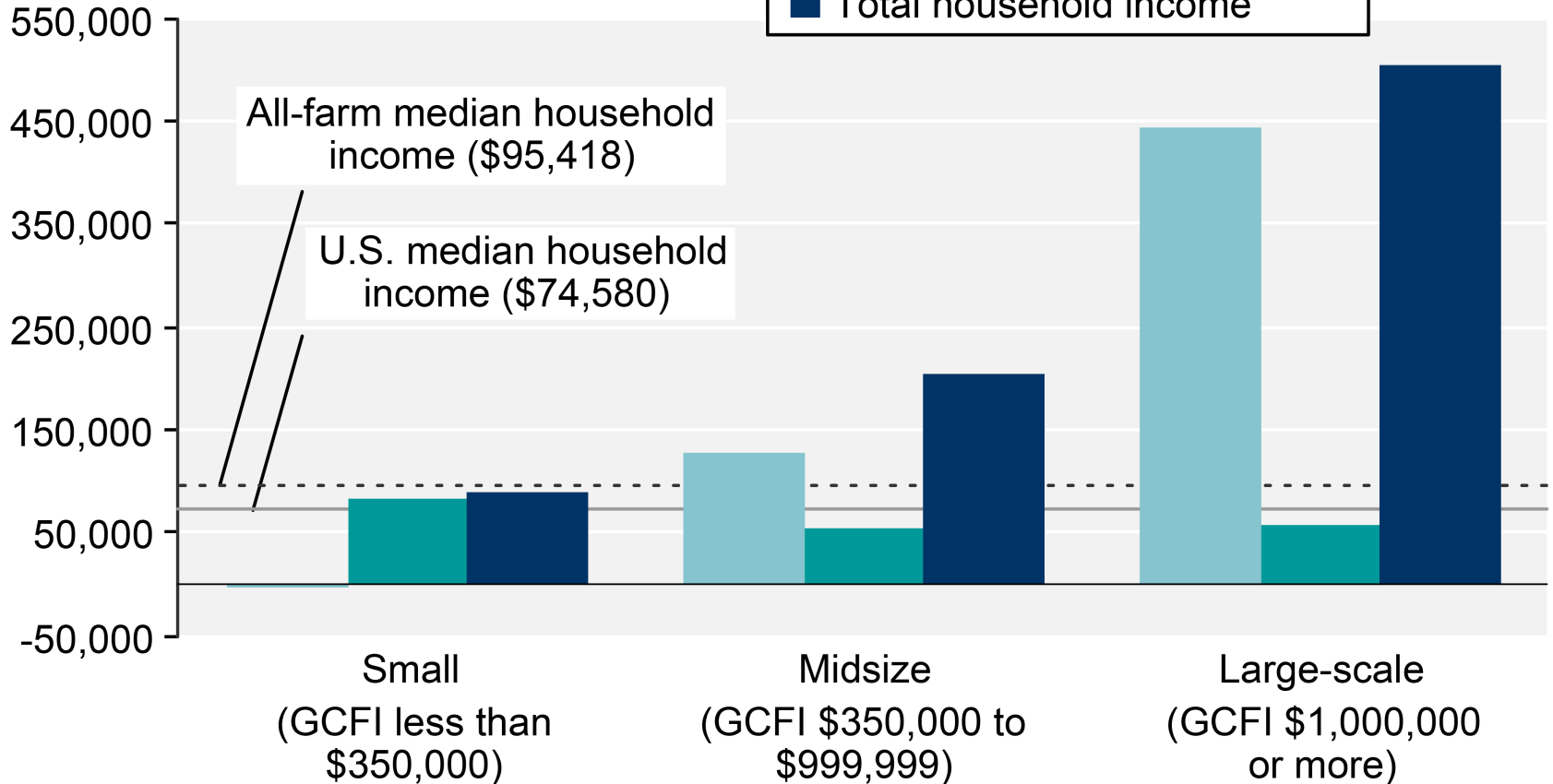


+10%

2022 = 2,375

Median income of farm households, by income source and farm type, 2022

Median income (dollars per household)








Note: Farm type reflects annual gross cash farm income (GCFI), which includes sales of crops and livestock, Federal Government payments, and other farm-related income, including fees received by operators from production contracts.

Sources: USDA, Economic Research Service and USDA, National Agricultural Statistics Service, Agricultural Resource Management Survey and U.S. Department of Commerce, Bureau of the Census, Current Population Reports (p60-279). Data as of November 30, 2023.

Montana's Increasing Tax Burden

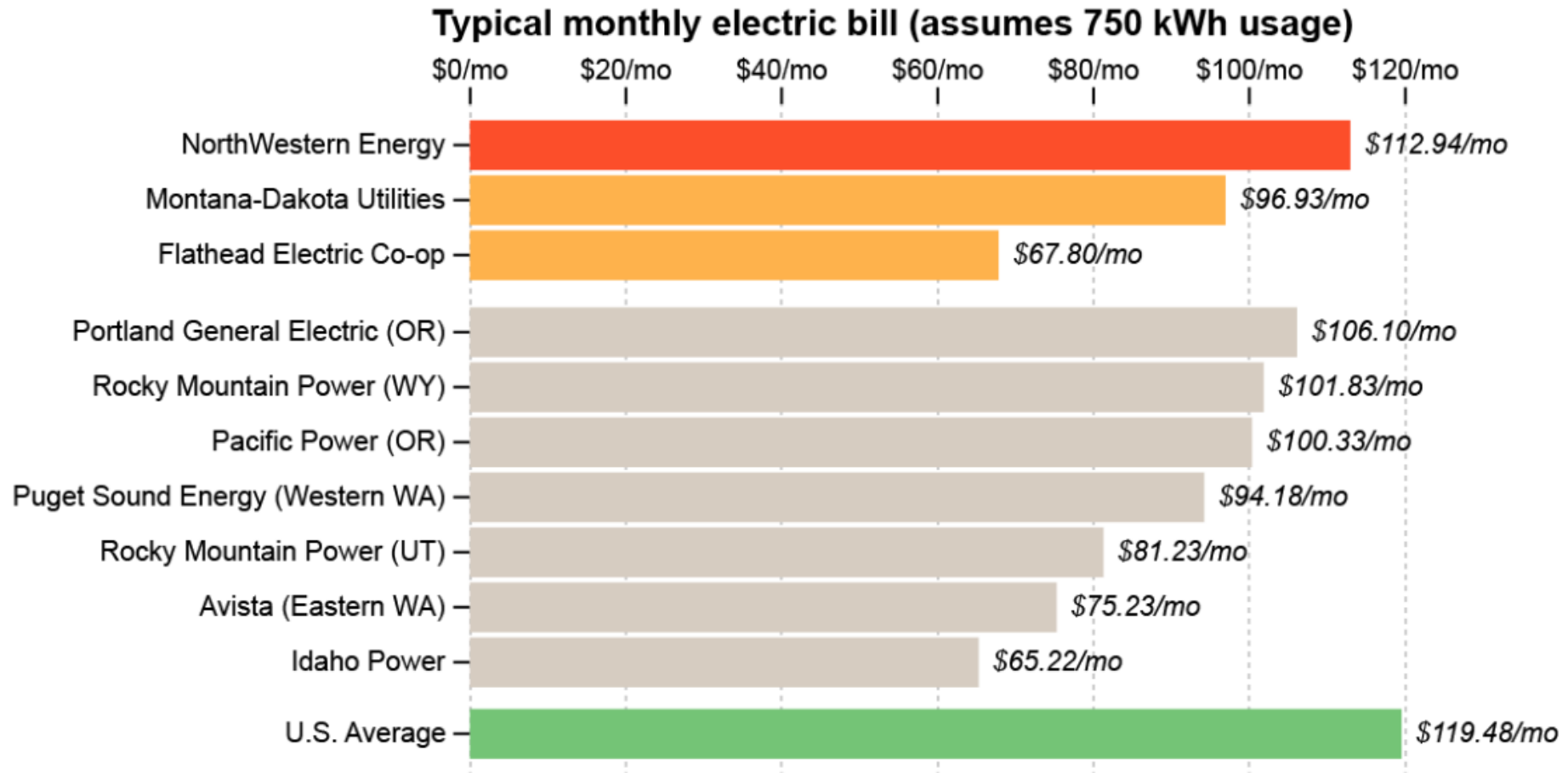
MTFP estimates for Montana tax bills in 2023 versus 2022

Property category	Median tax bill change	Typical range of change	Total change
 Residential	↑ 21%	+11% to +35%	↑ \$213 million
 Commercial	↑ 12%	+1% to +29%	↑ \$53.9 million
 Industrial	↑ 6%	-13% to +17%	↓ \$52.9 million
 Agricultural	↓ 3%	-9% to +6%	↑ \$13.6 million
 Other	↑ 7%	-10% to +30%	↑ \$11.8 million

Notes: Typical range of change represents values between 25th and 75th percentile. Total change is for properties on both the 2022 and 2023 tax rolls only.

<https://montanafreepress.org/2023/12/07/how-much-montana-property-taxes-are-rising/>

Montana's Increasing Energy Costs



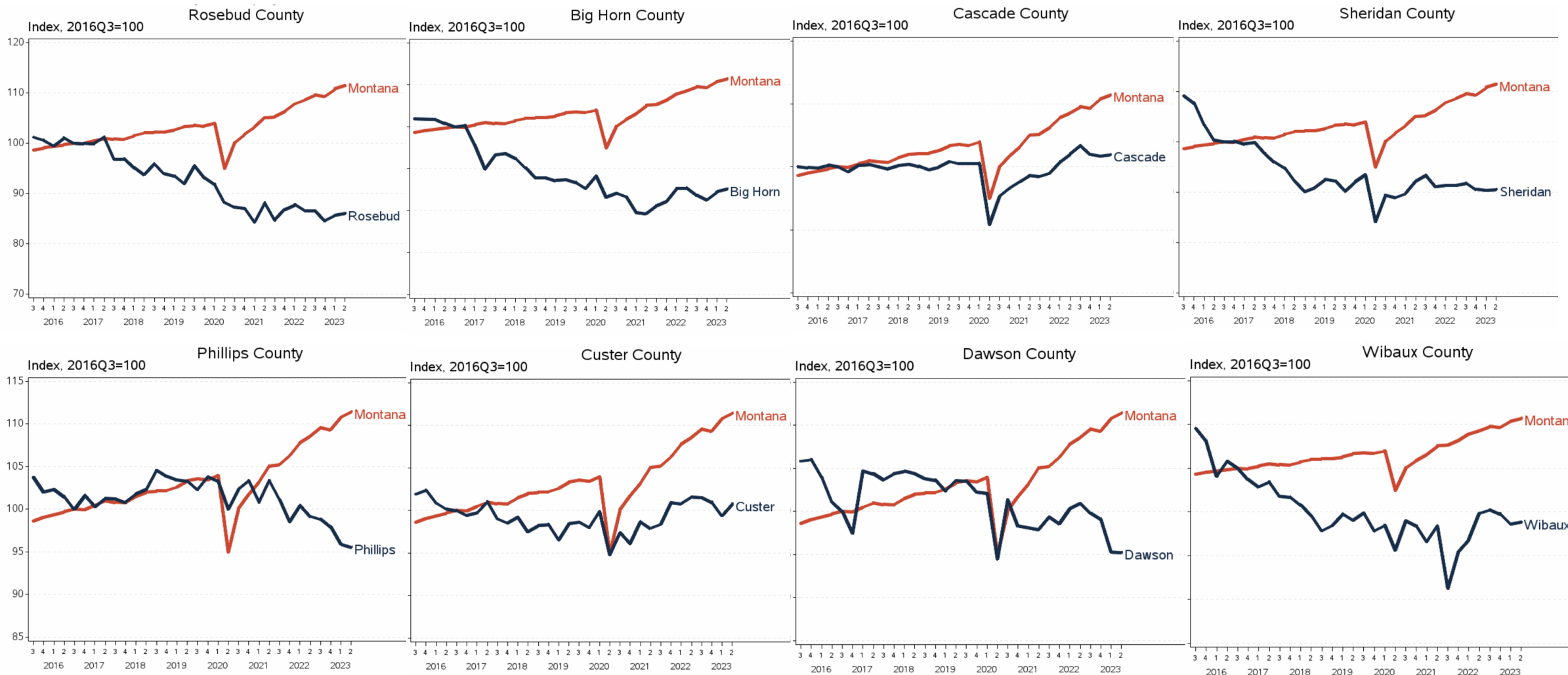
Data: Utility records, U.S. Energy Information Administration.

November 1, 2023

Graphic: Amanda Eggert & Eric Dietrich / MTFP

Eight Montana Counties with Excellent Wind Resource

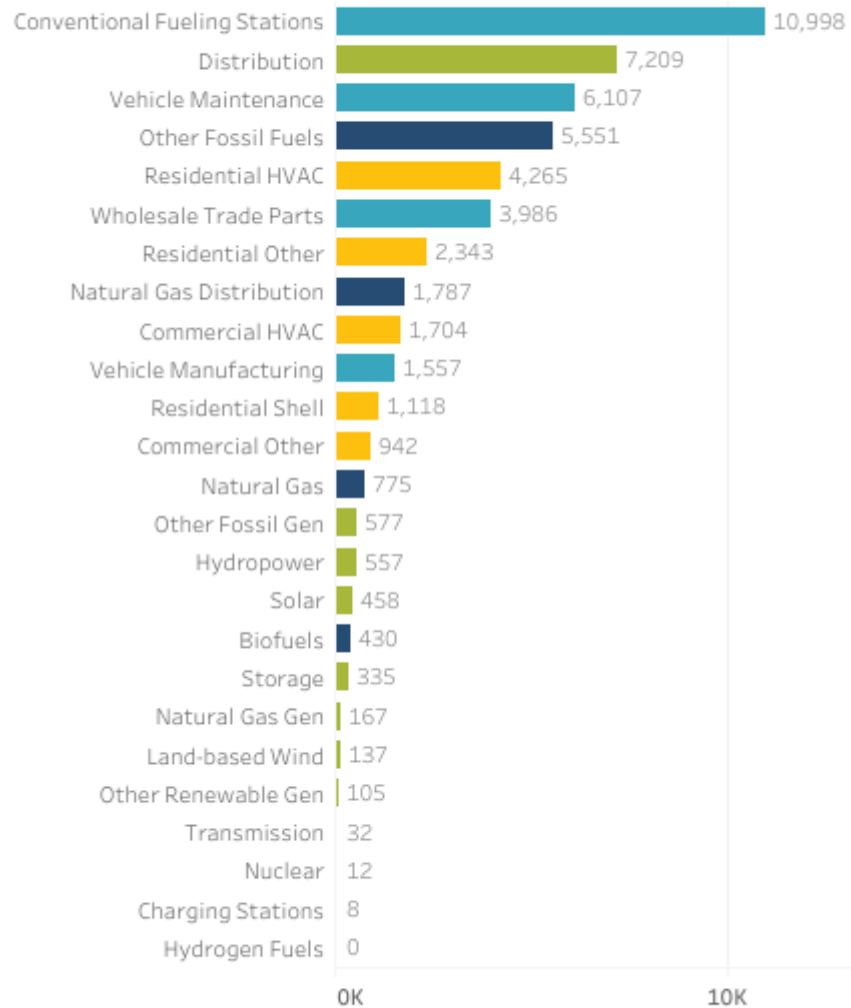
Payroll Employment by County



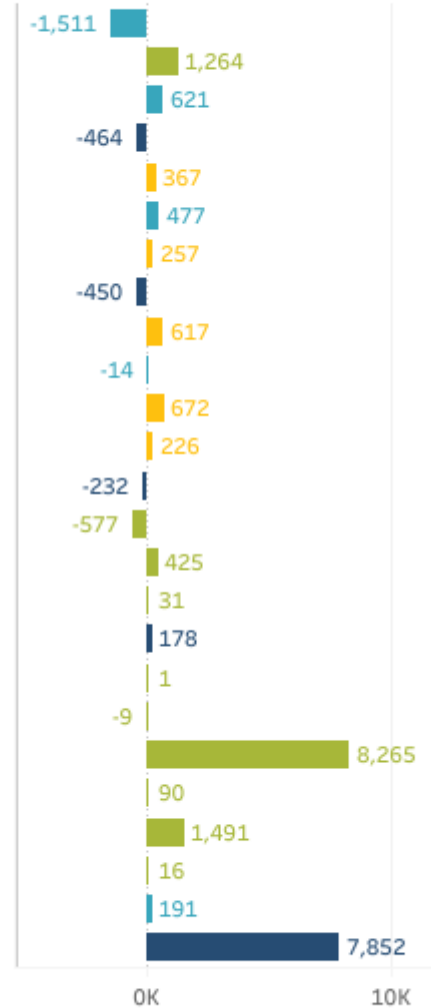
Clean Energy Development Creates Jobs

Figure 1. Montana Energy Employment by Subsector in 2021 and 2030

Employment by Subsector in 2021



Change from 2021 to 2030




-3,257  **+23,041** 

Figure includes direct, indirect, and induced employment.

Source: BW Research Partnership. *CETI Net-Zero Northwest Workforce Analysis Regional and State Technical Reports*, March 2024.

Transmission + Clean Generation

Industrial Growth

Micron Technology, Inc., one of the world's largest semiconductor companies and the only U.S.-based manufacturer of memory, will today celebrate the start of construction on the nation's first new memory manufacturing fab in 20 years...Through the lifespan of the project, Micron will directly infuse \$15.3 billion into the Idaho economy and directly spend \$13.0 billion with Idaho businesses. The project will create over 17,000 new Idaho jobs, including 2,000 Micron direct jobs...[Micron is] aiming to achieve 100% water reuse, recycling and restoration, as well as use 100% renewable electricity at the new facility.

Micron Technology, Inc.
October 3, 2023




The Idaho PUC last week approved an energy service agreement that will allow Idaho Power to provide electric service to a large new data center...the center will use between 10-20MW of power..[the data center] plans to support all of its operations through the addition of renewable resources, which would in turn be connected to Idaho Power's system.

Daily Energy Insider
May 16, 2023

The East Smoky Panel Mine, which was just approved, is actually the second mine approved for J.R. Simplot this year. The Dairy Syncline Mine Project was approved in April. That mine will be the next "generation" of phosphate mining for Simplot in southeastern Idaho. The project is expected to support more than 400 mining and service jobs over the next 30 years. In addition, the mine is expected to contribute to the region's economy via taxes and royalties, purchases, and sustaining support and service jobs that provide \$25 million in direct earnings.

National Mining Association
January 14, 2021

New Projects Bring Tax Base and Landowner Income

	Project	Tax Revenues*	Landowner Payments*
	Beaver Creek Wind Facility 248 MW Stillwater County	\$6,000,000/year	Not published
	Clearwater Wind Facility 750 MW Garfield, Custer, Rosebud Co.	\$7,230,000/year	\$7,530,000/year
	Apex Solar 105 MW Beaverhead County	\$931,500/year	Not published

*estimated



Conclusion

- By not planning for development of transmission, storage, or renewables, Montana is unique among its peers, and indeed in the entire West
- Unprecedented demand for transmission and generation in Montana and across the West necessitate substantial transmission investment
- What will be Montana's place in the new energy economy?
 - The outcome has major implications for Montana's economic outlook; transmission and generation development will result in tremendous benefit for the State of Montana, its counties, and its industry

Join the Conversation

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Montana & Idaho
Renewable Northwest
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Industry



NGOs



Power Marketers

Pending
7-8/2024

Developers



Engineering & Consulting

Topics

- Near term firm power supply alternatives, creative solutions
- New procurement arrangements
- Emerging technologies
- Transmission availability/constraints

