Montana's Place in the New Energy Economy

Kyle Unruh, Renewable Northwest

for the 68th Montana Legislature, Energy and Telecommunications Interim Committee

May 22, 2024

RENEWABLE NORTHWEST

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Benchmarking Montana's Transmission and Resource Development

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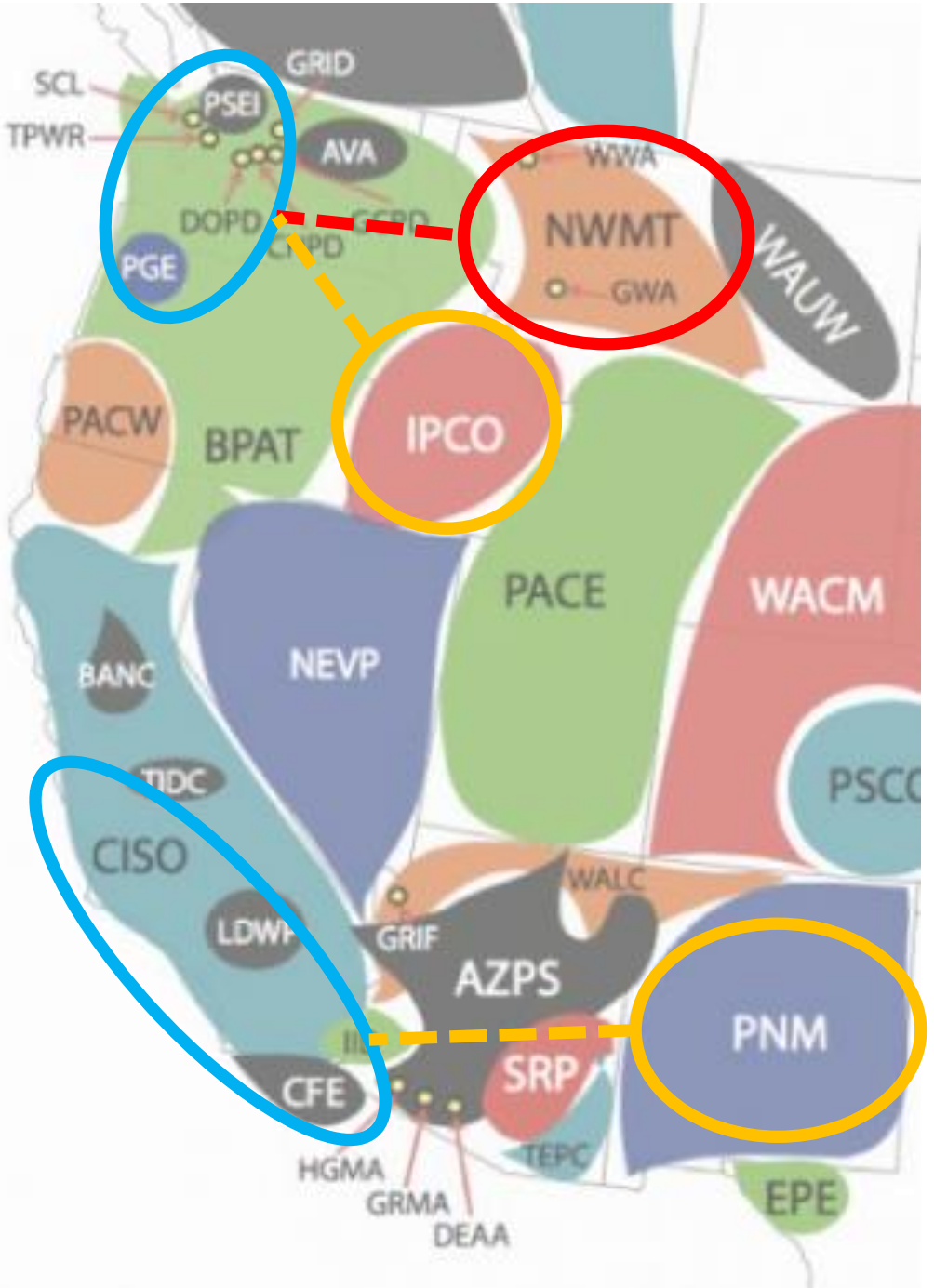
Idaho Power, PNM, NorthWestern Are Similar

- 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

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Resource Economics

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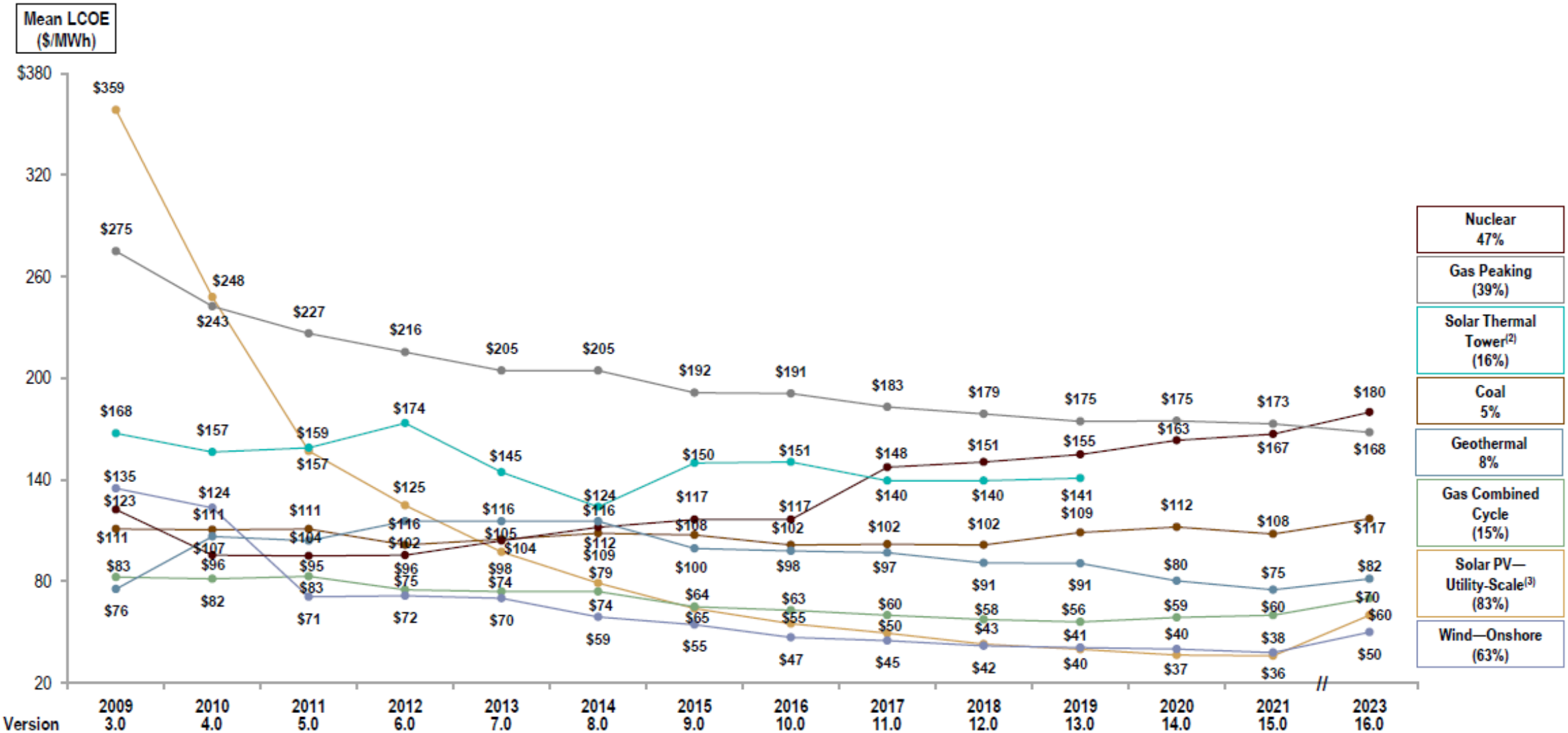
Levelized Cost of Energy Comparison—Historical Utility-Scale Generation Comparison

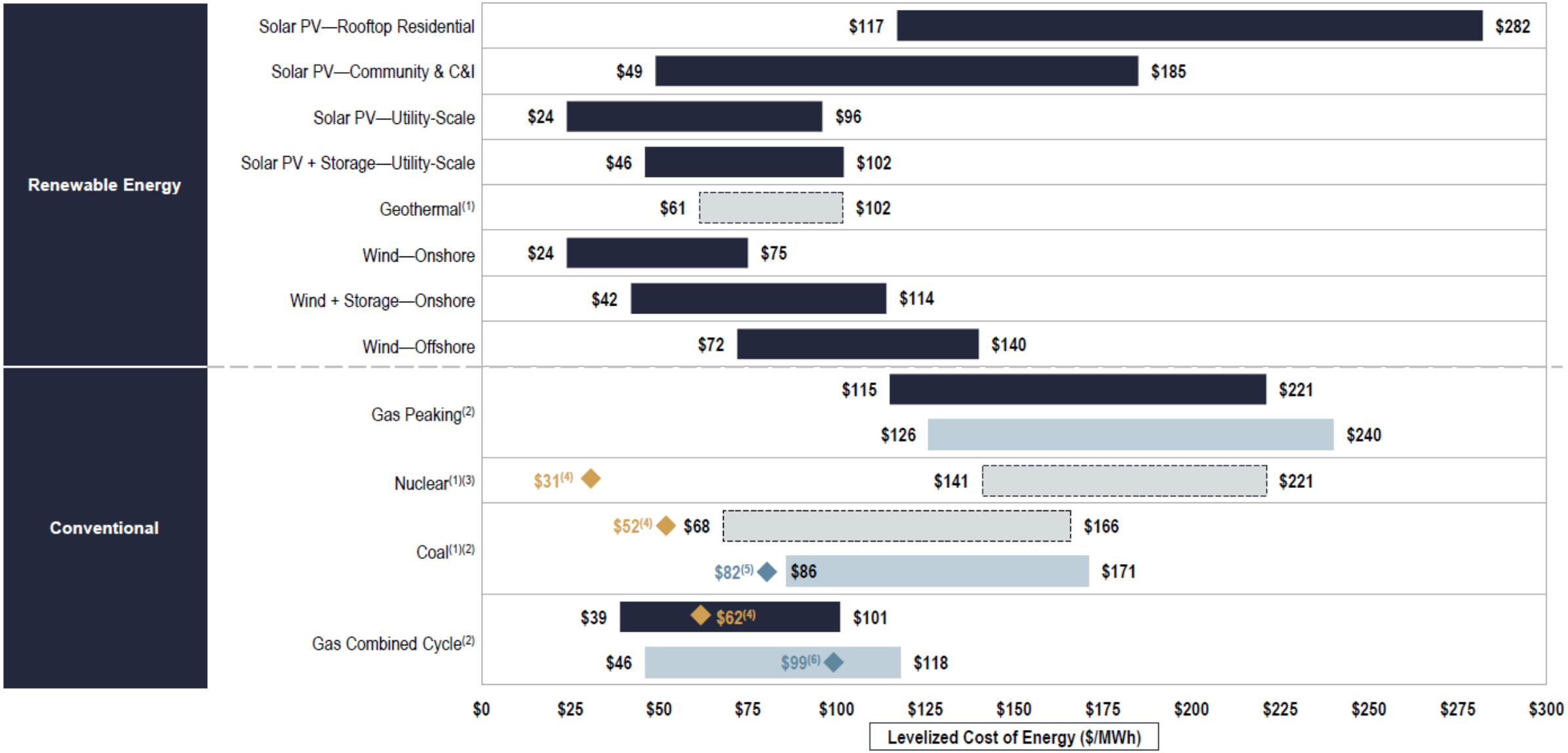
Lazard's unsubsidized LCOE analysis indicates significant historical cost declines for utility-scale renewable energy generation technologies driven by, among other factors, decreasing capital costs, improving technologies and increased competition

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



https://www.lazard.com/media/2ozoovyg/lazards-lcoeplus-april-2023.pdf

Levelized Cost of Energy Comparison—Sensitivity to Carbon Pricing

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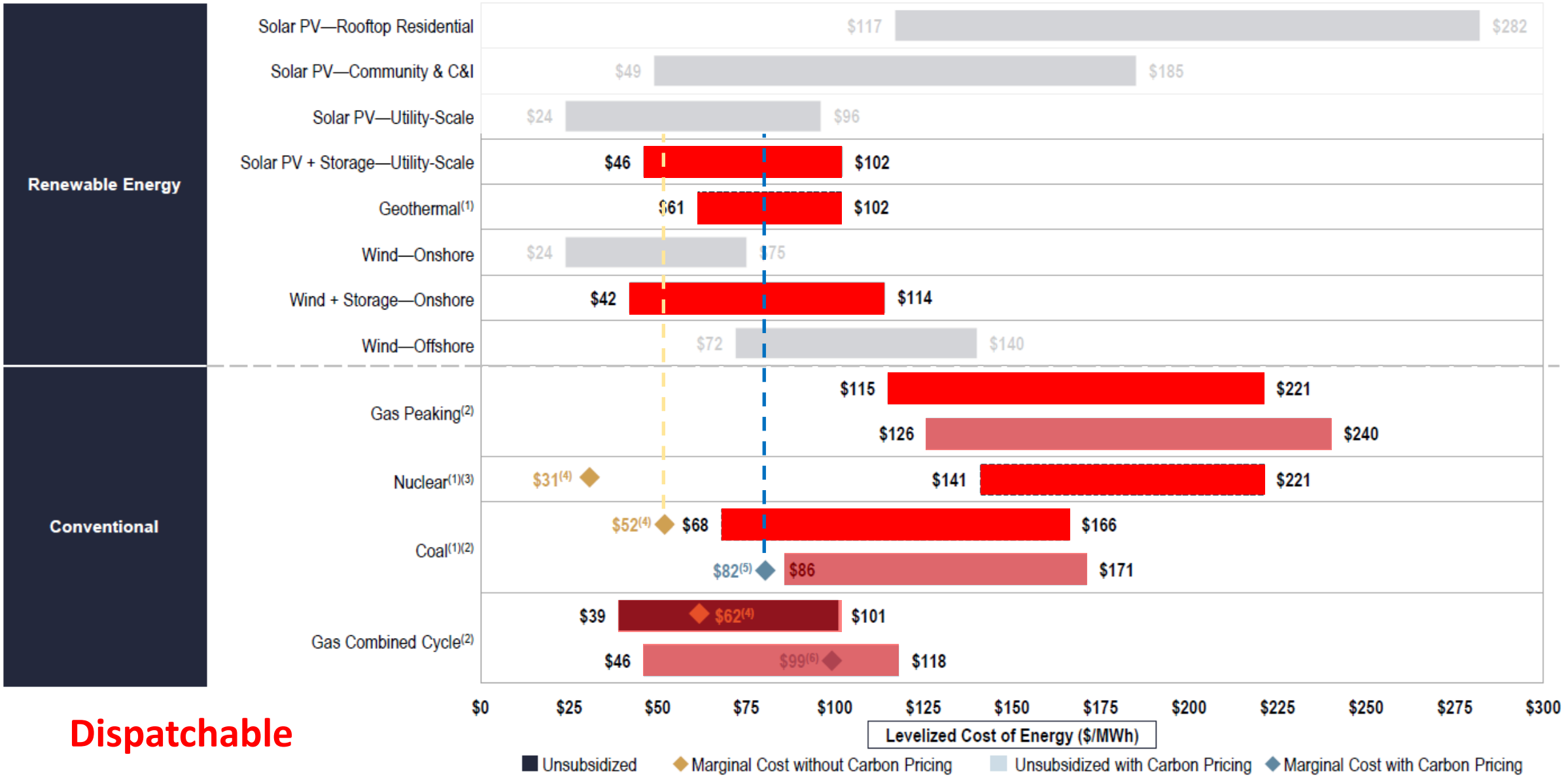
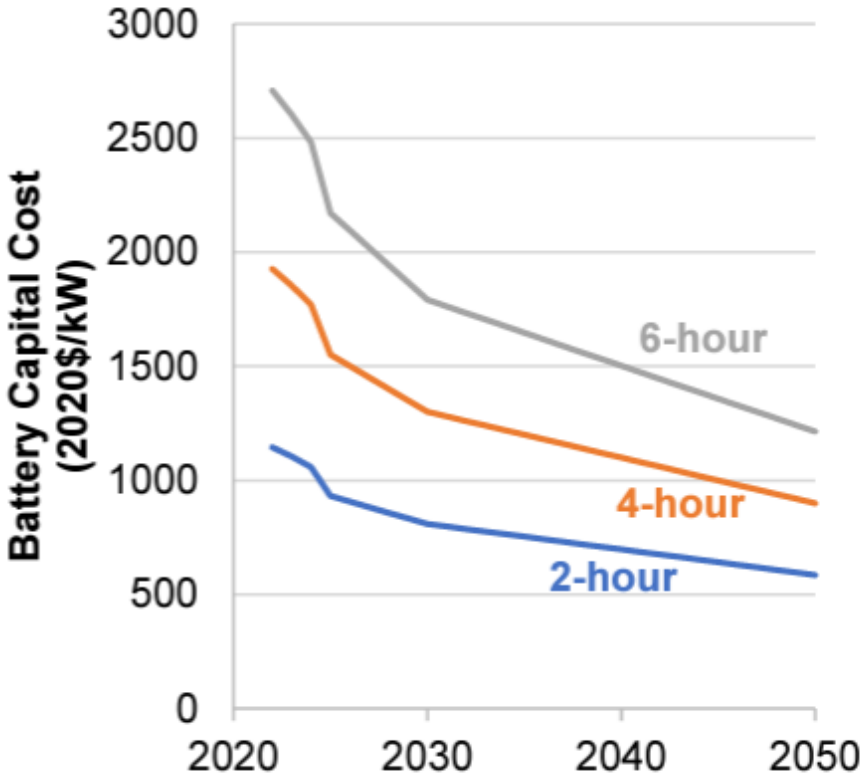
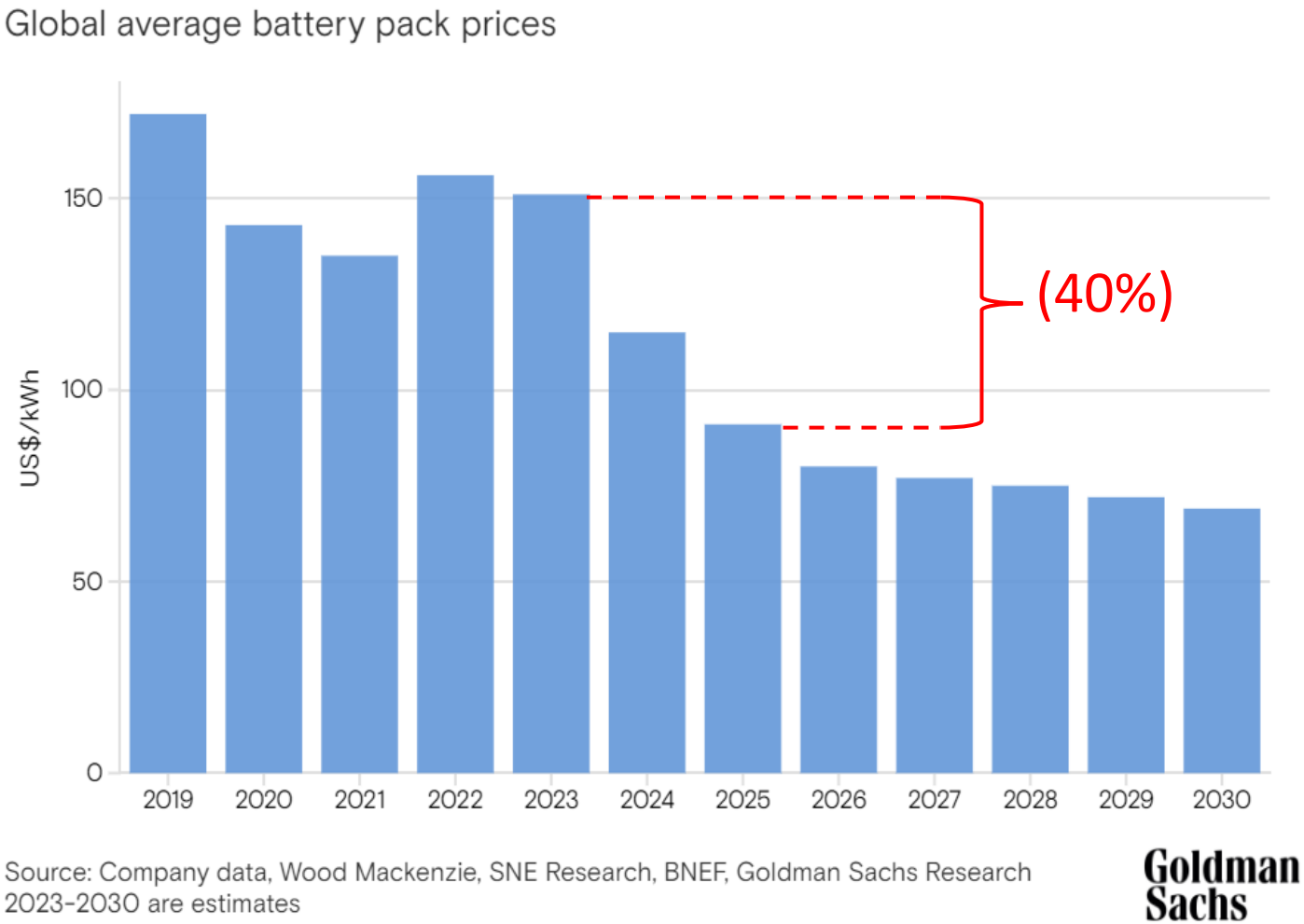


Dispatchable

BESS Cost Declines



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



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

Goldman Sachs

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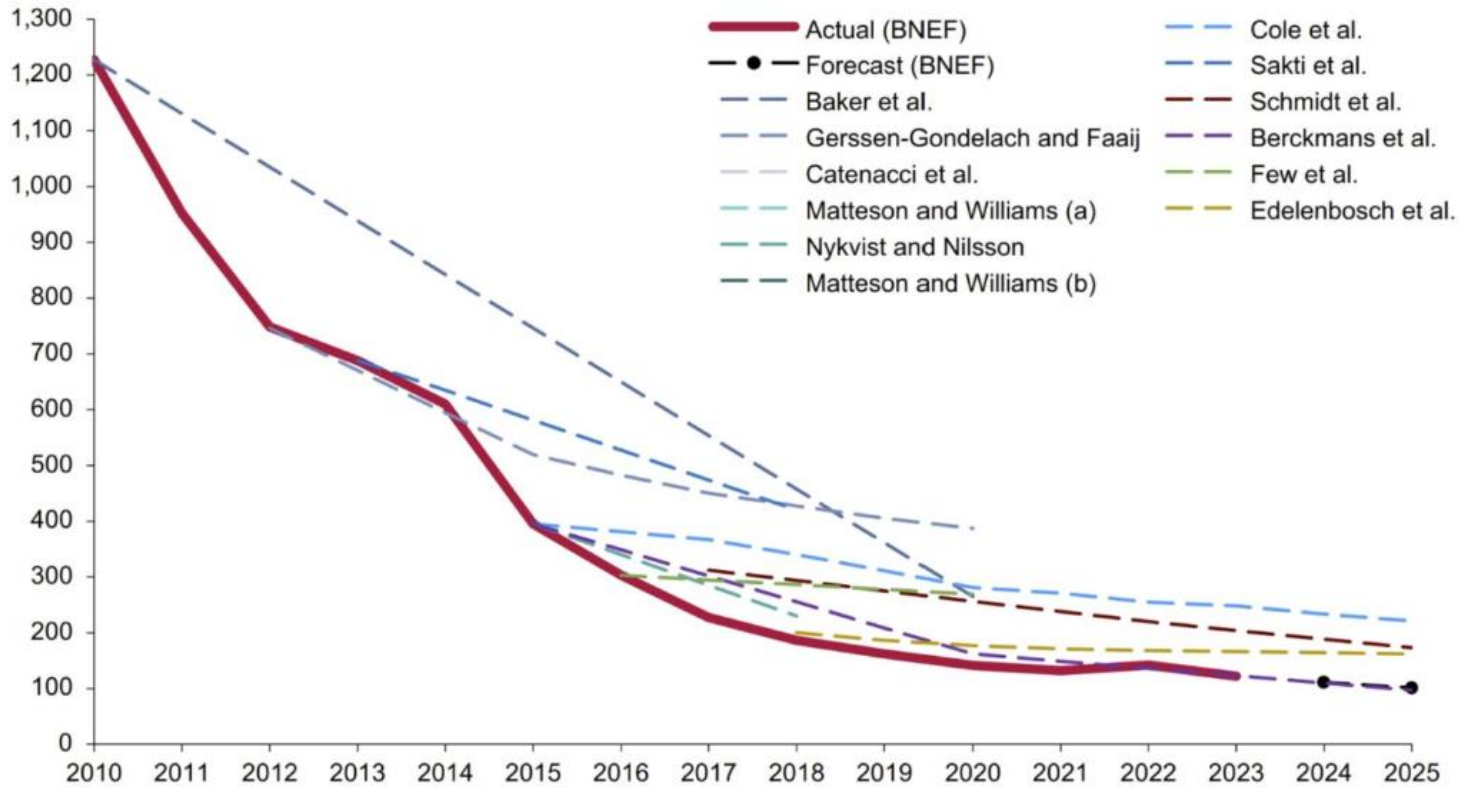
BESS: History of Conservative Forecasts

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.

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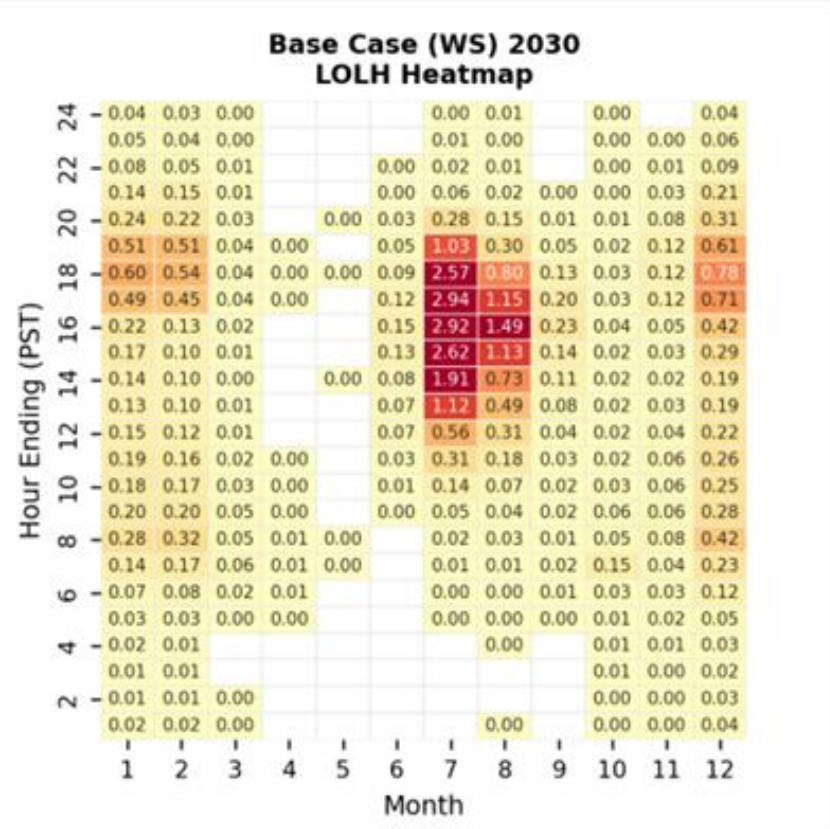
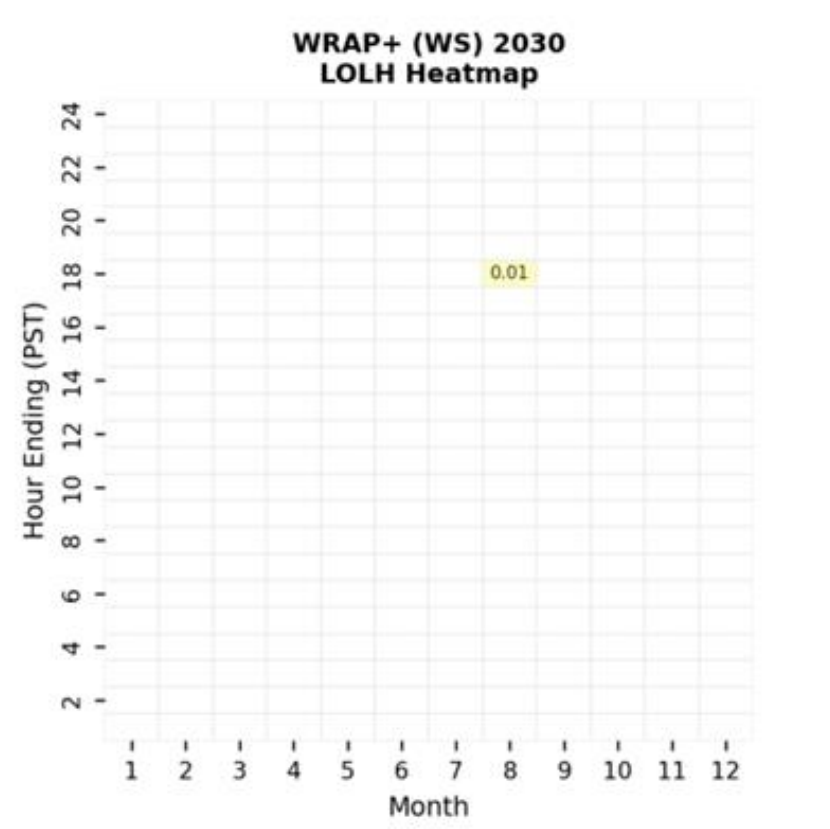
Montana's Capacity, Duration Need
WRAP 2030 Case





Scenario	LOLP$_{year}$	LOLE (days per 10 years)	LOLH (hours per year)	EUE (MWh per year)	Average Event Duration (hr)	Perfect Capacity Need (MW)
Base Case	97%	103.3	41.2	3,210	4.0	350
WRAP+	1%	0.1	0.0	0	1.0	0

GridLAB
ENERGY STRATEGIES

https://gridlab.org/wp-content/uploads/2024/02/GridLab_Montana-RA-study_Dec-2023.pdf

Montana Wind Resource

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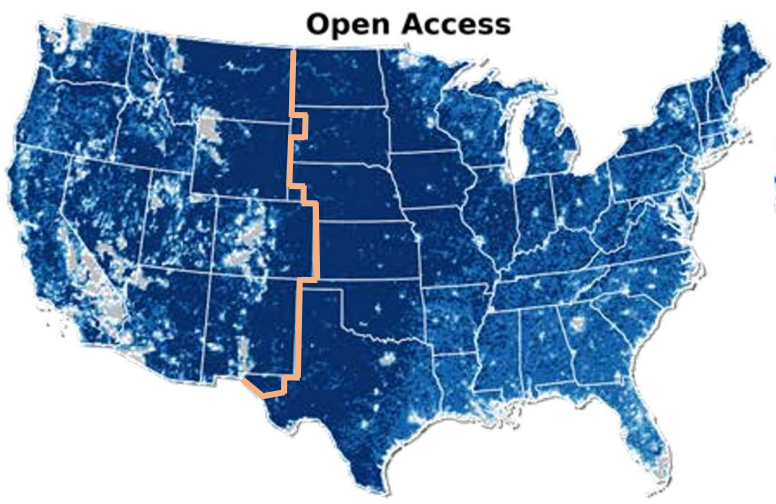
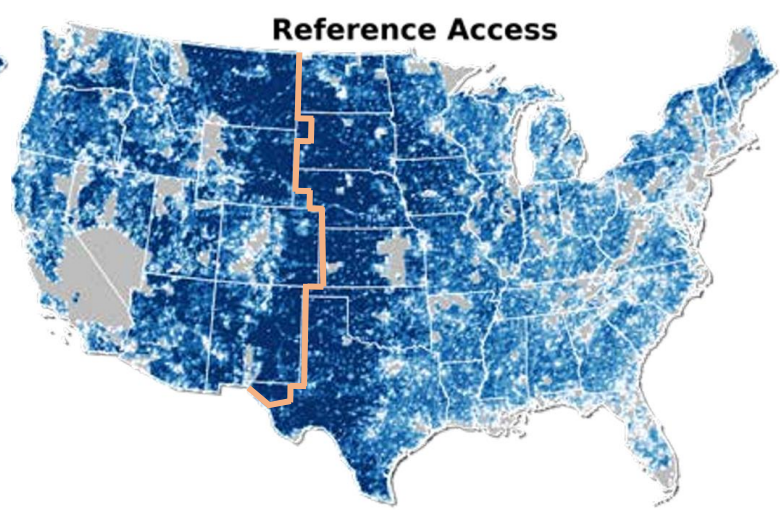
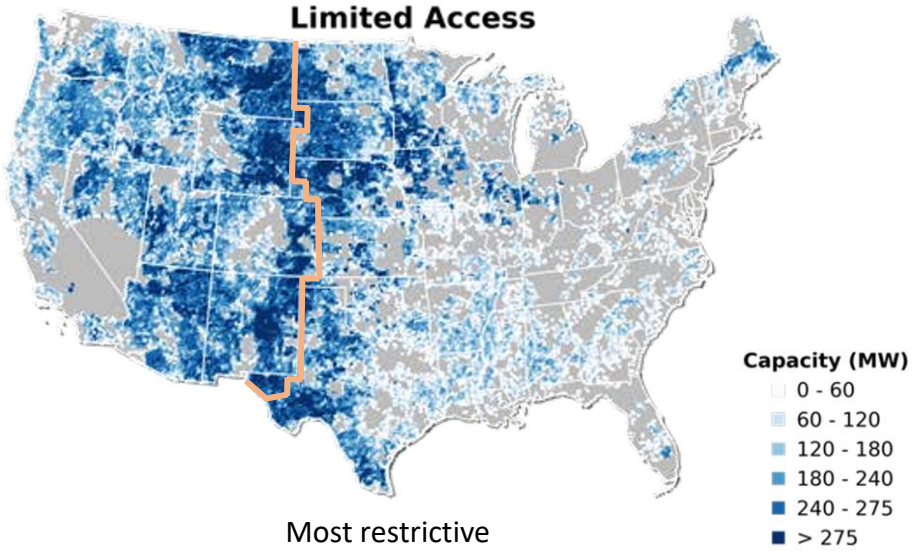
Technical Onshore Wind Power Potential by State: Three Scenarios



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)

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

https://www.nrel.gov/docs/fy24osti/87843.pdf

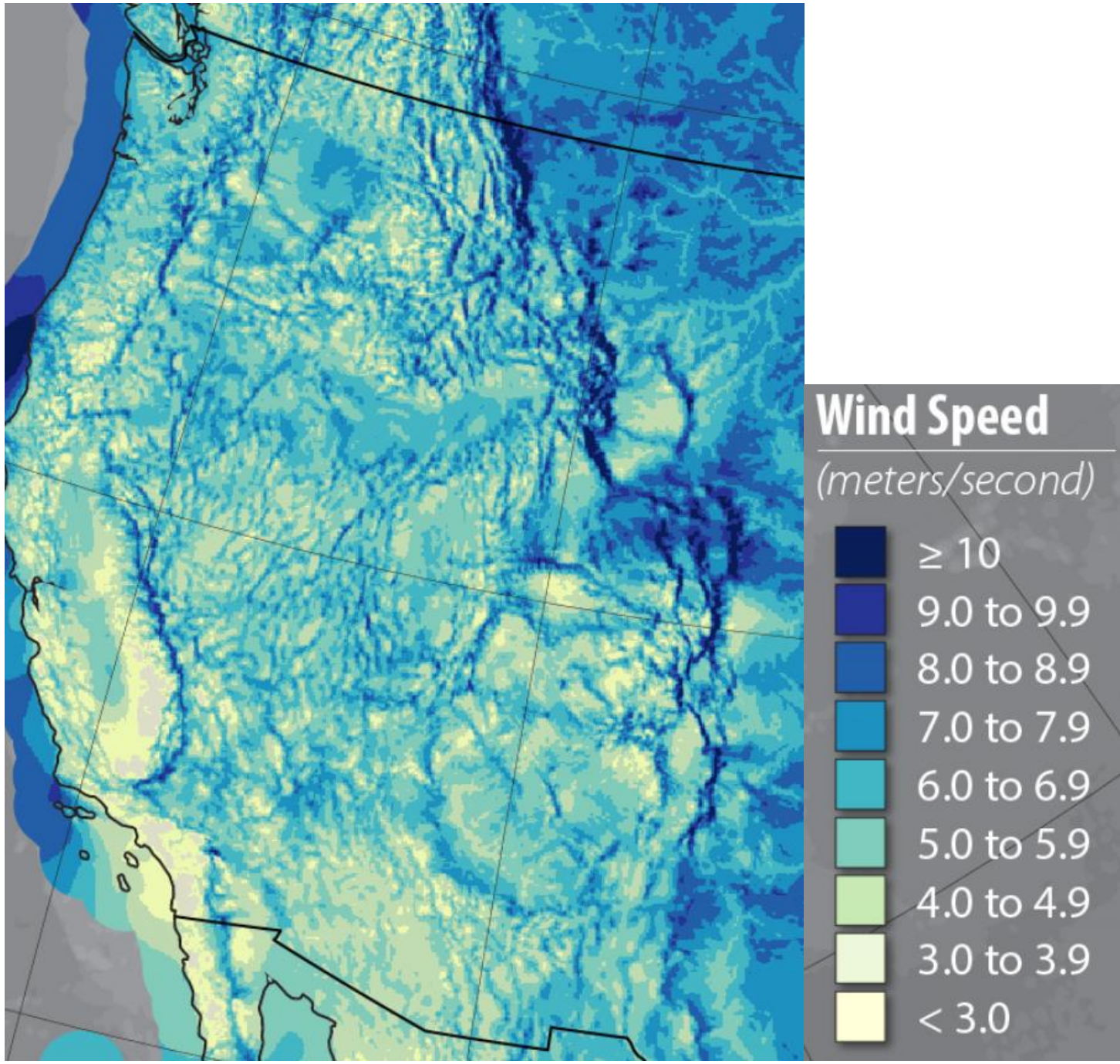
Why is Montana Wind So Valuable?

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

Why is Montana's installed wind capacity only 47% of Wyoming's?

Why is so little additional wind development planned in Montana?

Let's look at transmission…



https://www.nrel.gov/gis/assets/images/wtk-100-north-america-50-nm-01.jpg

Transmission Development

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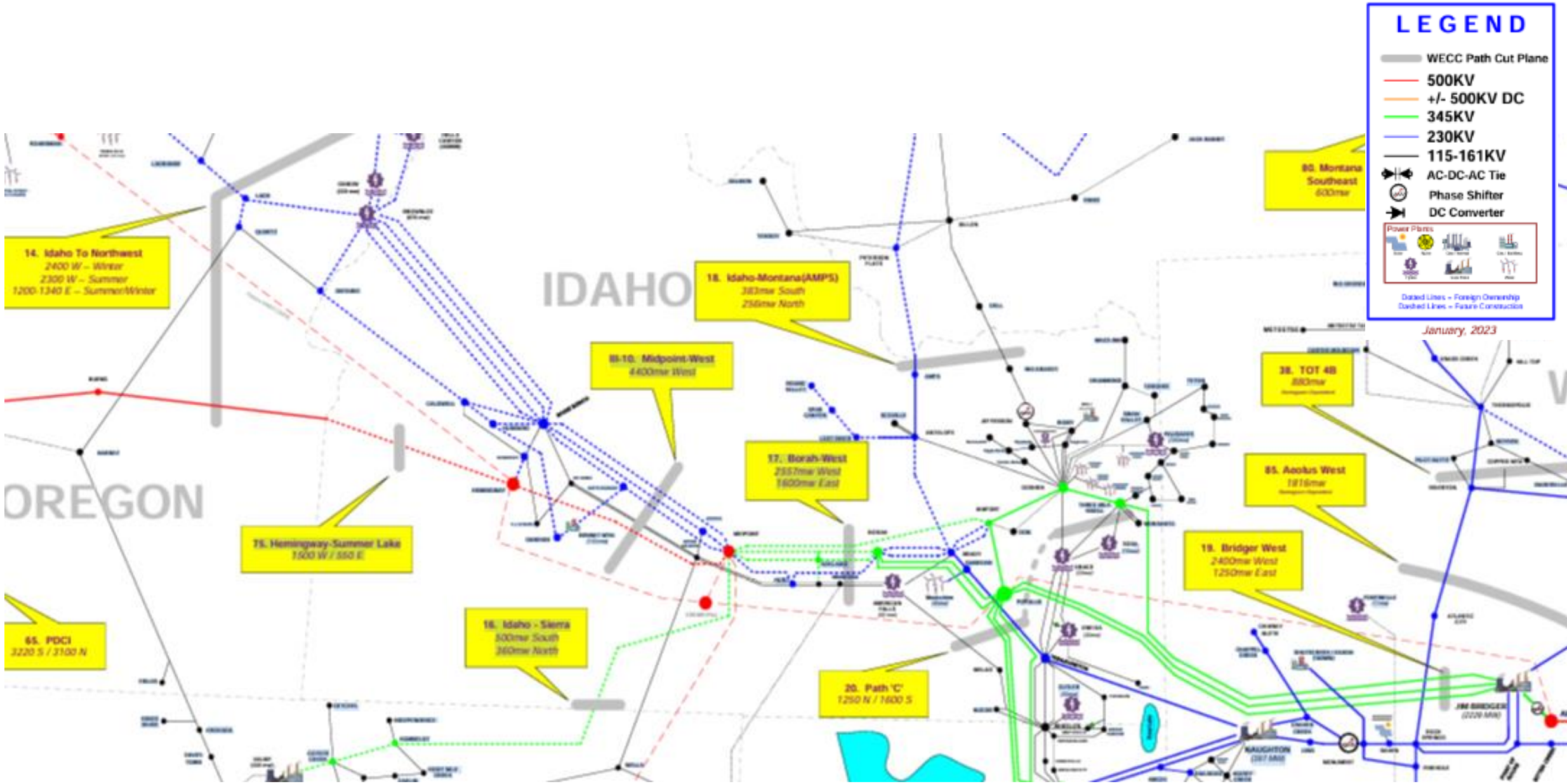
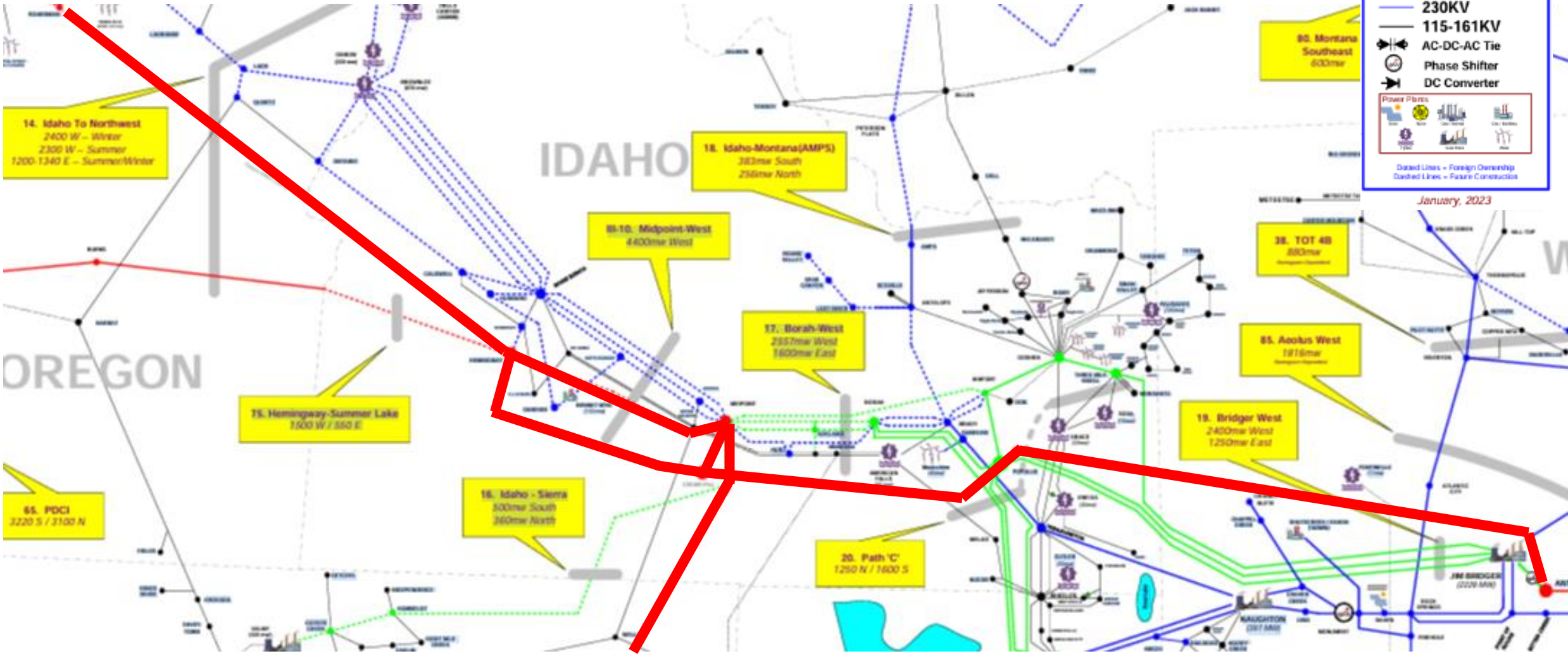
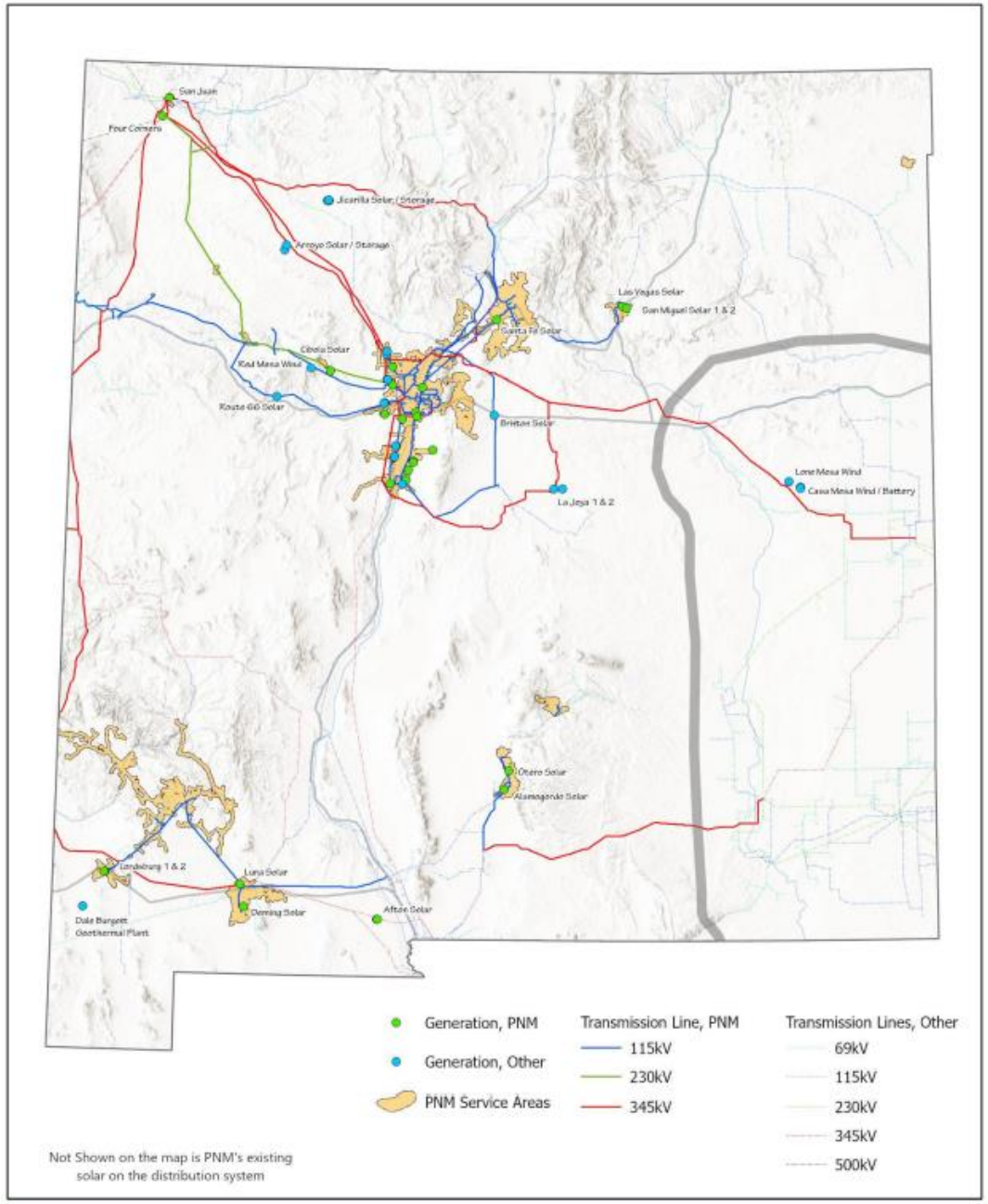
Idaho Transmission



Idaho Transmission with New Planned Lines
1585 miles



New Mexico Transmission



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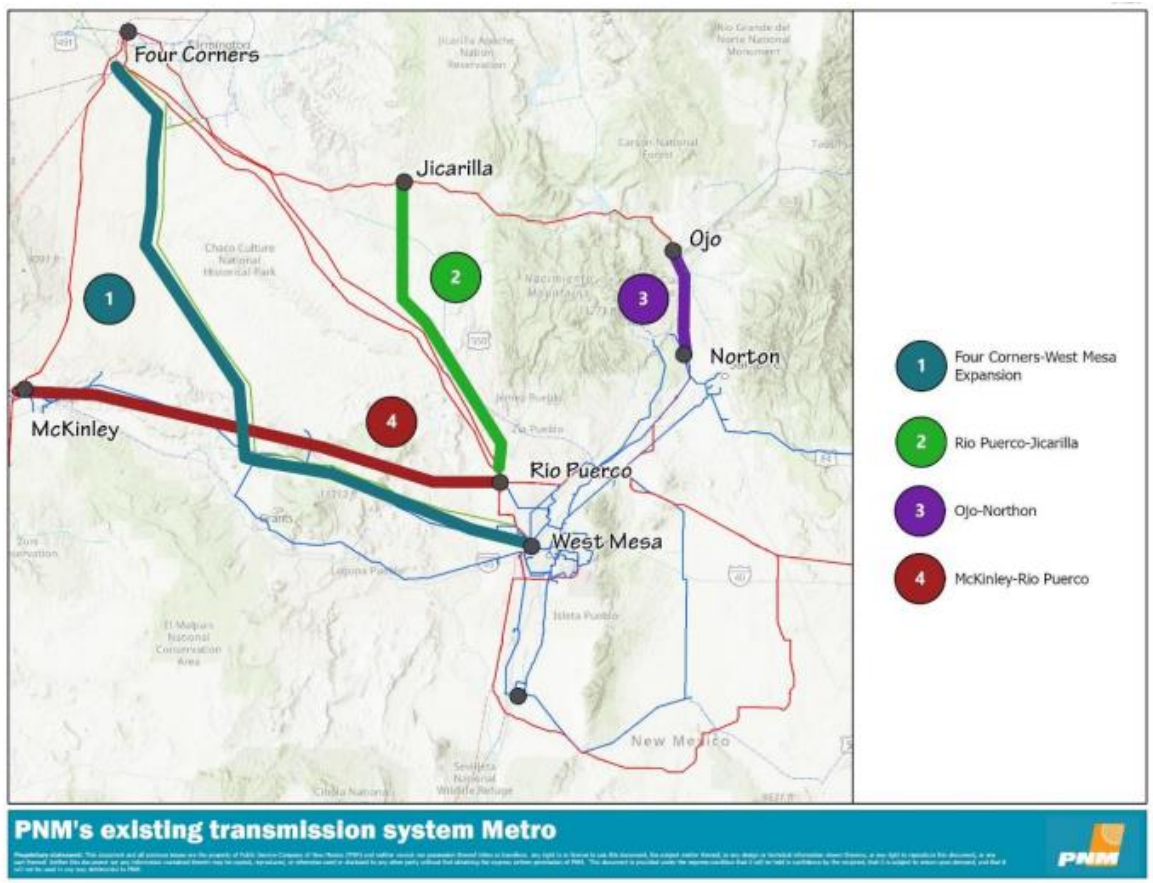
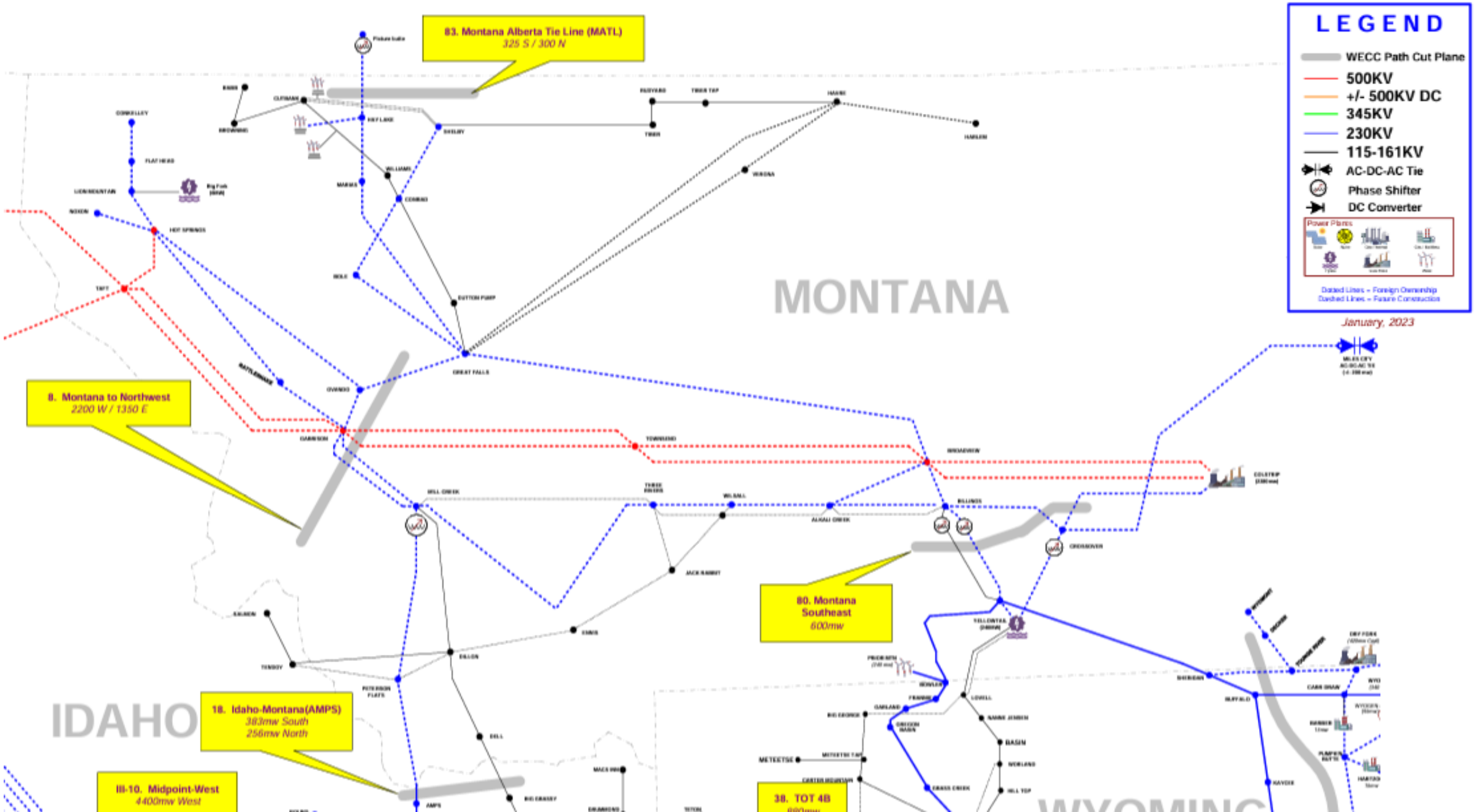
New Mexico Transmission with New Planned Lines 2541 miles

PNM-Planned Transmission Expansion

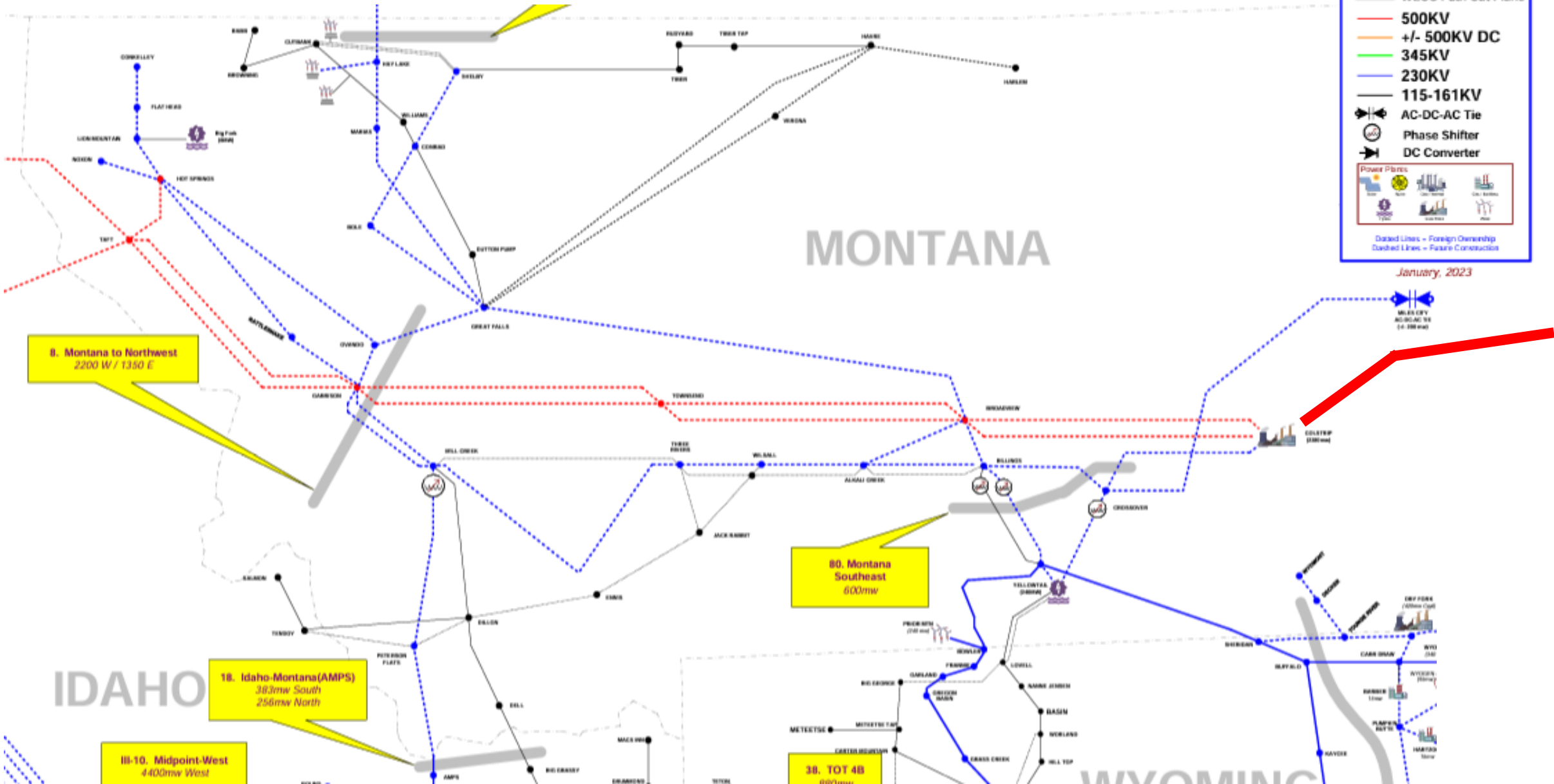


Merchant-Planned Transmission Expansion

Montana Transmission



Montana Transmission with New Planned Lines
400 miles



Demand for Transmission

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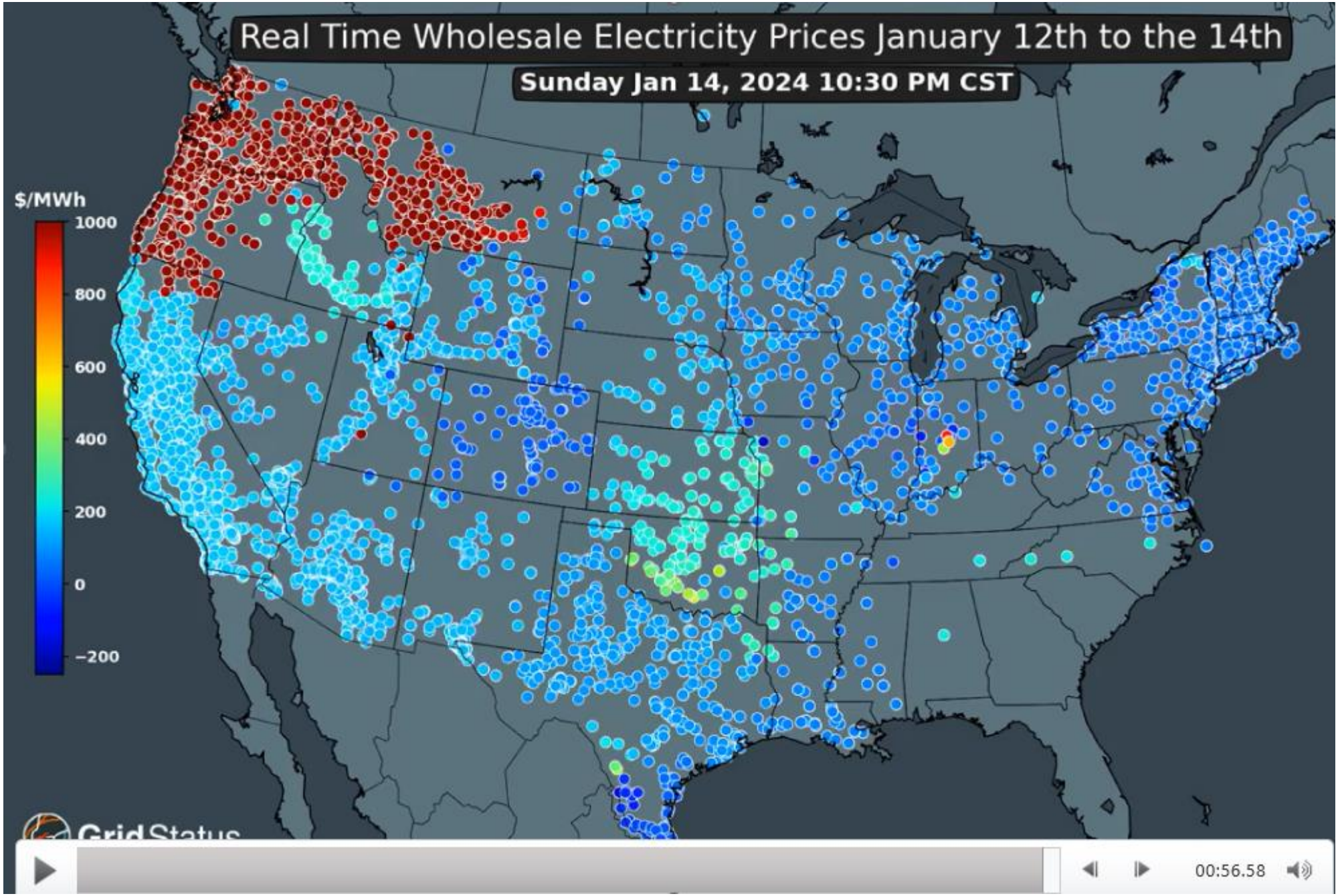

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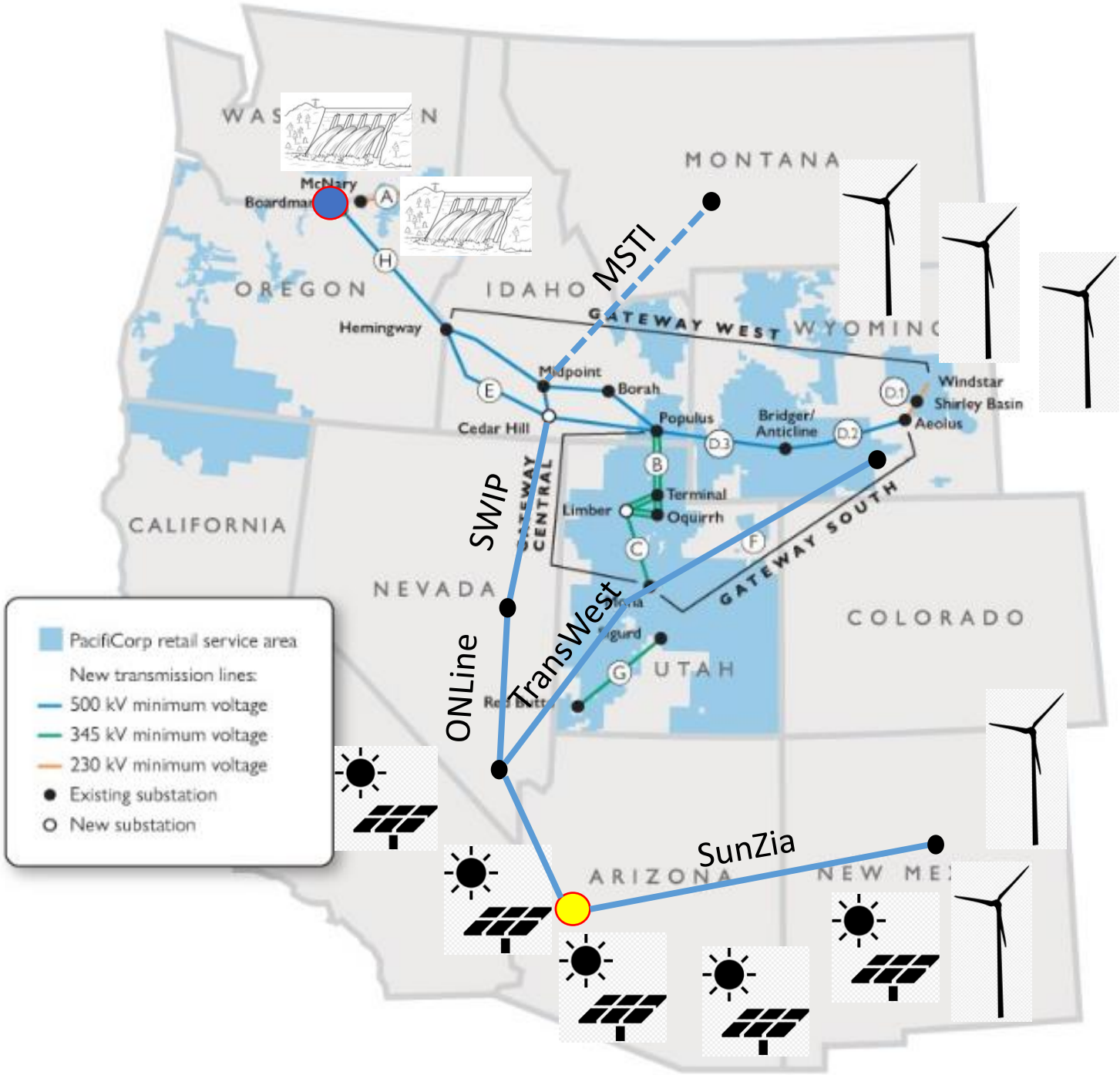
Enabling Geographic Diversity

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

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



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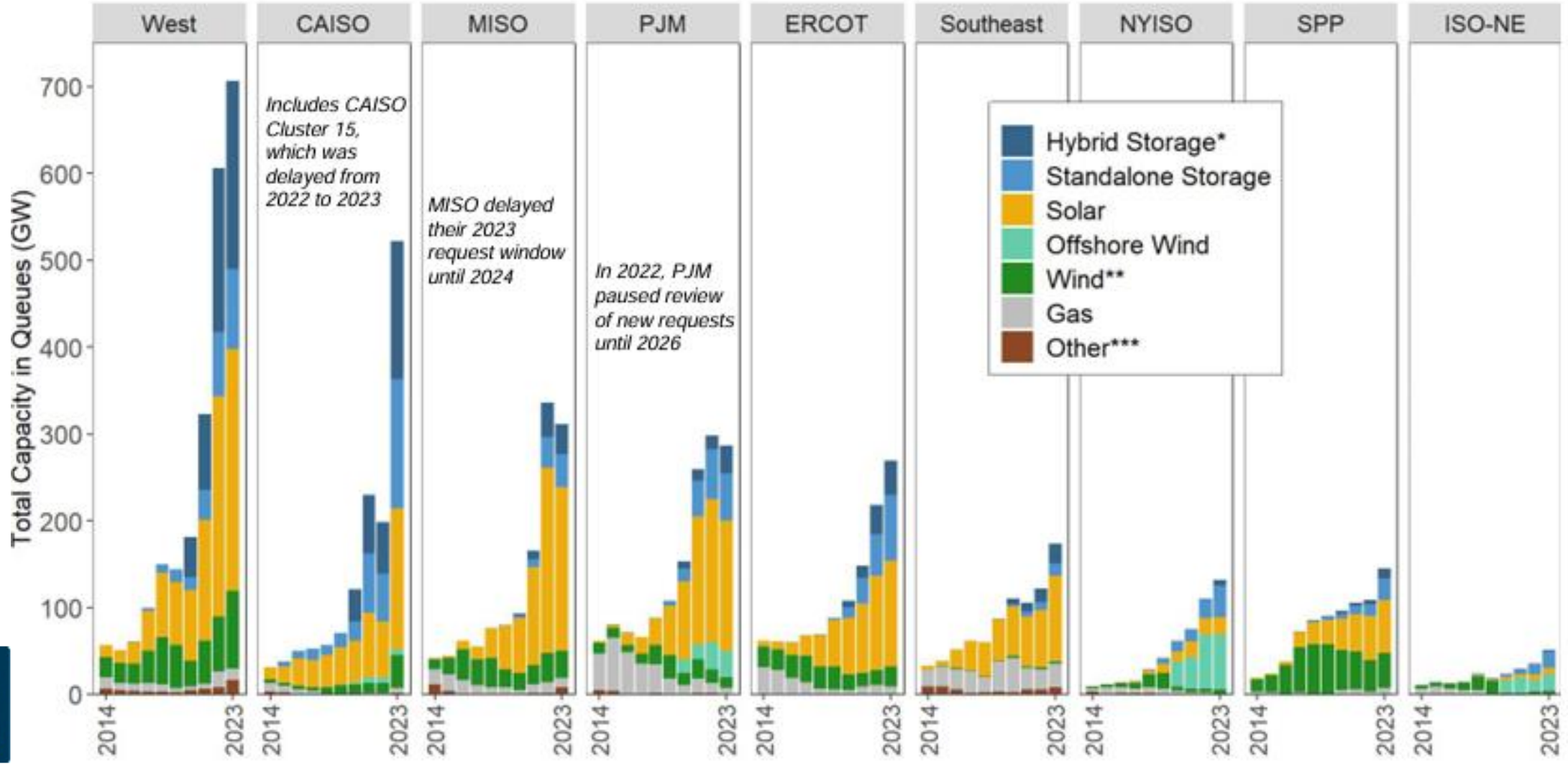
2014-2023 Cumulative Interconnection Queues

MT 2023 Queue Capacity

22,349 MW

96% renewables

S&P Global
Market Intelligence



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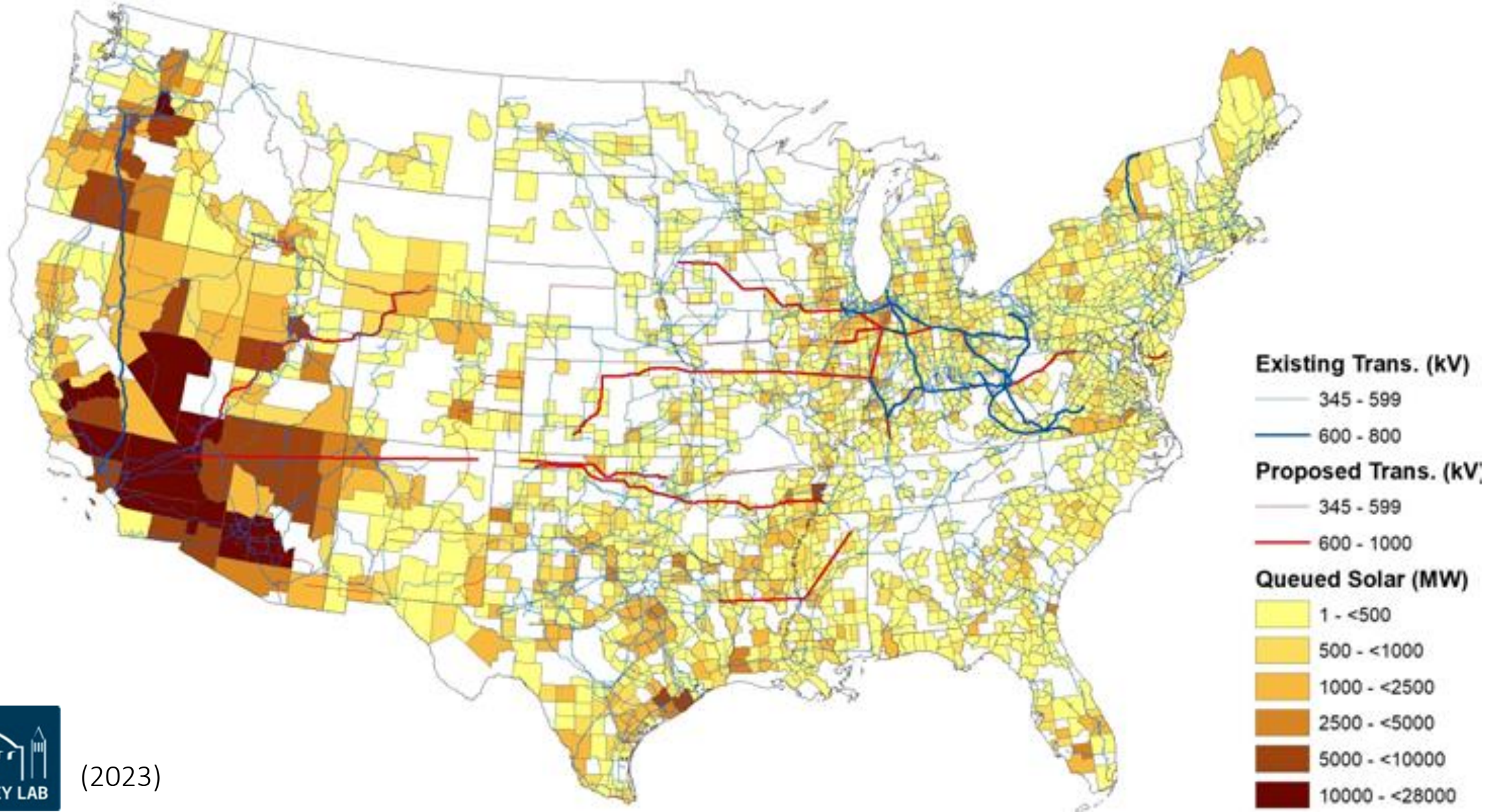
Solar Capacity in Queues by County



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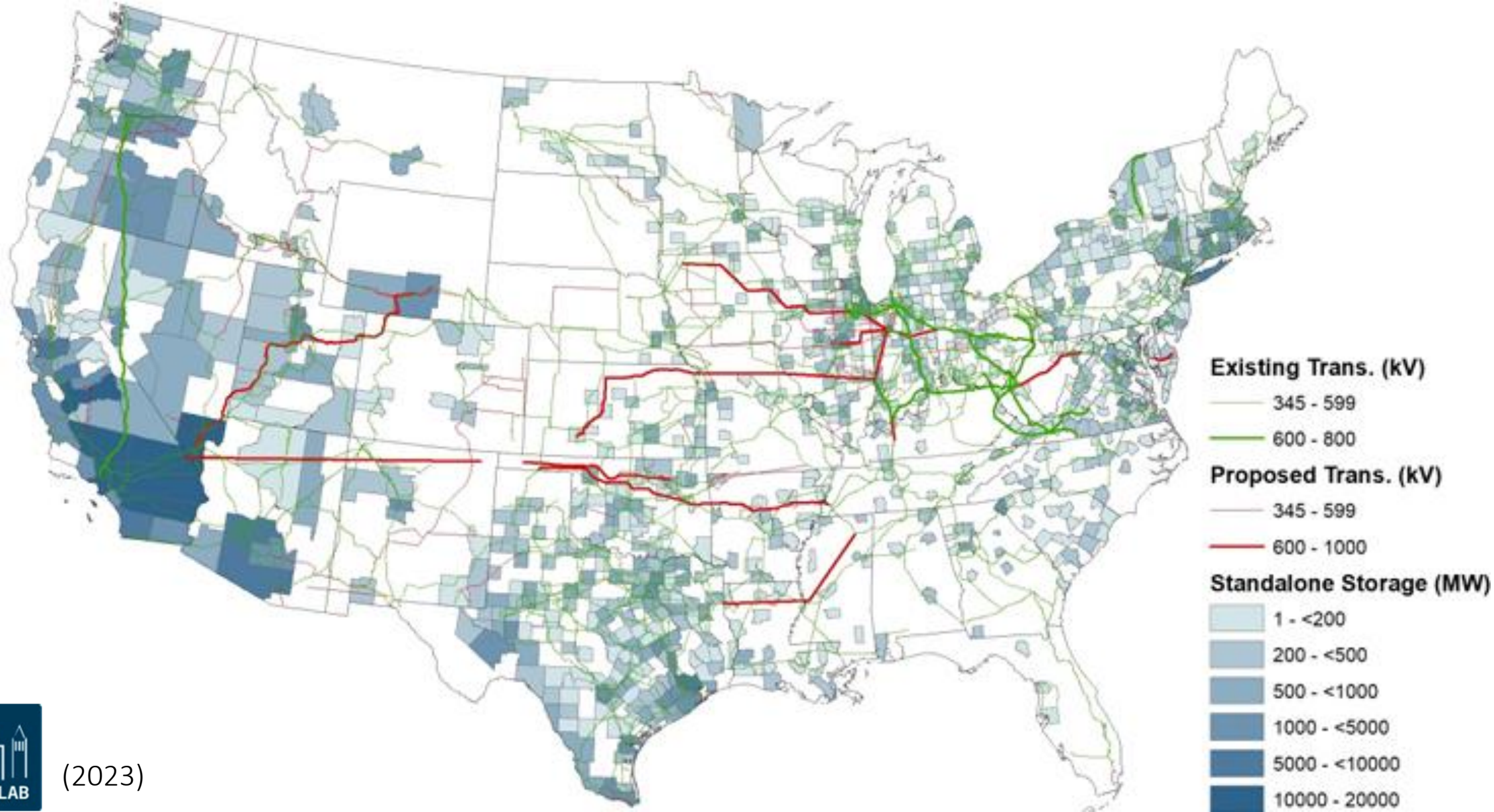
(2023)

Standalone Storage Capacity in Queues by County



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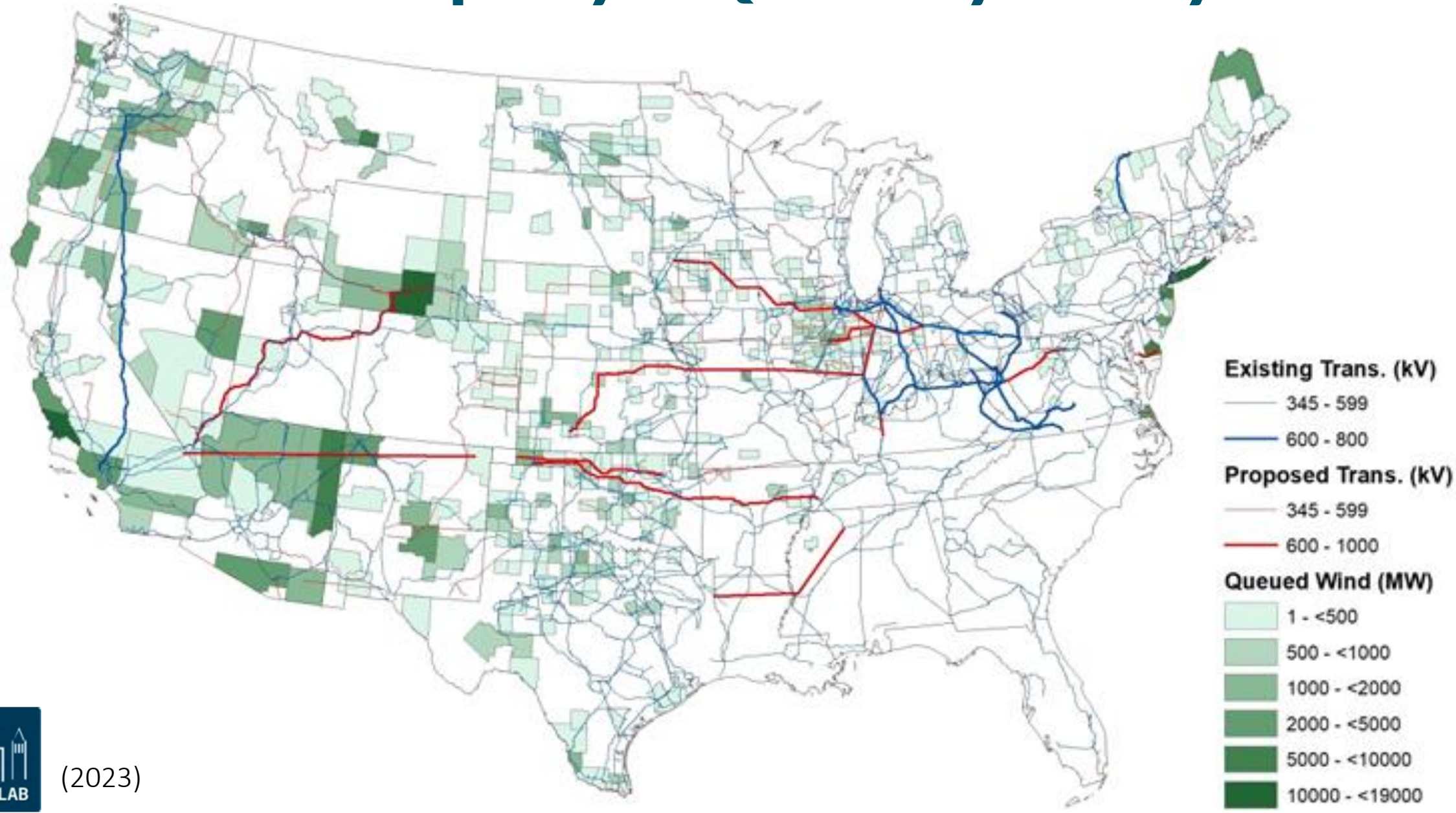
(2023)

Wind Capacity in Queues by County



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(2023)

NREL IREZ: Montana

Marginal levelized cost of energy using the zone's best 15 GW: $20.90/MWh

Destinations

- Seattle
- Portland

Most of this corridor is near existing 500-kV transmission operated by Bonneville Power Administration. Alternative transmission configurations using this existing system might be more cost-effective than the new 600-kV DC line modeled here.

The Blackfeet Tribe has land in the Montana IREZ and should be included in IREZ planning. The path from the IREZ to the region's existing 500-kV network would likely pass through Flathead Tribe land; that tribe should also be included in IREZ planning.

https://www.nrel.gov/docs/fy24osti/88228.pdf.

NREL IREZ: Montana (cont'd)

	Destination	
	Seattle	Portland
Energy cost savings[a] ($millions)	$940	$939
Annual revenue requirement for transmission[b] ($millions)	$235	$236
Benefit/cost ratio (energy savings only)	4.00	3.98
Expected unserved energy (IREZ vs. local renewables)[c]	Better	Better
3 GW as % of 2022 peak (included load zones)	42% (Puget Sound, Seattle City)	70% (PGE)

[a] Based on actual local energy costs in 2022. Energy costs will almost certainly be different when an IREZ corridor is built and energized. Decision makers and stakeholders should consider how their own expectations for future energy costs in their areas might affect benefit/cost ratios going forward. See Section 5.2 for an explanation of the methodology used.

[b] Based on a 600-kV HVDC transmission line from the IREZ to the load center. Decision makers and stakeholders should regard this as a benchmark for considering other transmission options that might be more cost-effective. See Section 5.1 for a description of assumed transmission costs.

[c] Impact on expected unserved energy (EUE) estimated by increasing simulated load to the point where EUE is approximately 0.001% of load, then adding 3 GW of new renewable resources and remeasuring EUE. See Section 5.3 for an explanation of the resource adequacy methodology and scoring criteria.

https://www.nrel.gov/docs/fy24osti/88228.pdf.

Demand for Generation

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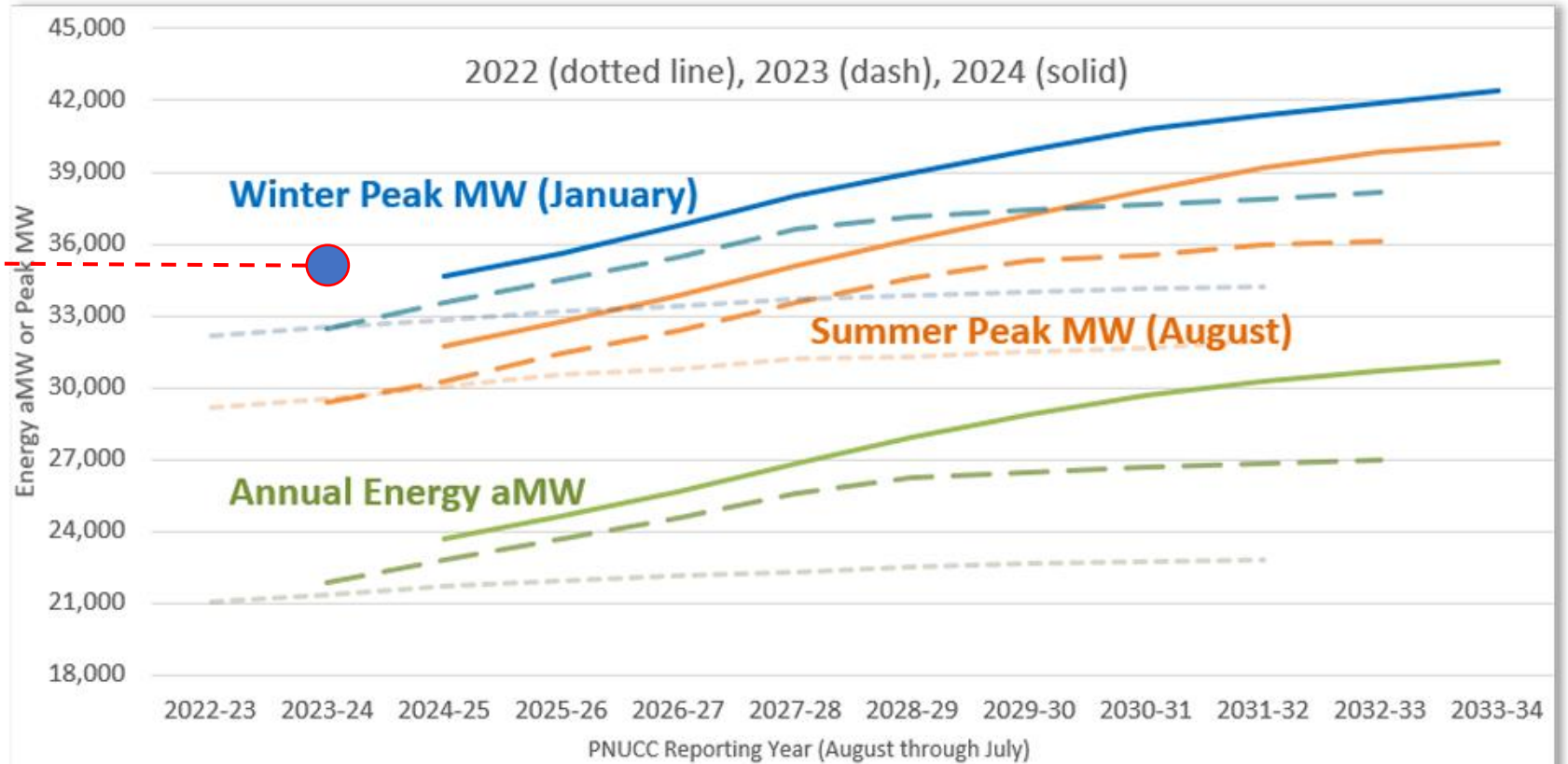
2024-2034 Northwest Regional Forecast

Jan 13, 2024
35,594 MW



Growth Rates

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

https://www.pnucc.org/wp-content/uploads/2024-PNUCC-Northwest-Regional-Forecast-final.pdf

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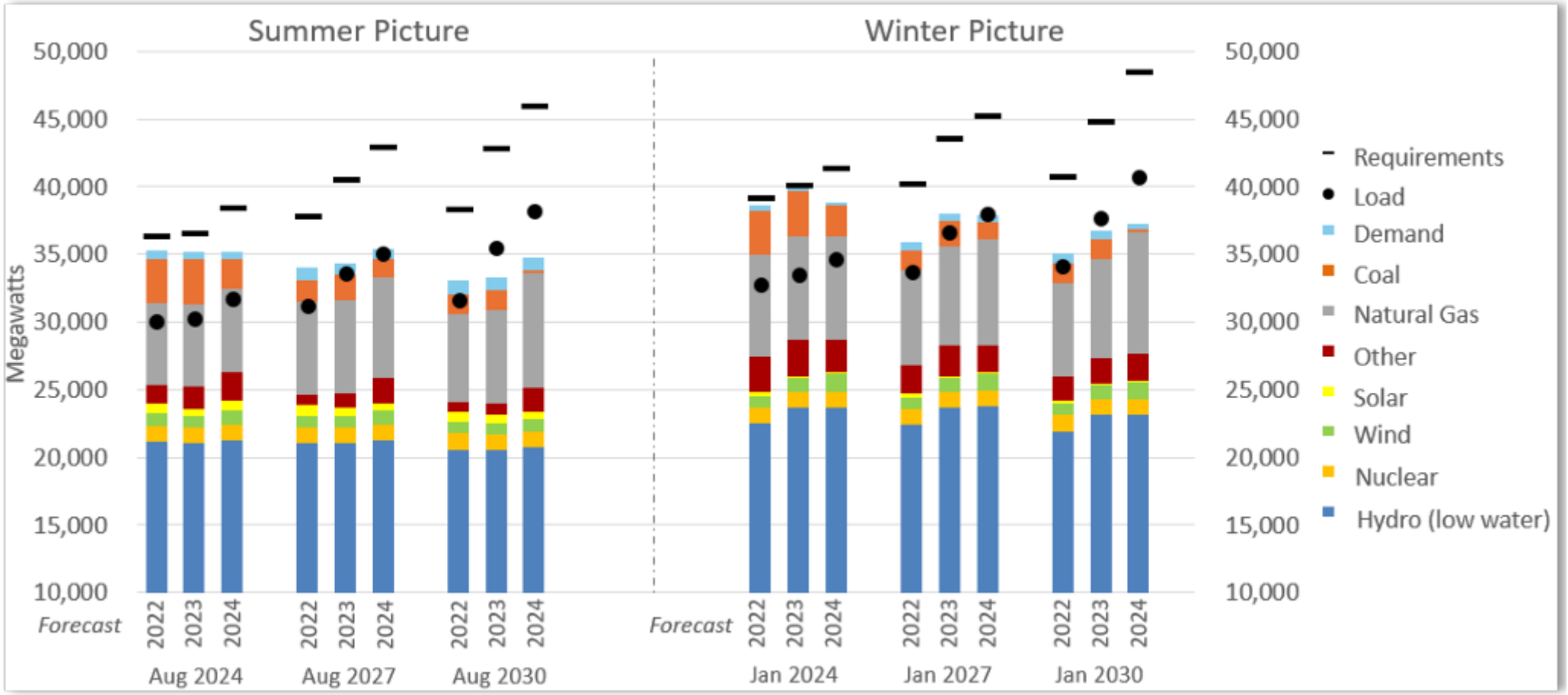
Forecast Capacity Deficit with Existing Resources



https://www.pnucc.org/wp-content/uploads/2024-PNUCC-Northwest-Regional-Forecast-final.pdf

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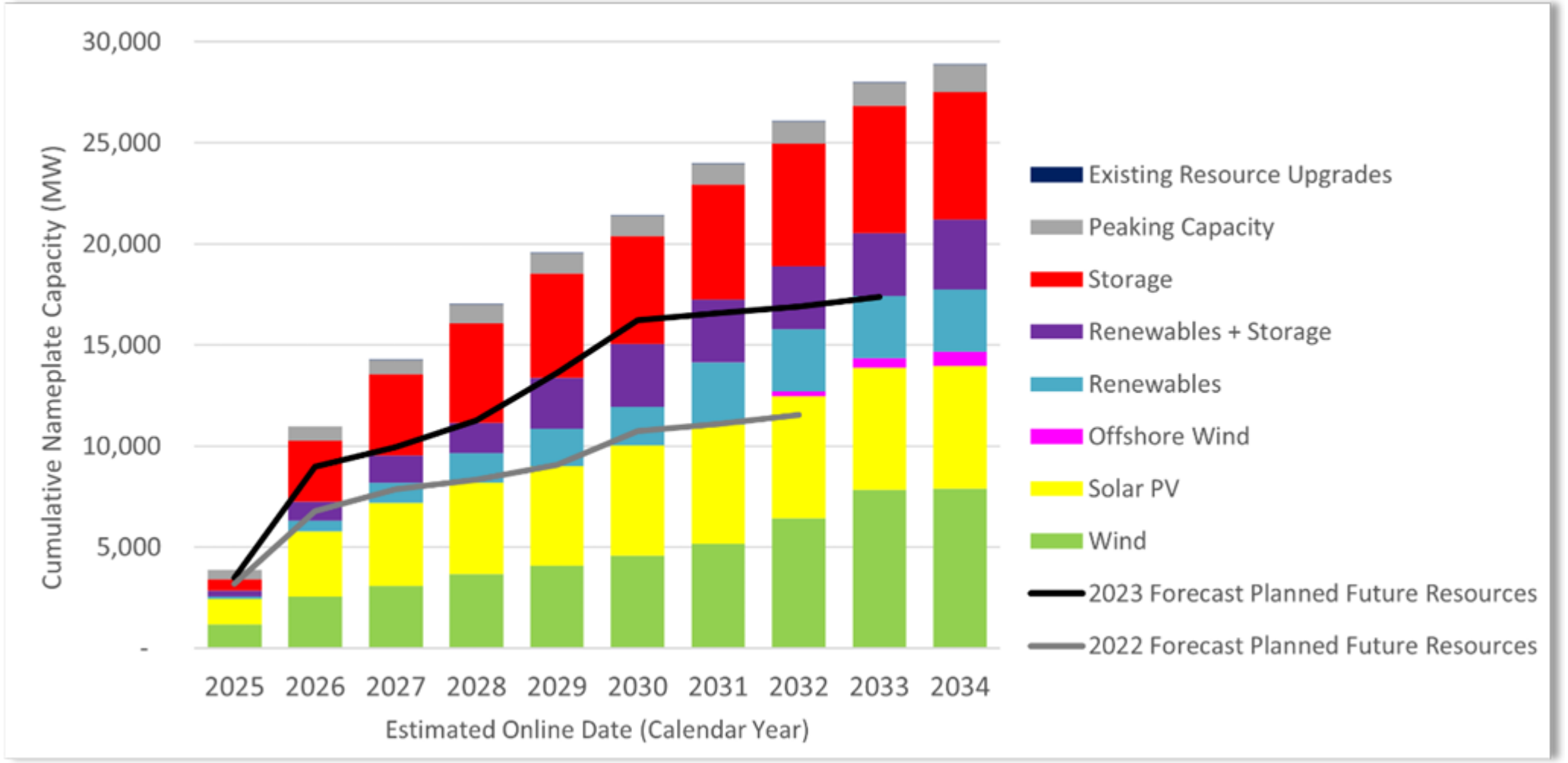
Planned New Resources



www.pnucc.org/wp-content/uploads/2023-PNUCC-Northwest-Regional-Forecast-final.pdf

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Montana's Economic Constraints and Opportunity

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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 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

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

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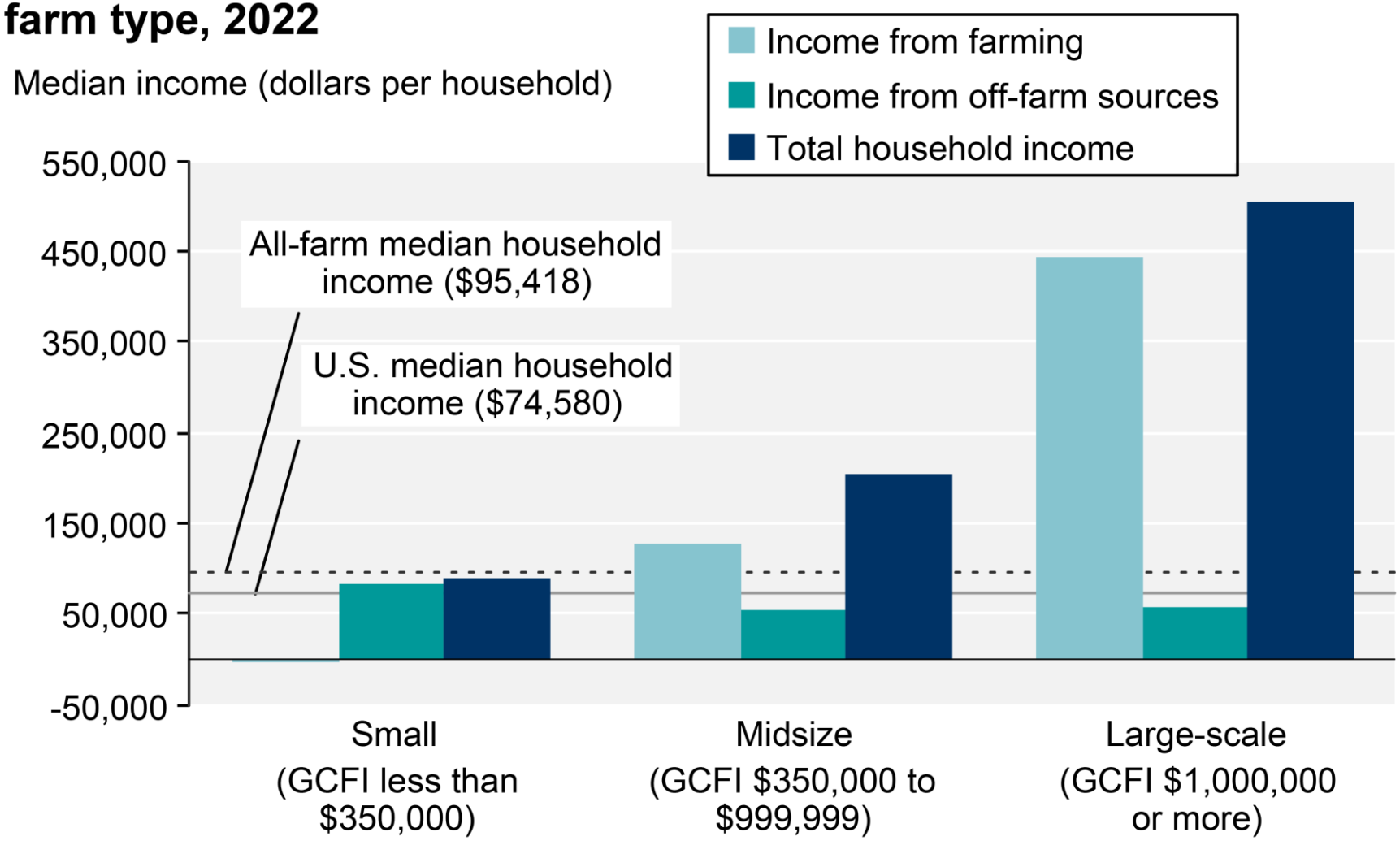
Median income of farm households, by income source and farm type, 2022



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 Farms

Count

2017 = 27,000

↓ (10%)

2022 = 24,250

Avg Size

2017 = 2,150

↓ +10%

2022 = 2,375

https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_2_County_Level/Montana/

Montana's Increasing Tax Burden

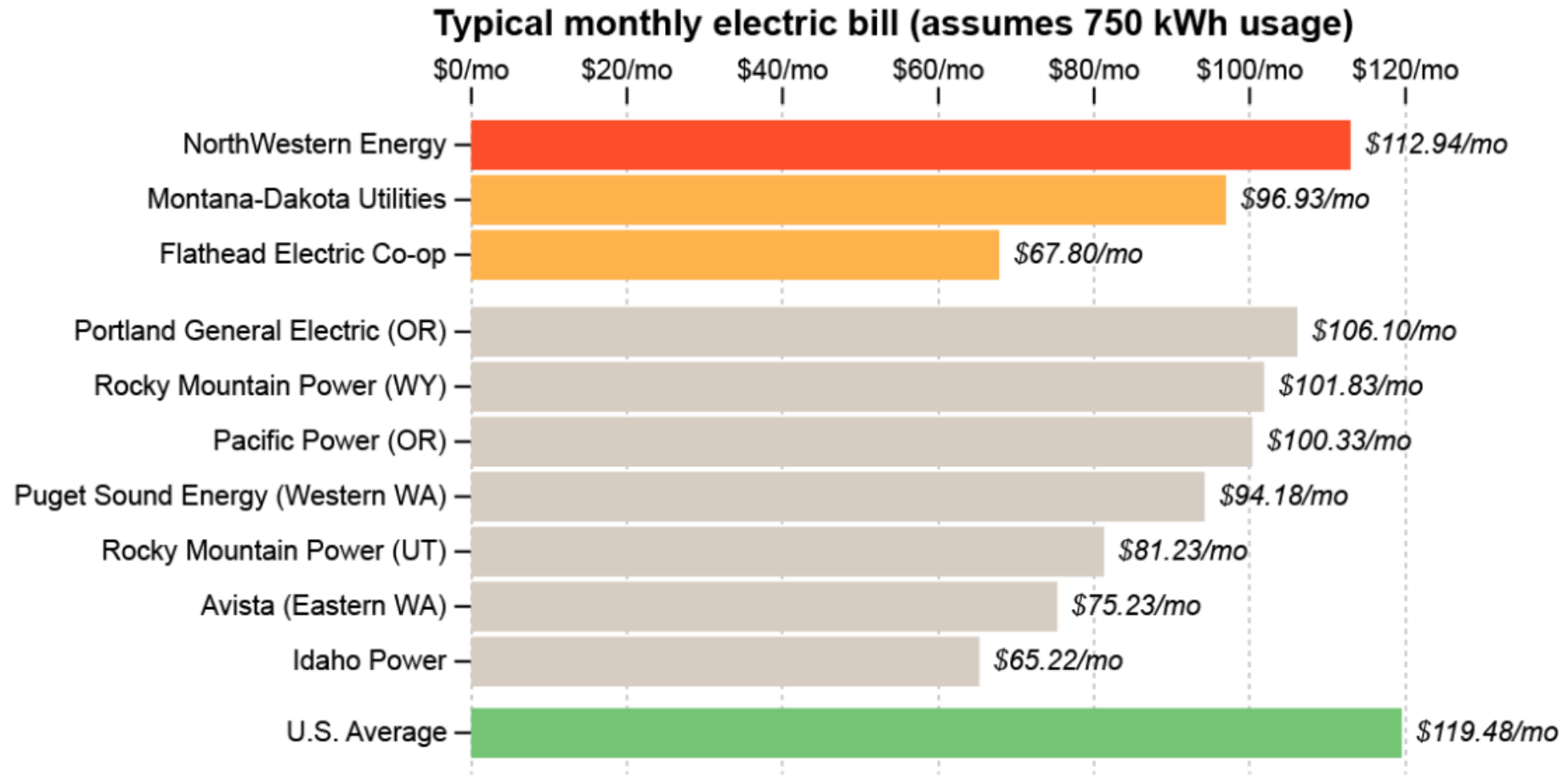
MTFP estimates for Montana tax bills in 2023 versus 2022

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.
Graphic: Amanda Eggert & Eric Dietrich / MTFP

November 1, 2023

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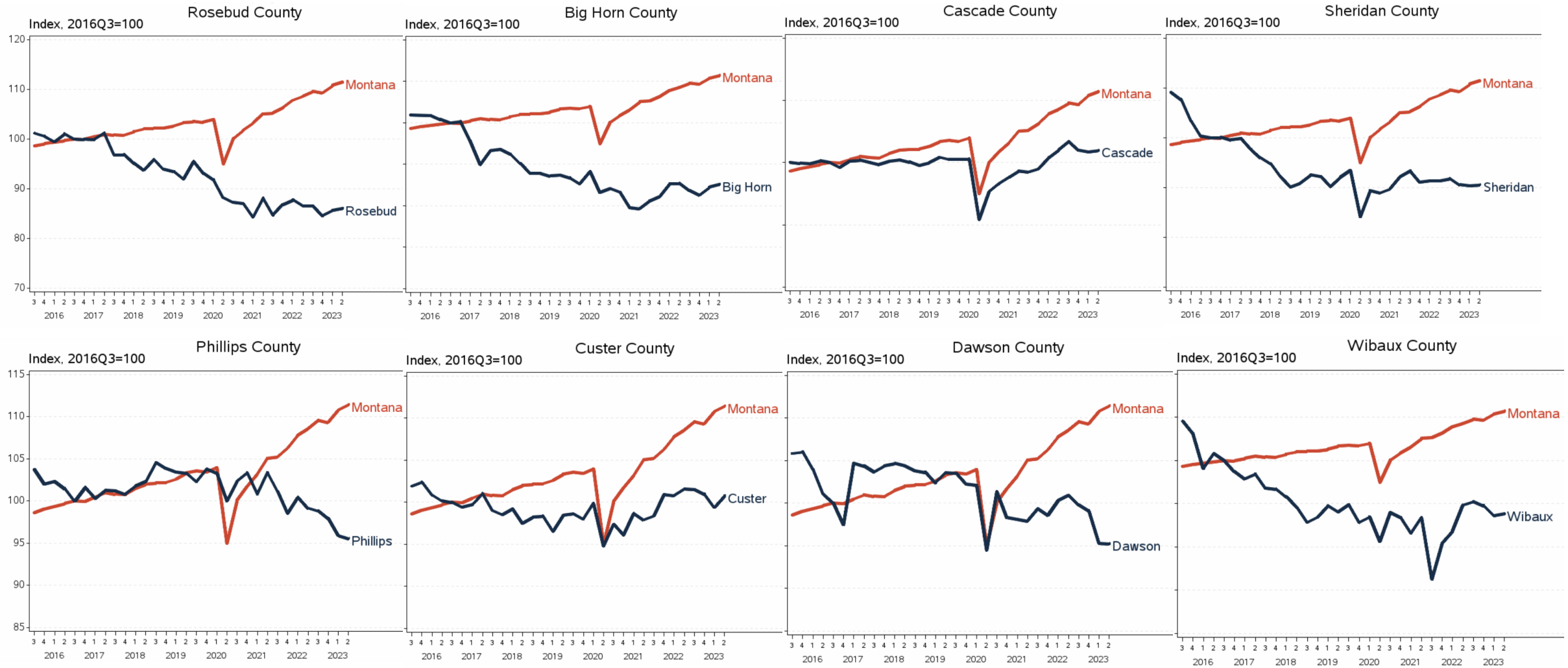
Eight Montana Counties with Excellent Wind Resource

Payroll Employment by County



BUREAU OF BUSINESS AND ECONOMIC RESEARCH
UNIVERSITY OF MONTANA

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Clean Energy Development Creates Jobs

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

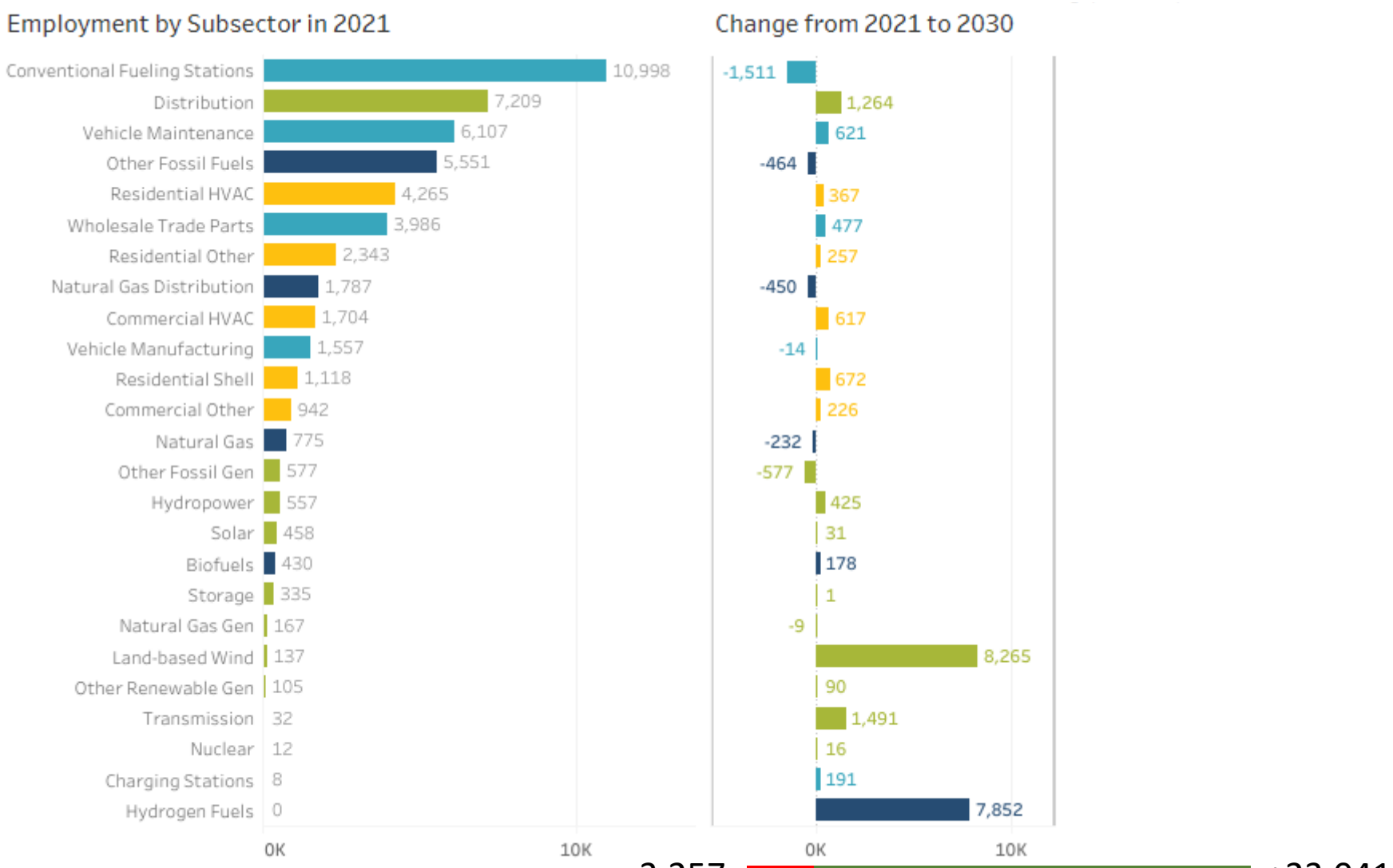


Figure includes direct, indirect, and induced employment.

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

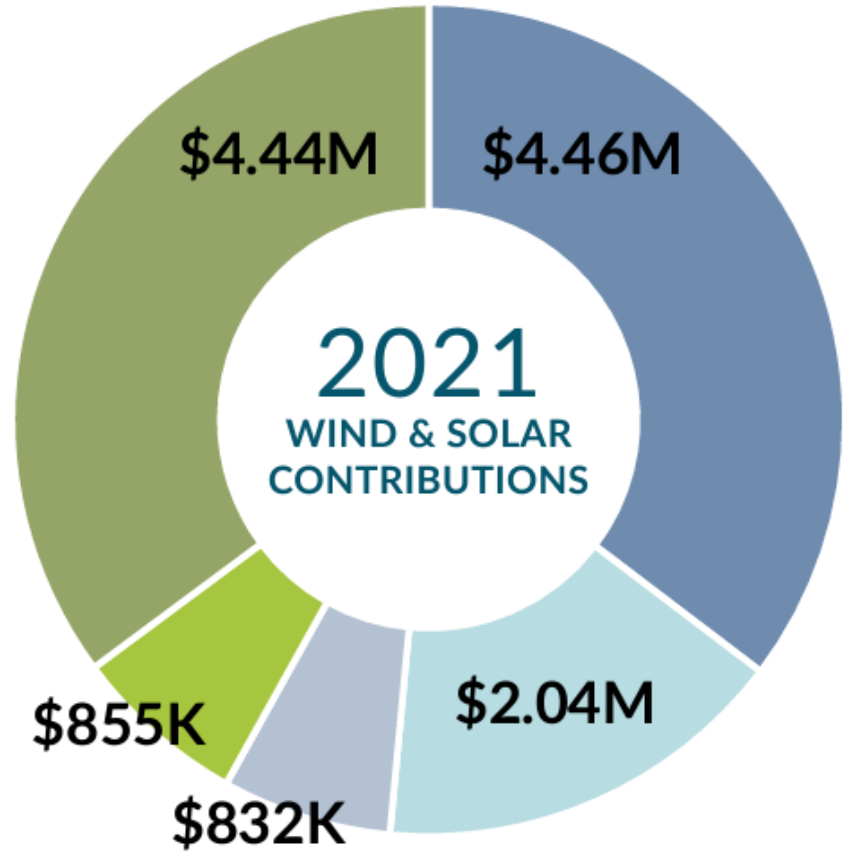
The East Smoky Panel Mine, which was just approved, is actually the second mine approved for J.R. Simplot this year. The Dairy Syncline Mine Project was approved in April. That mine will be the next "generation" of phosphate mining for Simplot in southeastern Idaho. The project is expected to support 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

RENEWABLE ENERGY PAYMENTS: TOP MONTANA COUNTIES

County	2021 Contributions
Cascade	$2,496,870
Toole	$2,471,435
Wheatland	$1,248,407
Judith Basin	$1,216,391
Carbon	$989,466
Sweet Grass	$786,669
Stillwater	$706,696
Teton	$601,516
Glacier	$453,889
Fallon	$340,799
Meagher	$274,949
Lewis and Clark	$85,256
Golden Valley	$35,501
Yellowstone	$34,682

For communities across the state, tax revenue from wind and solar production is used to build roads, fund schools and hospitals, maintain emergency services and support city and county services—all taking the pressure off of local taxpayers.



Education (elementary, high school, K-12, county-wide schools, universities and the Vo-Tech general fund)

County budgets (general funds, public safety, roads and bridges and health and sanitation)

Fire and miscellaneous funds

Montana State General Fund

Cities and towns

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New Projects Bring Tax Base and Landowner Income

	Project	Tax Revenues*	Landowner Payments*
PSE PUGET SOUND ENERGY	Beaver Creek Wind Facility 248 MW Stillwater County	**$6,000,000/year**	Not published
NEXTera ENERGY	Clearwater Wind Facility 750 MW Garfield, Custer, Rosebud Co.	**$7,230,000/year**	**$7,530,000/year**
Clēnera AN ENLIGHT COMPANY	Apex Solar 105 MW Beaverhead County	**$931,500/year**	Not published

*estimated

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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 and counties where investment is needed

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