TOWN HALL MEETING
regarding
FUTURE ENERGY GENERATION FOR LOS ALAMOS

January 26, 2023

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Load and Generation

- Base Load for the Power Pool is roughly 45 MW
- Summer Peak Load and Winter Peak Load are very close in terms of MWs
- LAPP is transitioning to a positive reserve margin.
  - Excess Capacity from dispatchable resources is preferred for optimization of resource fleet.

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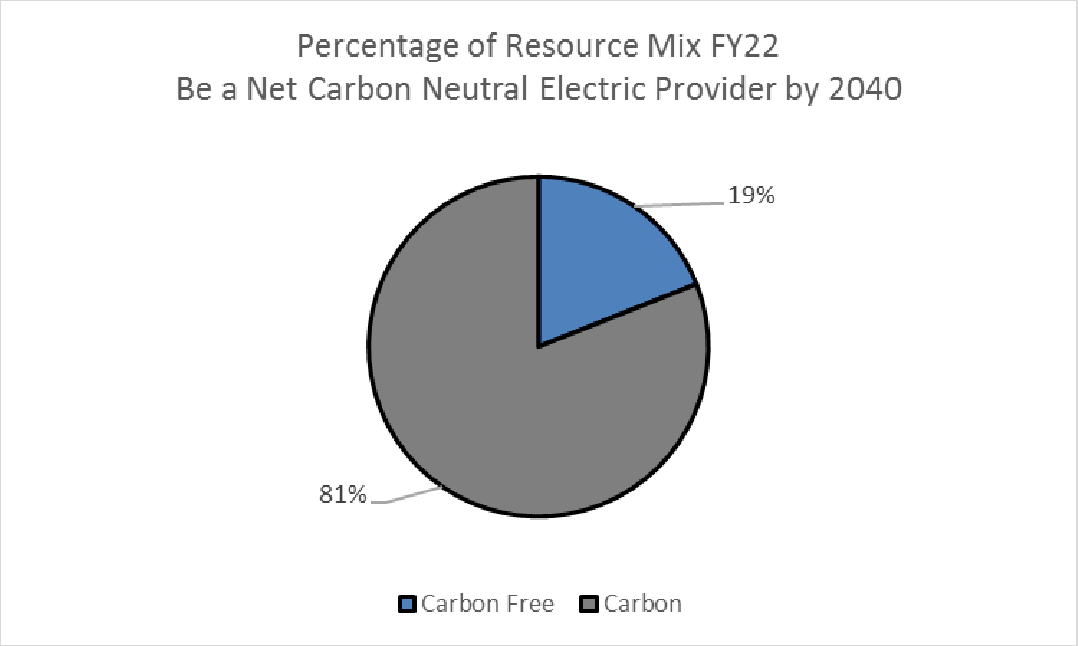
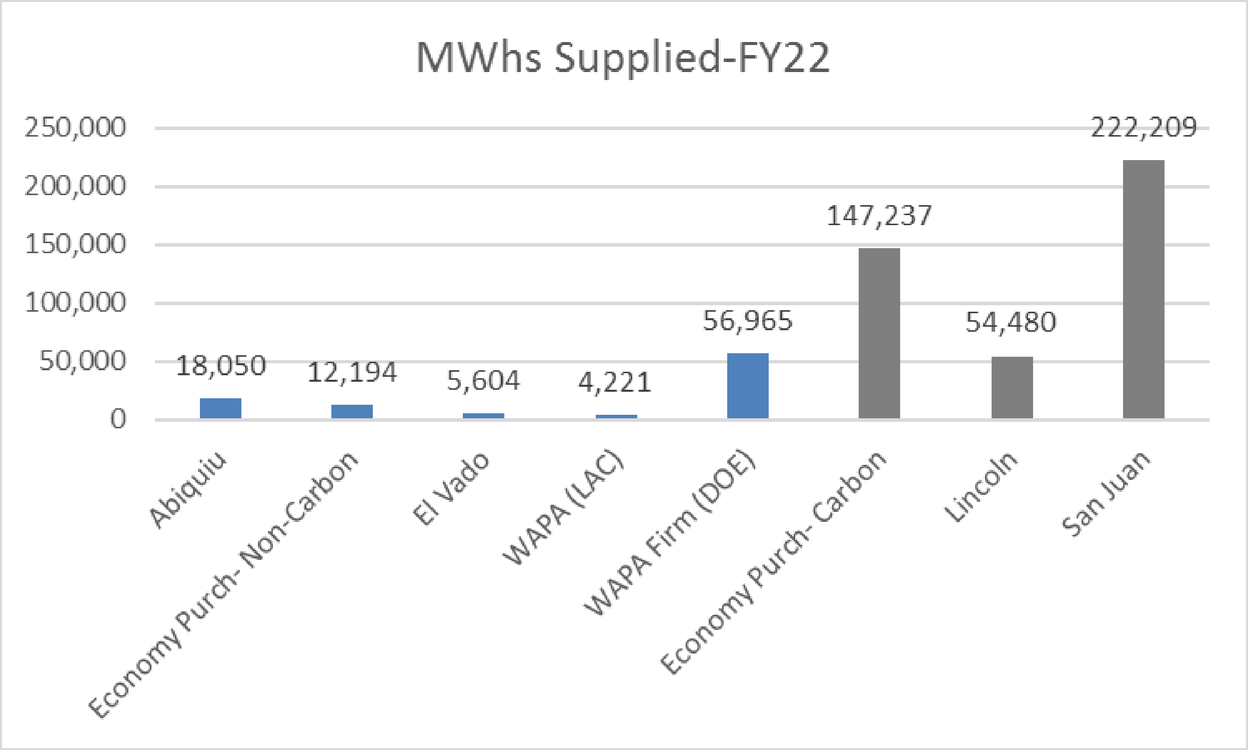
Current Resource Mix- Goal of Carbon Neutrality by 2040





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IRP Identified Need

- 20 Year Outlook
  - – 55MW (4 hour) Battery Storage- Capacity Adjusted 9 MW
  - – 380MW Solar - Capacity Adjusted 114MW
  - – 135MW Wind - Capacity Adjusted 54MW
  - – 8MW SMR/CFPP -Capacity Adjusted 7.6MW
- 5 Year
  - – 30MW Battery Storage - Capacity Adjusted 5MW
  - – 85MW Solar - Capacity Adjusted 25.5 MW
  - – 105 MW Wind - Capacity Adjusted 42 MW

Source: Los Alamos County 2022 Integrated Resource Plan, p. 15, exhibit 3.

What is an IRP?

LAC and LANL 2022 Integrated Resource Plan (IRP)

- The Los Alamos County (LAC) Department of Utilities (DPU) and the Los Alamos National Lab (LANL) jointly conducted this IRP for the Los Alamos Power Pool (LAPP) to comprehensively address the near-term and long-term decisions through assessing the evolving resources needs during the planning horizon (2022 - 2041).
- This IRP considers the electricity demand from residential, commercial, industrial customers, electric vehicle (EV), as well as residential and industrial electrification as a result of natural gas reduction.
- The IRP takes a least-cost and technology-agnostic approach to meet the carbon neutral goal by 2040 for LAC and 100 percent renewable goal by 2035 for LANL.
- These goals are critical to LAPP's continued environmental leadership in supporting the New Mexico's Energy Transition Act, which calls for 100 percent zero-carbon resources for investor-owned utilities by 2045 and rural electric cooperatives by 2050.
- The IRP develops portfolio options based on current commercially available utility-scale resources to contain cost, mitigate risk, improve sustainability, improve reliability and operational flexibility.
- The IRP is based upon the best available information at the time of preparation, recognizing that the industry is rapidly evolving with new cost and technology trends.
- The IRP is a roadmap and is subject to update as new information becomes available or circumstances change.

Examine **20-year resource plan** horizon

Create a **5-year action plan**

Revisit the IRP every **three years**, _or_

When there are **material changes in policy, market, load, resources, or technology**

Improve plan through **stakeholder inputs**:

- Board of Public Utilities (BPU)
- LAC and LANL
- Public process

Incorporate **pivot strategies** as new information becomes available or as circumstances change

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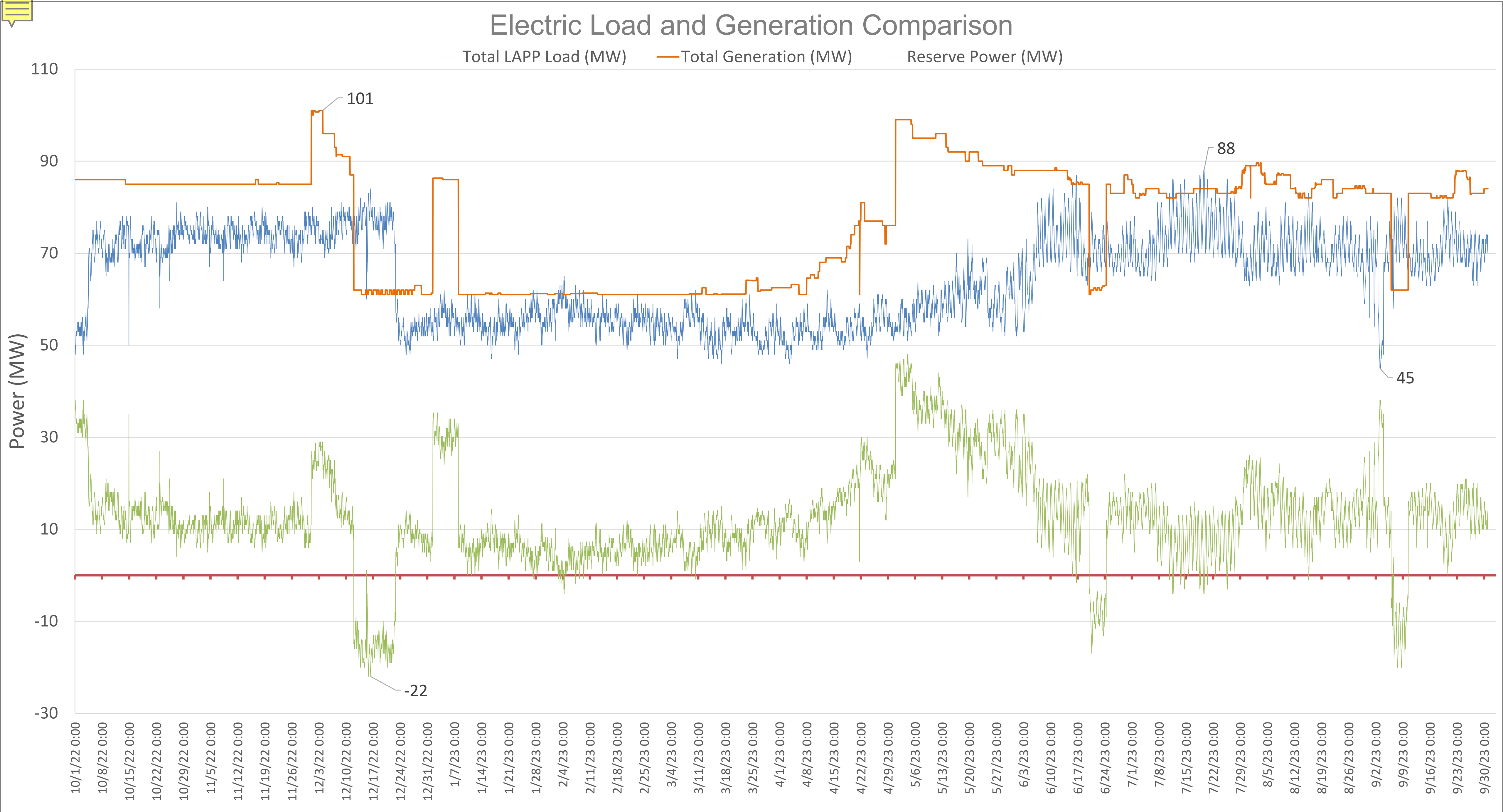
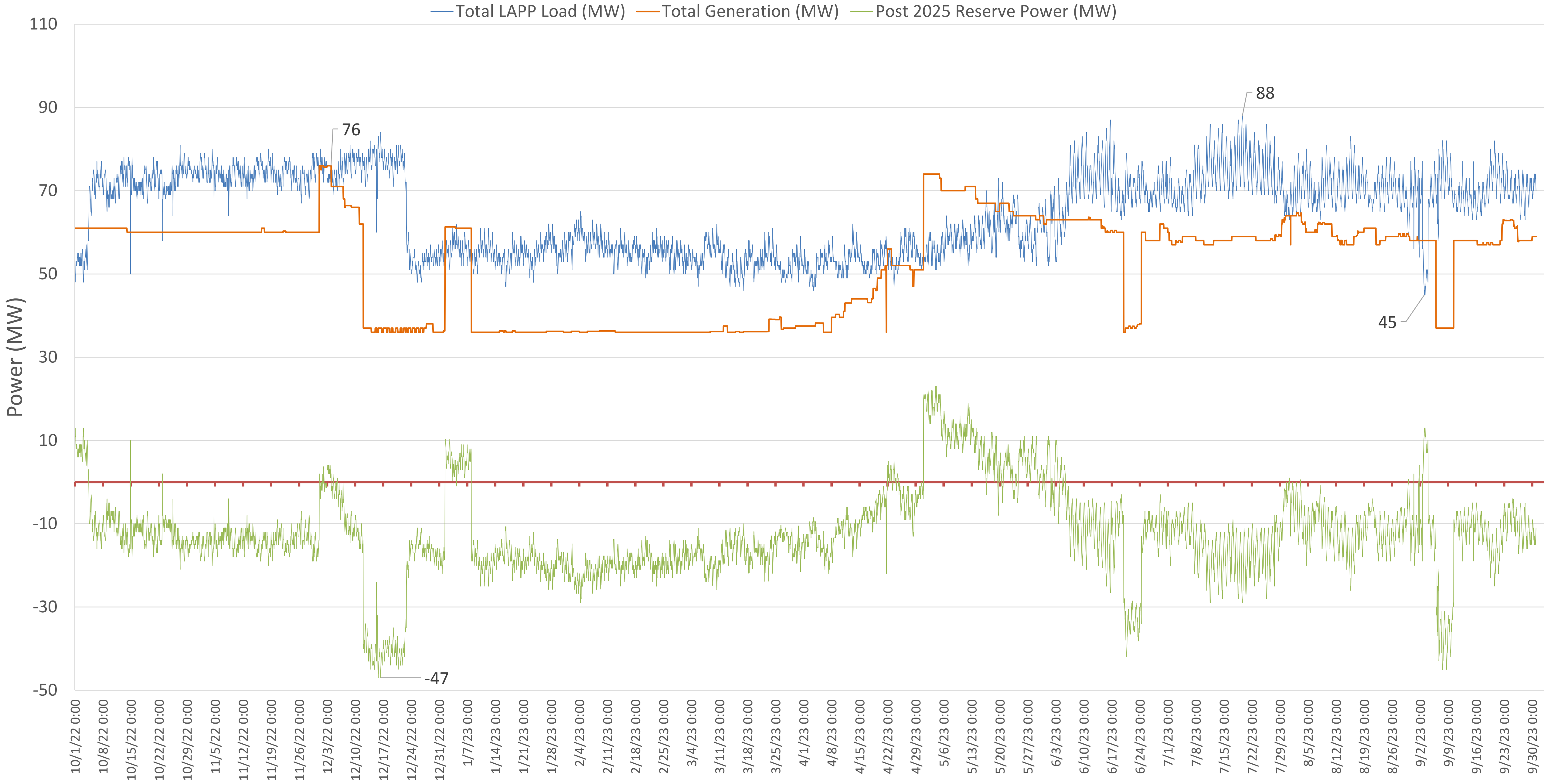


Electric Load and Generation Comparison
Total LAPP Load (MW)
Total Generation (MW)
Reserve Power (MW)
Power (MW)
110
90
70
50
30
10
-10
-30
101
88
45
-22
10/1/22 0:00
10/8/22 0:00
10/15/22 0:00
10/22/22 0:00
10/29/22 0:00
11/5/22 0:00
11/12/22 0:00
11/19/22 0:00
11/26/22 0:00
12/3/22 0:00
12/10/22 0:00
12/17/22 0:00
12/24/22 0:00
12/31/22 0:00
1/7/23 0:00
1/14/23 0:00
1/21/23 0:00
1/28/23 0:00
2/4/23 0:00
2/11/23 0:00
2/18/23 0:00
2/25/23 0:00
3/4/23 0:00
3/11/23 0:00
3/18/23 0:00
3/25/23 0:00
4/1/23 0:00
4/8/23 0:00
4/15/23 0:00
4/22/23 0:00
4/29/23 0:00
5/6/23 0:00
5/13/23 0:00
5/20/23 0:00
5/27/23 0:00
6/3/23 0:00
6/10/23 0:00
6/17/23 0:00
6/24/23 0:00
7/1/23 0:00
7/8/23 0:00
7/15/23 0:00
7/22/23 0:00
7/29/23 0:00
8/5/23 0:00
8/12/23 0:00
8/19/23 0:00
8/26/23 0:00
9/2/23 0:00
9/9/23 0:00
9/16/23 0:00
9/23/23 0:00
9/30/23 0:00

Electric Load and Generation Comparison w/o 25MW PPA



WECC Recommends Entities to take Action to Mitigate Risks

NERC and WECC assessments highlight the risks of loss of load due to declining reserve margin, increasing load and resource variability.

- Los Alamos County's Balancing Authority (BA) PNM is in the Southwest Reserve Sharing Group (SRSG), one of the three reserve sharing groups in WECC in addition to the California Independent System Operator (CAISO), and the Northwest Power Pool (NWPP).
- The North American Electric Reliability Corporation (NERC)'s 2021 Long-term Reliability Assessment has shown that CAISO, NWPP, and SRSG all face potential load loss hours in the near term (2022 - 2024).
- The 2021 Western Assessment of Resource Adequacy (WARA) concludes that resource adequacy risks to reliability are likely to increase over the next 10 years. WECC recommends entities take immediate action to mitigate near-term risks and prevent long-term risks.
- Climate change and extreme weather (cold snaps, high heat, drought, etc.) lead to increasing demand volatility and resource variability.
- Transportation electrification and Distributed Energy Resources (DERs) will continue to modify load pattern and levels.
- Increasing Variable Energy Resources (VERs), coupled with large planned baseload resource retirements contribute to declining reserve margins and pose supply-side challenges.
  - Nuclear (Diablo Canyon, 2.3 GW by 2024 - 2025)
  - Coal-fired generation resources (3.5 GW by 2026)
  - Coastal gas-fired generation resources (3 GW in 2024-2029) due to once-through cooling regulation.
- Potential Aliso Canyon closure could further stress the power grid.

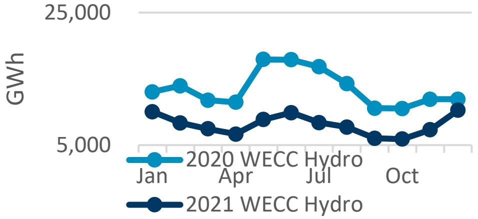
WECC Reserve Sharing Groups

Los Alamos County

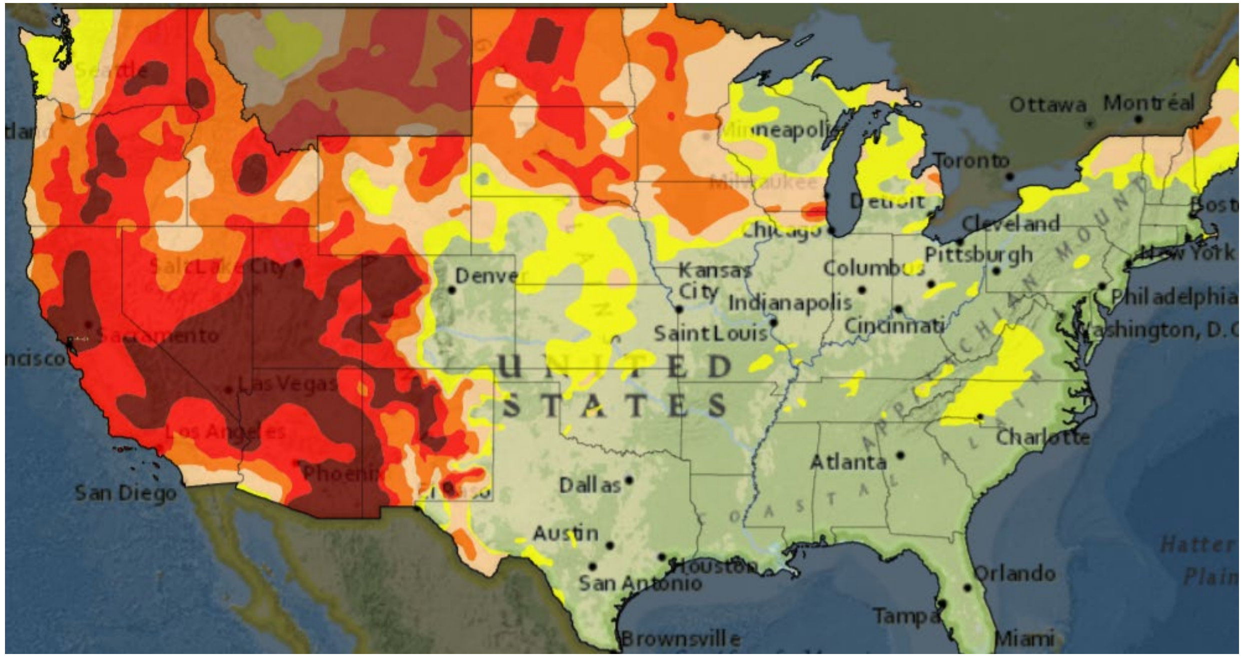
Recent Drought Conditions Caused Low Hydro Output in WECC Market

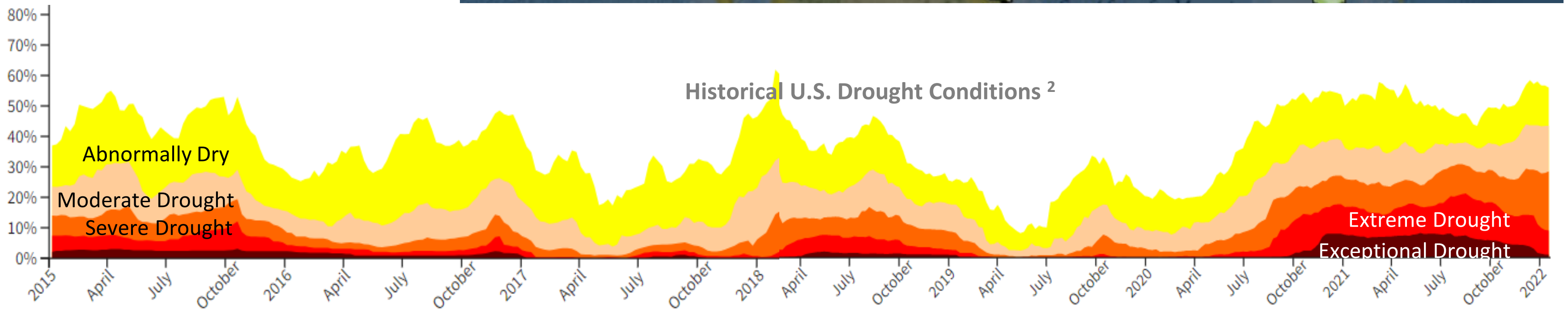
As climate changes intensify drought conditions in the west, the likelihood of low hydro output and high demand are likely to increase.

- High temperatures, wildfires, and drought have stressed the WECC power grid in recent years. The combination of low hydro output and high demand poses challenges to utility resource planning.
- In 2021, WECC hydro generation declined by 40 percent from 2020 levels due to drought. As a result, hydro accounted for 16 percent of total generation in WECC in 2021, in comparison to over 22 percent



U.S. Drought Condition Map for Week of July 13, 2021





Sources: 1) EIA 923 data 2) National Integrated Drought Information System

Increasing Volatility in PNM BA Area Power Prices

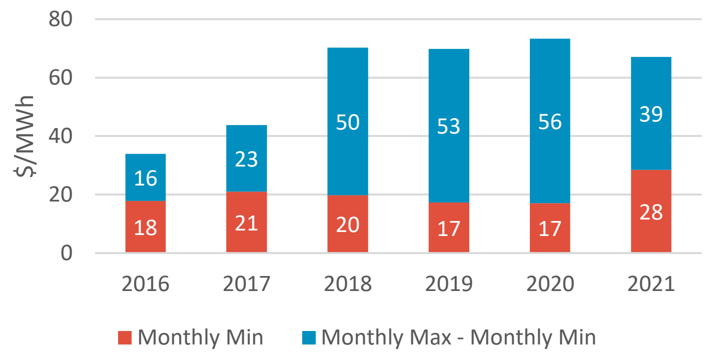
The power prices in the PNM BA area have exhibited higher peak and lower off-peak during the past few years, driven by evolving load and resource variability.

- The PNM BA area has experienced increasing power prices from an annual average of $27/MWh in 2016 to $50/MWh in 2021.
- The drought conditions have in general correlated with higher power prices.
- Due to lack of storage and redundancy in gas infrastructure, the gas supply in the southwest region is susceptible to disruptions. Gas supply curtailments could impact power generation during winter peaks.

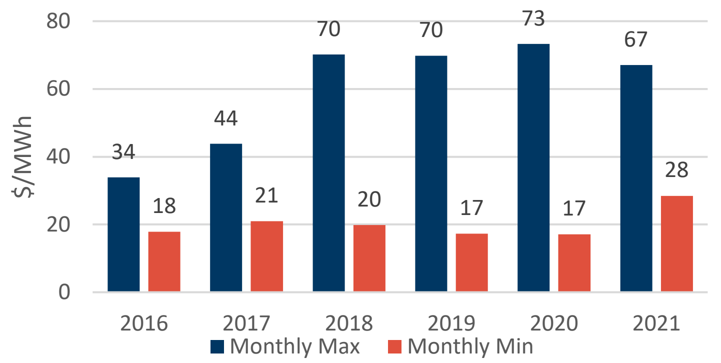
Historical Average PNM Four Corners Prices

$/MWh	2016	2017	2018	2019	2020	2021	Avg
Jan	26	32	32	38	27	30	**31**
Feb	22	26	29	70	24	62	**37**
Mar	18	21	28	35	25	28	**26**
Apr	18	24	24	22	19	32	**24**
May	21	28	20	17	17	31	**23**
Jun	29	32	27	23	22	49	**31**
Jul	33	35	70	31	28	67	**43**
Aug	34	44	63	32	73	59	**48**
Sep	31	37	33	34	43	66	**40**
Oct	32	36	38	33	40	60	**39**
Nov	26	31	47	38	35	56	**37**
Dec	33	29	50	36	36	60	**39**
Avg	**27**	**31**	**38**	**34**	**32**	**50**	**35**

Historical PNM Four Corners Prices



Historical PNM Four Corners Prices: Monthly Max and Min



Increasing Volatility in PNM BA Area Power Prices

The power prices in the PNM BA area have exhibited higher peak and lower off-peak during the past few years, driven by evolving load and resource variability.

- The PNM BA area has high price of $961/MWh and low price of -$6/MWh in 2021, with a total of 27 hours above $300/MWh and 51 hours of negative prices.
- The PNM BA area has high price of $1,342/MWh and low price of -$17/MWh in 2020, with a total of 35 hours above $300/MWh and 106 hours of negative prices.
- With increasing intermittent renewable generation on the system, the Effective Load Carrying Capability (ELCC) of solar and wind decreases.
- These price patterns will continue to evolve as New Mexico faces capacity shortages, with coal retirements in the PNM BA area not yet refilled with new resource procurement. PNM's plans to make up the capacity shortfall includes increased imports, battery storage projects, and renewables.

2020 - 2021 PNM Four Corners Prices

	Max	Min	Average	> $300/MWh	Negative Prices
	$/MWh	$/MWh	$/MWh	Hours	Hours
2021	961	(6)	50	27	51
2020	1,342	(17)	32	35	106

2021 PNM Four Corners Prices

$/MWh	Month												Avg
Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0	32	74	34	38	36	46	58	56	63	61	56	55	**50**
1	30	51	32	36	34	41	54	51	59	59	52	53	**46**
2	29	48	31	34	32	39	50	49	57	56	51	50	**44**
3	29	46	30	33	31	38	48	48	56	54	50	49	**43**
4	29	47	31	33	31	37	47	47	55	54	51	49	**42**
5	29	50	33	35	33	38	48	48	57	55	53	51	**44**
6	33	78	38	40	36	41	50	51	61	61	60	57	**50**
7	39	99	45	44	36	45	57	56	70	71	68	72	**58**
8	38	67	37	37	27	32	46	48	62	72	61	70	**50**
9	28	38	24	26	20	29	42	41	48	57	48	58	**38**
10	20	25	16	21	18	29	43	40	44	47	41	52	**33**
11	19	20	12	17	16	29	44	41	43	42	37	48	**31**
12	17	17	9	15	15	32	48	44	45	40	36	45	**30**
13	14	15	7	14	16	36	54	48	50	40	36	43	**31**
14	15	14	7	14	18	41	59	52	55	42	37	43	**33**
15	18	17	8	15	20	44	64	57	60	44	43	48	**37**
16	26	28	11	17	22	50	71	63	66	49	56	60	**43**
17	38	54	17	20	22	53	76	66	71	56	75	78	**52**
18	46	125	33	30	30	61	87	75	89	79	93	95	**70**
19	44	153	49	46	44	89	128	102	130	94	81	82	**86**
20	41	135	53	58	60	124	173	106	106	84	73	77	**90**
21	39	114	46	54	58	90	109	83	86	76	69	73	**74**
22	37	97	42	46	48	70	86	73	78	73	63	67	**65**
23	33	79	37	41	40	50	67	60	68	66	58	61	**55**
Avg	**30**	**62**	**28**	**32**	**31**	**49**	**67**	**59**	**66**	**60**	**56**	**60**	**50**

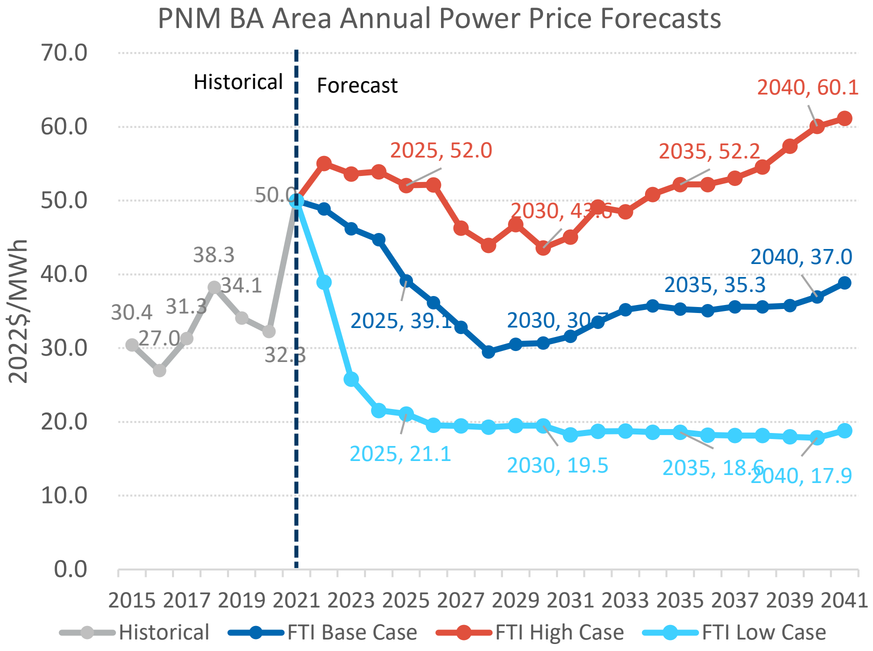
PNM BA Area Annual Power Prices Forecast

Desert Southwest region has increasingly variable demand and resource profiles. The rising the seasonal and hourly mismatches of supply and demand lead to increasing energy market risks.

- New Mexico state Renewable Portfolio Standard (RPS), and investor-owned utilities, public power RPS goals drive resource decisions in the region.

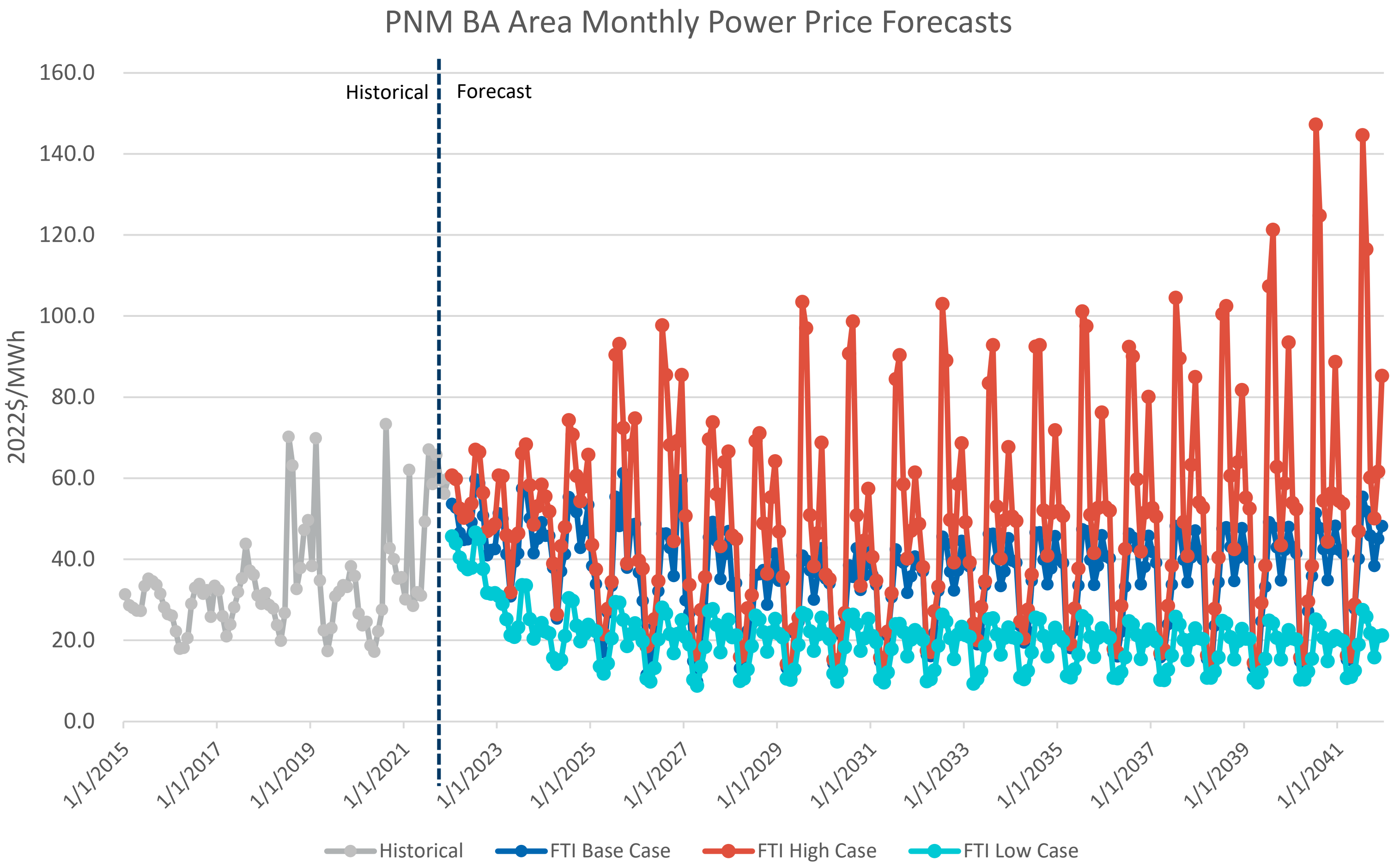
State and Representative Utilities	Renewables Portfolio Standard Target
New Mexico State	New Mexico's Energy Transition Act calls for 100 percent zero-carbon resources for investor-owned utilities by 2045, and rural electric cooperatives by 2050.
PNM	100% by 2040 Voluntary; 100% by 2045 Mandatory
El Paso Electric	100% by 2045
Southwestern Public Service	100% by 2045
Arizona Public Service	100% by 2050
Tucson Electric Power	80% reduction in CO_2 emissions by 2035
Salt River Project	90% reduction in CO_2 emissions by 2050

- The PNM BA area near term capacity shortages are expected to moderate after replacement resources are integrated into the grid.
- FTI forecasts an average price of $39/MWh in the Base Case, an average of $52/MWh in the High Case, and an average of $21/MWh in the Low Case in 2025 (all dollars in real 2022 dollar unless otherwise noted).



PNM BA Area Monthly Power Prices Forecast

Desert Southwest region has increasingly variable demand and resource profiles. The rising the seasonal and hourly mismatches of supply and demand lead to increasing energy market risks.



Future Resources Being Investigated

Types		Resources	Considerations
Baseload	Thermal	Combined Cycle (CC)	Inconsistent with carbon neutral goal
		Laramie River Station (LRS)	Exit when economical, no later than 2042[1]
	Nuclear	Carbon Free Power Project (CFPP)	Subscription levels: 0, 8, 36 MW
	Hybrid	ATC PPA with 28% Renewable[2]	Near term bridge PPA to replace San Juan Unit 4
	Firm Renewables	Solar + Wind	Uniper contract + more
		Solar + Battery	Solar weather dependent
		Geothermal	High cost, opportunistic and geography dependent
		Fuel Cells	< 5 MW size, implemented in other national labs
Peaking	Thermal	Reciprocating Internal Combustion Engine (RICE)	Explore in IRP for dispatchability and balancing
		Simple Cycle Gas Turbine (SCGT)	Explore in IRP for dispatchability and balancing
	Storage	Pumped Hydro	Cost and ownership of water rights; Opportunistic and geography dependent
		Lithium-ion Battery	Duration considerations
		Vanadium Redox Flow Battery	High-cost; lack of actual projects development
Intermittent	Renewables	Solar (onsite or offsite)	Weather dependent
		Onshore Wind	Weather dependent; transmission constraints

Resources being investigated currently (highlighted: CFPP, ATC PPA with 28% Renewable, Solar + Battery, Geothermal, SCGT, Pumped Hydro)

Source: Los Alamos County 2022 Integrated Resource Plan, p. 45, exhibit 32.

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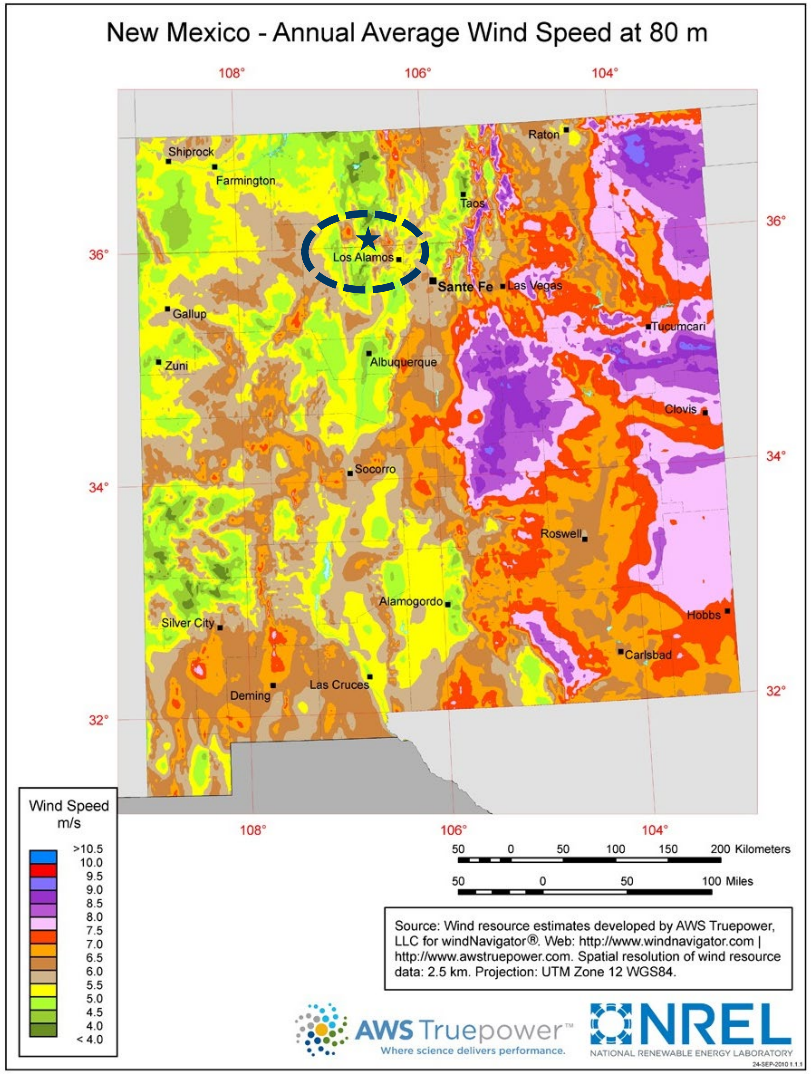
Wind Resources in East NM Require New Transmission

- The eastern side of New Mexico has favorable wind resources, with predicted average annual wind speeds above 6.5 meters per second at an 80-meter height.
- New transmission will be needed to bring new wind generation to serve LAC and LANL load because currently the transmission between eastern New Mexico and Albuquerque is fully subscribed.
- Opportunities for projects that could be developed on sites with existing transmission or in locations that are not transmission constrained are limited.
- The LAPP transmission capacity is currently at 116 MW and will expand to 200 MW once the EPCU project is completed in July 2028. The new wind capacity is subject to this transmission constraint.



Sources: NREL, Wind Exchange, https://windexchange.energy.gov/maps-data/89

Wind Shows Low Seasonal and Hourly Correlation with Peak Load

- New Mexico wind resources typically have lower generation during peak hours (07:00-22:00) than off-peak hours.
- The wind resource have the lowest average capacity factor during the peak hours (07:00-22:00) of the summer peak months (June – September).

Simulated Wind Capacity Factory		Peak 7:00-22:00	Off Peak 0-6:00; 23:00	All Hour
Winter Peak	Dec, Jan, Feb	43%	55%	47%
Summer Peak	Jun, Jul, Aug, Sep	26%	46%	33%
Off Peak	Mar, Apr, May, Oct, Nov	36%	53%	42%
All Season		34%	51%	40%

Capacity Factor (%) — Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
0	60%	56%	57%	60%	49%	56%	47%	44%	40%	57%	56%	61%	**53%**
1	59%	54%	60%	62%	49%	60%	48%	39%	44%	56%	56%	60%	**54%**
2	60%	52%	57%	57%	51%	57%	49%	41%	42%	53%	56%	55%	**52%**
3	55%	51%	58%	52%	50%	57%	48%	38%	42%	52%	55%	56%	**51%**
4	58%	52%	57%	53%	51%	51%	48%	34%	42%	50%	56%	51%	**50%**
5	56%	53%	55%	52%	46%	54%	46%	36%	38%	47%	55%	50%	**49%**
6	55%	52%	56%	49%	42%	46%	38%	32%	36%	47%	52%	52%	**46%**
7	56%	51%	48%	36%	32%	28%	21%	11%	24%	44%	53%	49%	**38%**
8	49%	44%	31%	29%	30%	32%	18%	12%	13%	25%	40%	45%	**31%**
9	36%	40%	26%	30%	26%	28%	16%	12%	11%	21%	24%	36%	**25%**
10	32%	39%	28%	32%	26%	27%	13%	9%	12%	23%	24%	33%	**25%**
11	31%	39%	33%	32%	26%	24%	14%	9%	12%	23%	26%	31%	**25%**
12	30%	40%	33%	31%	30%	25%	14%	9%	12%	22%	25%	33%	**25%**
13	32%	39%	39%	31%	34%	24%	18%	13%	12%	21%	26%	36%	**27%**
14	34%	39%	37%	35%	37%	28%	22%	14%	17%	21%	27%	37%	**29%**
15	35%	39%	40%	37%	35%	31%	24%	16%	23%	22%	28%	34%	**30%**
16	33%	40%	38%	37%	31%	36%	31%	21%	24%	25%	25%	32%	**31%**
17	41%	39%	33%	42%	34%	35%	29%	24%	21%	25%	36%	42%	**33%**
18	48%	42%	36%	37%	36%	43%	29%	30%	31%	37%	46%	49%	**39%**
19	53%	45%	39%	42%	37%	47%	34%	36%	38%	44%	53%	54%	**44%**
20	57%	48%	40%	40%	39%	46%	35%	40%	42%	49%	57%	55%	**46%**
21	57%	54%	44%	47%	43%	51%	37%	45%	40%	51%	58%	57%	**49%**
22	60%	56%	51%	55%	45%	55%	41%	43%	41%	56%	59%	58%	**52%**
23	61%	56%	50%	53%	47%	56%	44%	50%	45%	57%	58%	57%	**53%**
Avg	**48%**	**47%**	**44%**	**43%**	**39%**	**42%**	**32%**	**27%**	**29%**	**39%**	**44%**	**47%**	**40%**

Source: FTI simulation of the Sagamore Wind project using NREL Wind Integration National Dataset

Future Resources Being Investigated

RESOURCE	DISPATCHABLE	CARBON FREE	ELCC	COST ($/MW)	AVAILABILITY
CFPP	YES	YES	VERY HIGH	89	VERY LOW, 7+ YEARS
ATC PPA	NO	NO	VERY HIGH		UNK
Solar + Battery	NO	YES	MODERATE	60 - 250	2+ YEARS
Solar	NO	YES	LOW	30 - 70	1+ YEARS
Geothermal	MAYBE	YES	VERY HIGH	65 – 400+	VERY LOW, 5+ YEARS
Wind	NO	YES	LOW/MODERATE	25 - 50	UNAVAILABLE
Gas Turbine	MAYBE	NO	VERY HIGH	80 -120+	MODERATE, 2+ YEARS
Pumped Hydro	YES	YES	MODERATE	120+	VERY LOW, 5+ YEARS

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IRP Pivot Strategies Identified

- Investigate
  - Simple Cycle Gas Turbine
  - Reciprocating Internal Combustion Engine
- When cost effective:
  - Hydrogen
  - Flow battery
  - Compressed Air Storage
- Partners and Potential locations for Resources listed above
  - San Ildefonso Pueblo
  - NGI-NTUA Generation Inc.
  - Jicarilla Energy Center
  - UNIPER
  - Mercuria Energy
  - Four Corners
  - San Juan
  - UAMPS
  - Affordable Solar
  - CREDA

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Carbon Free Power Project (CFPP)

- CFPP is a Small Modular Reactor (SMR) system
- February 2023 decision point on whether to continue participating
- Small cost obligation to continue for the next 10 months
- LAC is financially protected by reimbursement agreements
- Next decision point in December 2023
- Large increase in cost obligation after December 2023
- Begin construction in 2026
- Full operating capability in November 2030
- Cost of $89/MWh

Additional CFPP status at: https://losalamos.legistar.com/Calendar.aspx#
Board of Public Utilities meeting on January 11, 2023

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ATC PPA

- Consider 2-year extension of the 25 MW Uniper resource
- Gives time to acquire and construct resources per the IRP Implementation plan
- Availability and cost under evaluation

Solar + Battery on LANL Site

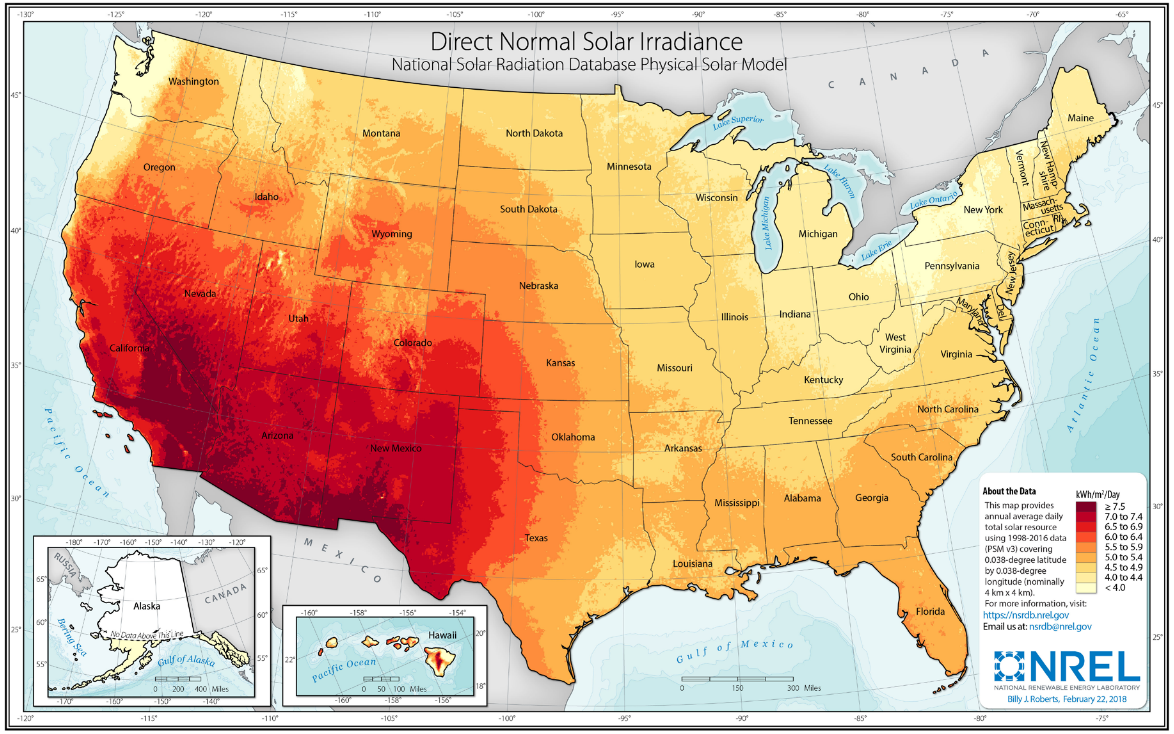
- 7-9MW of PV on LANL Site
- DOE/NNSA would lease land to LAC
- LAC would develop the PV site
- DOE/NNSA would install interconnection power lines
- LAC has engaged a PV developer for initial concept exploration of suitability and cost
- LAC has requested a battery study for potential locations within our service territory with the new possibilities the Inflation Reduction Act has enabled

Solar + Battery Storage

- Currently investigating off-site solar + battery options
- Investigation is looking at 100 MW solar projects
  - 50 MW storage with 4-hour duration
- Interconnection planned for PacifiCorp East control area
- Anticipate COD ranging from 2026 to 2028
  - COD dependent on generator interconnection timing – uncertainty on most projects
- 25-year PPA
- Limited ability for load following with storage
- General price ranges, not specific to any projects
  - Solar $30-50/MWh
  - Battery $100-200/MWh
  - Solar + Battery 4-hour $60-100/MWh
  - Solar + Battery around the clock $130-250/MWh

Solar Resources in South NM Require New Transmission

- The south side of New Mexico has favorable solar resources. The solar performance difference is less differentiated across the state than wind.
- New transmission will be needed to bring new solar generation to serve LAC and LANL load if built out of the service territory.
- Opportunities for projects that could be developed on sites with existing transmission or in locations that are not transmission constrained are being explored by several developers.



Source: NREL

Solar not Reliable to Serve the Evening Super Peak Hours

- Even though solar resources generally generate during the peak hours (7:00-22:00), they are typically not reliable to serve the evening portion of the super peak hours (13:00-20:00).

Simulated Solar Capacity Factor		Peak	Off Peak	All Hour
		7:00-22:00	0-6:00; 23:00	
Winter Peak	Dec, Jan, Feb	29%	0%	19%
Summer Peak	Jun, Jul, Aug, Sep	41%	2%	30%
Off Peak	Mar, Apr, May, Oct, Nov	38%	4%	27%
All Season		37%	4%	26%

Capacity Factor (%)	**Month**												**Avg**
Hour	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	
0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
4	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
5	0%	0%	0%	1%	24%	31%	22%	1%	0%	0%	0%	0%	**7%**
6	0%	0%	14%	42%	55%	60%	56%	45%	37%	14%	0%	0%	**27%**
7	5%	40%	61%	60%	70%	73%	72%	61%	59%	55%	39%	12%	**51%**
8	45%	62%	74%	67%	68%	78%	77%	68%	66%	67%	52%	40%	**64%**
9	50%	67%	79%	64%	64%	76%	79%	72%	66%	68%	54%	42%	**65%**
10	50%	69%	75%	64%	66%	74%	75%	69%	66%	62%	49%	44%	**64%**
11	49%	62%	75%	61%	65%	74%	65%	60%	64%	59%	47%	43%	**60%**
12	45%	56%	68%	60%	69%	61%	63%	58%	56%	57%	46%	43%	**57%**
13	46%	60%	71%	56%	57%	60%	57%	41%	61%	57%	49%	46%	**55%**
14	47%	59%	68%	51%	64%	61%	59%	44%	53%	60%	49%	49%	**55%**
15	46%	56%	64%	54%	62%	53%	58%	33%	51%	58%	47%	46%	**52%**
16	34%	50%	54%	42%	60%	48%	56%	41%	44%	45%	26%	22%	**44%**
17	0%	11%	38%	30%	47%	35%	43%	28%	31%	2%	0%	0%	**22%**
18	0%	0%	0%	2%	23%	21%	26%	7%	0%	0%	0%	0%	**7%**
19	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
20	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
21	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
22	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
23	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Avg	17%	25%	31%	27%	33%	33%	34%	26%	27%	25%	19%	16%	26%

Source: FTI simulation of solar array based on historical Los Alamos weather data with NREL's System Advisor Model (SAM)

Solar and Storage Example Scenario

27%

73%

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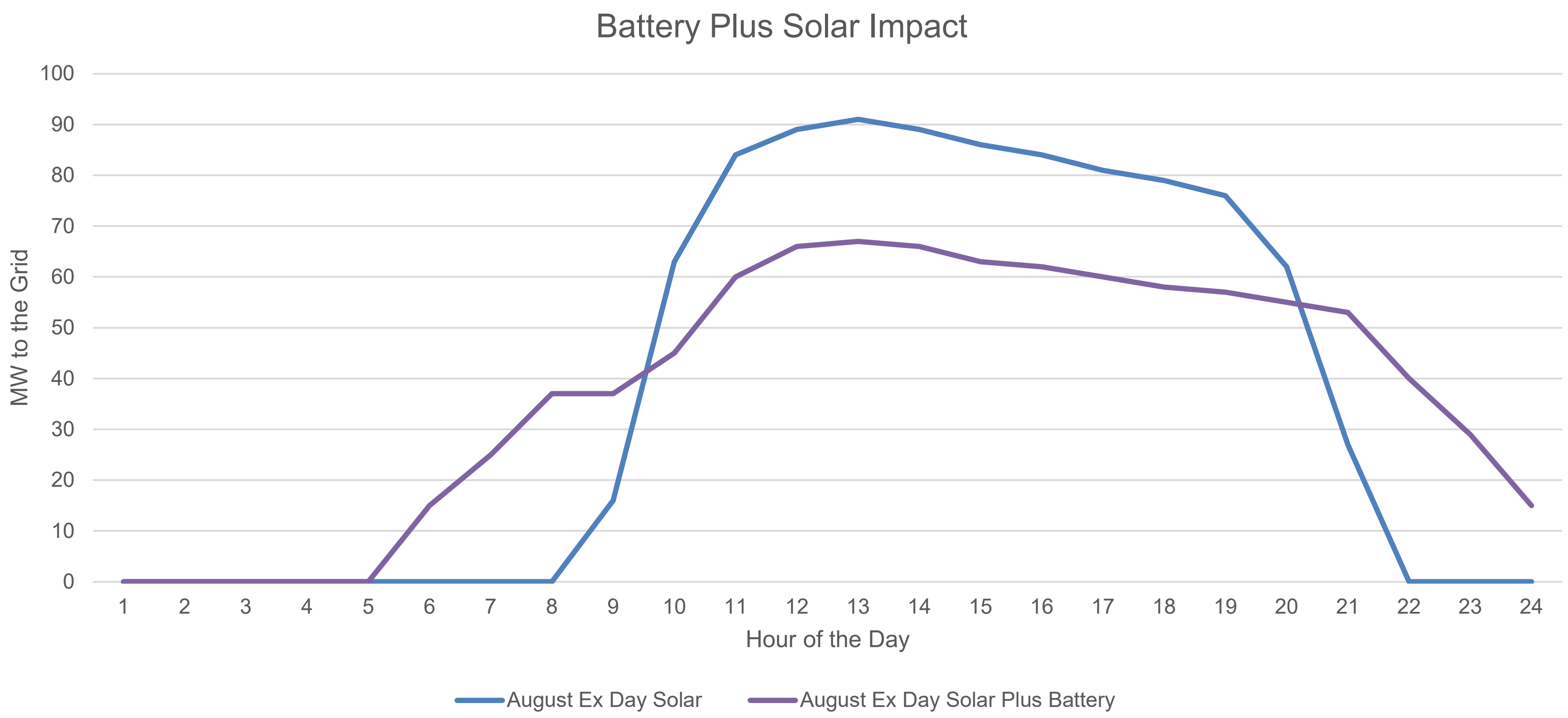
Solar and Storage Example Scenario

27%

73%

Later in the day

Solar and Storage Profile Example



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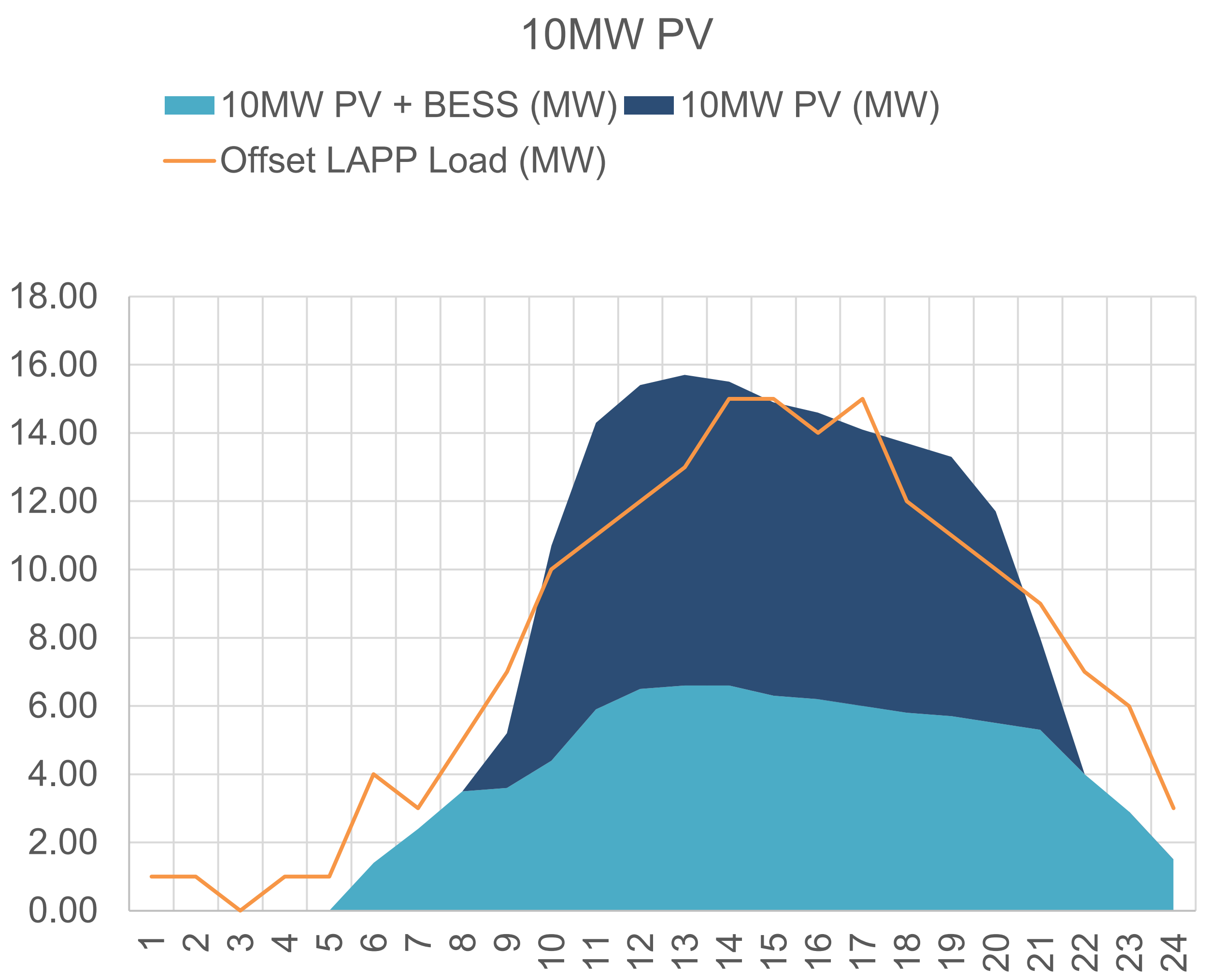
Load Following with Solar + Storage



Geothermal-UAMPS

- UAMPS currently investigating geothermal options
- There is significant interest across the west in geothermal
  - Most available options are under contract
- Projects are often in the 30 MW size range
- 15-25 year PPA desired
- Most options are "take or pay"
  - Good for base load, but expensive to use for load following
- Some flexibility on location, depending upon project
- General price range, not specific to any projects \$65-120, can be >\$400/MWh

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Natural Gas Generation-UAMPS

- Limited certainty into the future
  - Air permits, carbon taxes
  - Uncertain gas pricing into the future
  - Short amortization period, maybe 10 years
- Flexible, able to ramp quickly and follow load
- Smaller "behind the meter" options will be investigated as well as larger projects
- Timeline for transmission interconnection a concern
- Investigating potential hydrogen fuel capability
- General price range, not specific to any project $80-120, fuel cost dependent

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LAC Exploration of Gas Generation

- Different Options for participation in a gas resource:
  - Call option:
    - Pay monthly demand fee
    - Pay for energy as it is called upon
    - Premium due to limited ownership liability
  - Resource Investment/Ownership
    - Similar structure to San Juan
    - Demand and Energy Costs
    - Shutdown Liabilities born by Ownership
  - Access to Bulk Electric System for Offloading into Market

Pumped Hydro-Very Preliminary

- Modular 10MW, 40MWh tank-based pumped hydro system, first considered by DPU in 2020
- Concept has matured over the past 2 years, with 4 projects in pre-construction development
- 2+ years development timeline
- 8MW return pumping load per module
- $120/MWh + $6/kW-month rough estimate
- Local, provides resilience and fire protection
- 2-month preliminary evaluation at no cost to DPU

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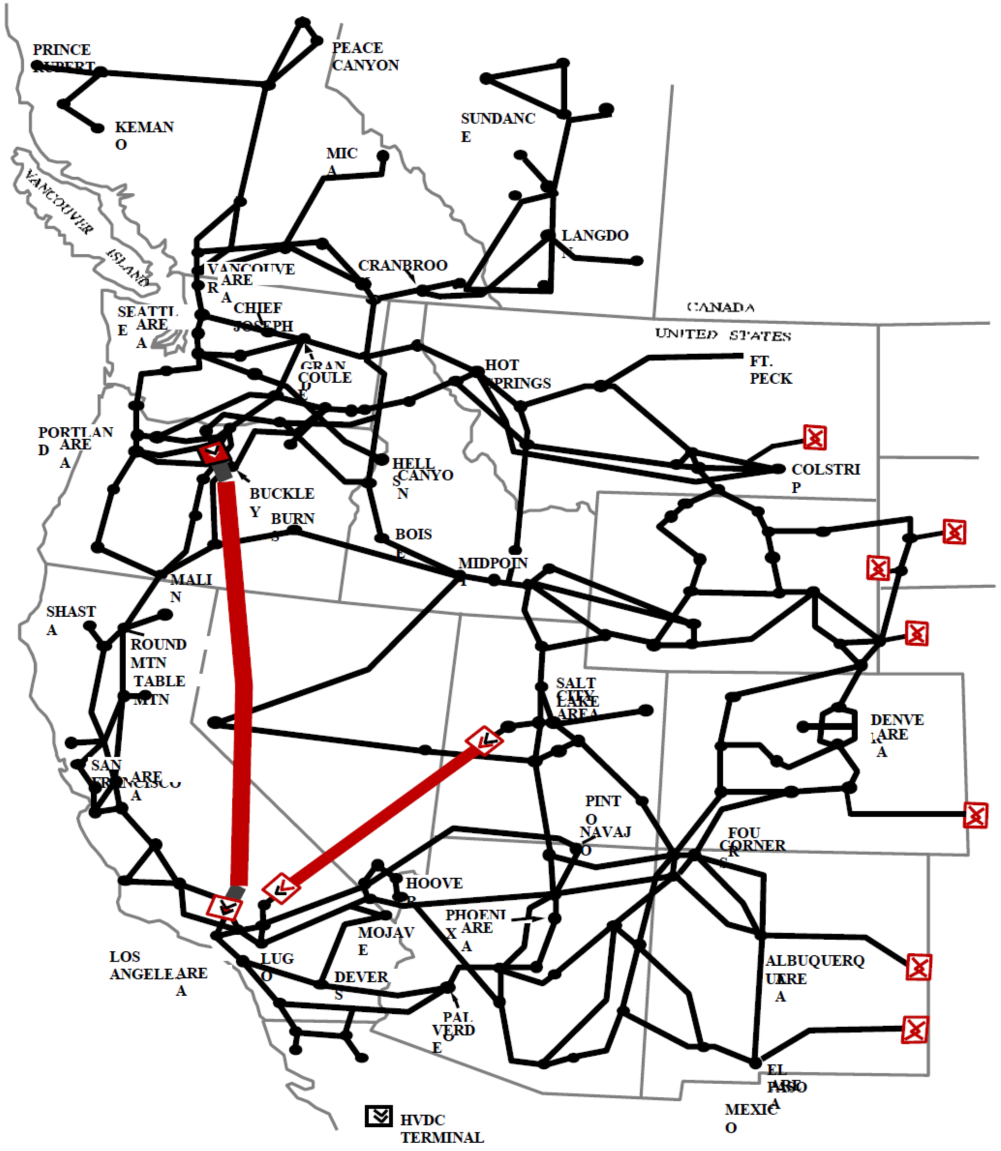
Transmission Considerations



Transmission Cost by Resource				
Existing Resource	**Transmission cost above PNM**	**PNM BA Ancillaries & Transmission**	**LANL/DOE Transmission**	**Total Transmission Cost**
Abiquiu	$ 2.50	$ 6.00	$ 2.50	$ 11.00
Economy Purch	$ -	$ 6.00	$ 2.50	$ 8.50
El Vado	$ 5.97	$ 6.00	$ 2.50	$ 14.47
Lincoln-Wyoming	$ 3.50	$ 6.00	$ 2.50	$ 12.00
San Juan	$ -	$ 6.00	$ 2.50	$ 8.50
WAPA (LAC)	$ -	$ 6.00	$ 2.50	$ 8.50
WAPA Firm (DOE)	$ -	$ 6.00	$ 2.50	$ 8.50
Proposed Resources				
CFPP-Proposed	$ 7.00	$ 6.00	$ 2.50	$ 15.50
Uniper-Proposed	$ -	$ 6.00	$ 2.50	$ 8.50

Transmission

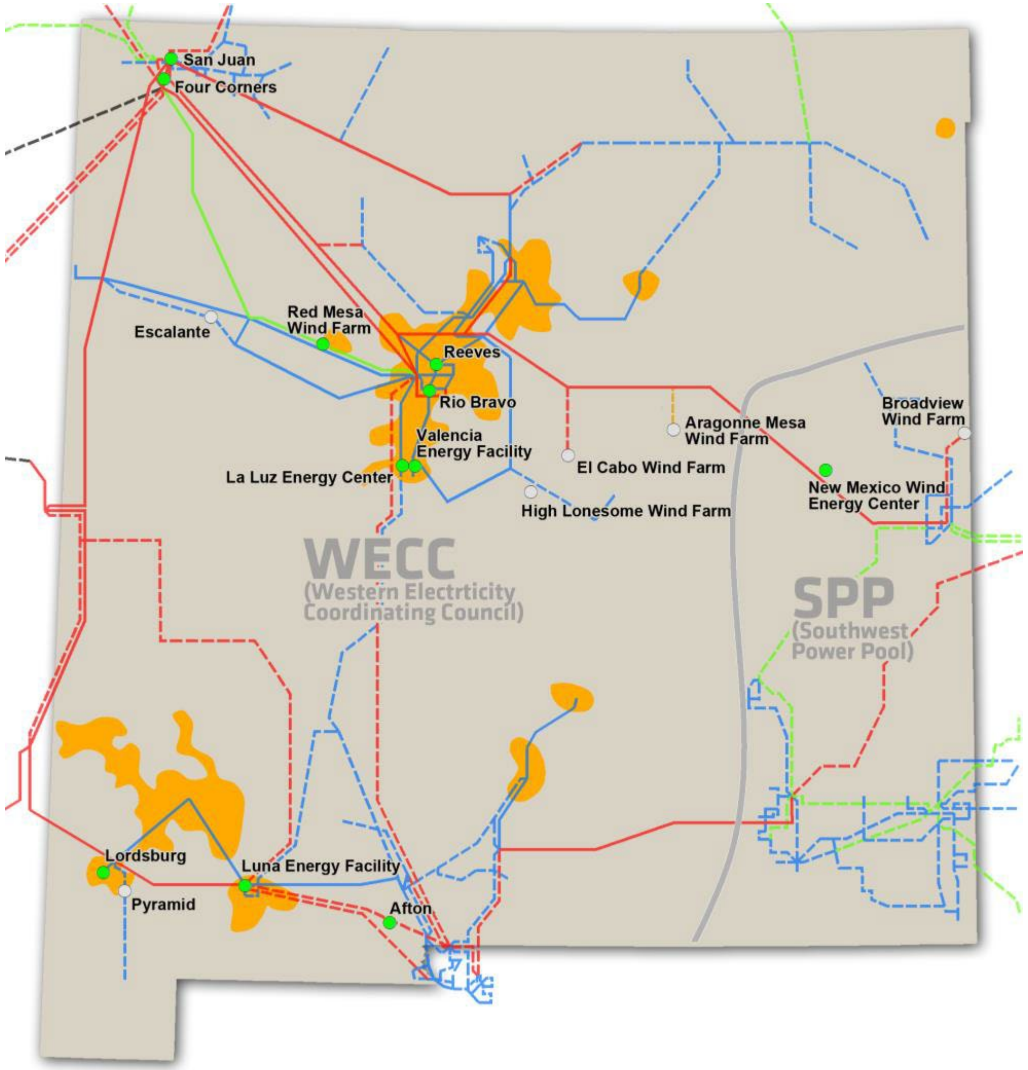
Existing Transmission

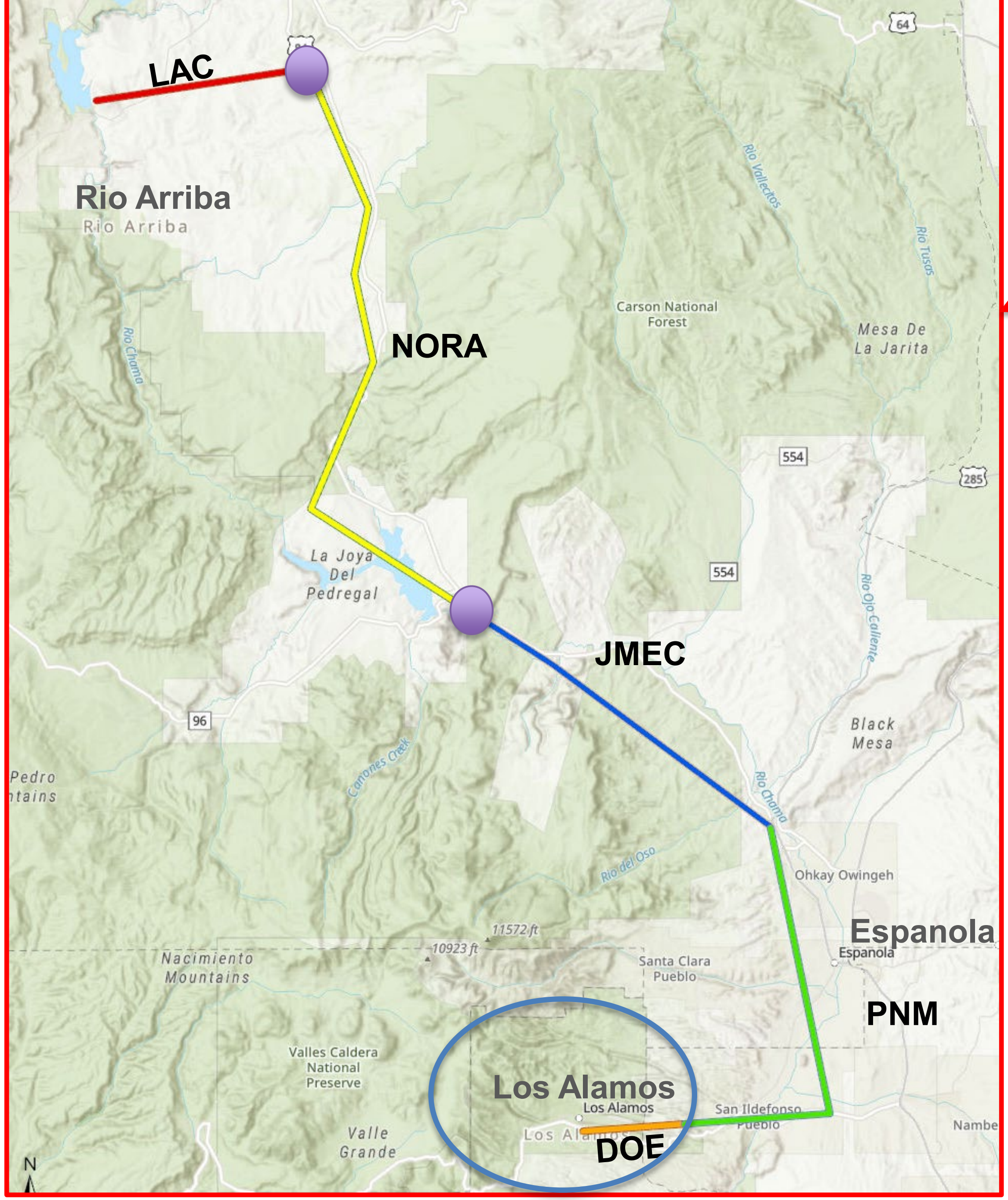
PNM 115kV
Other 115kV
PNM 230kV
Other 230kV
PNM 345kV
Other 345kV
Other 500kV

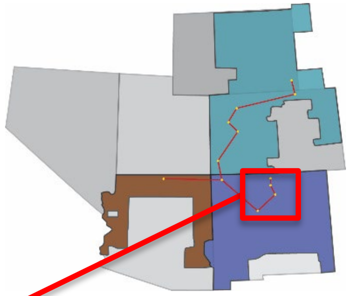
Existing Generation

PNM
Other

PNM Service Areas







Pancaking/Layering Transmission Rates

(yellow line)	NORA Electric Co-op Transmission	$3.47/MWh
(purple circle)	TSGT Substation	$0.50/MWh
(blue line)	JMEC	$2.00/MWh
(green line)	PNM	Approx. $6.00/MWh
(orange line)	DOE-NNSA	Approx. $2.50/MWh

Example:
El Vado Trans. Cost $14.47/MWh

Operational Path Forward

- Continue search for Solar, Wind, BESS, and Thermal resources bearing in mind the new developments with the IRA
- Continue to pursue CFPP
- Explore Partnerships with other entities
  - Continue to Explore and Expand Partnerships listed in Slide 4
- The IRP and the projections presented do not account for extreme weather events
- Firm Dispatchable resources are extremely valuable for the pool from an Operational and Economical perspective

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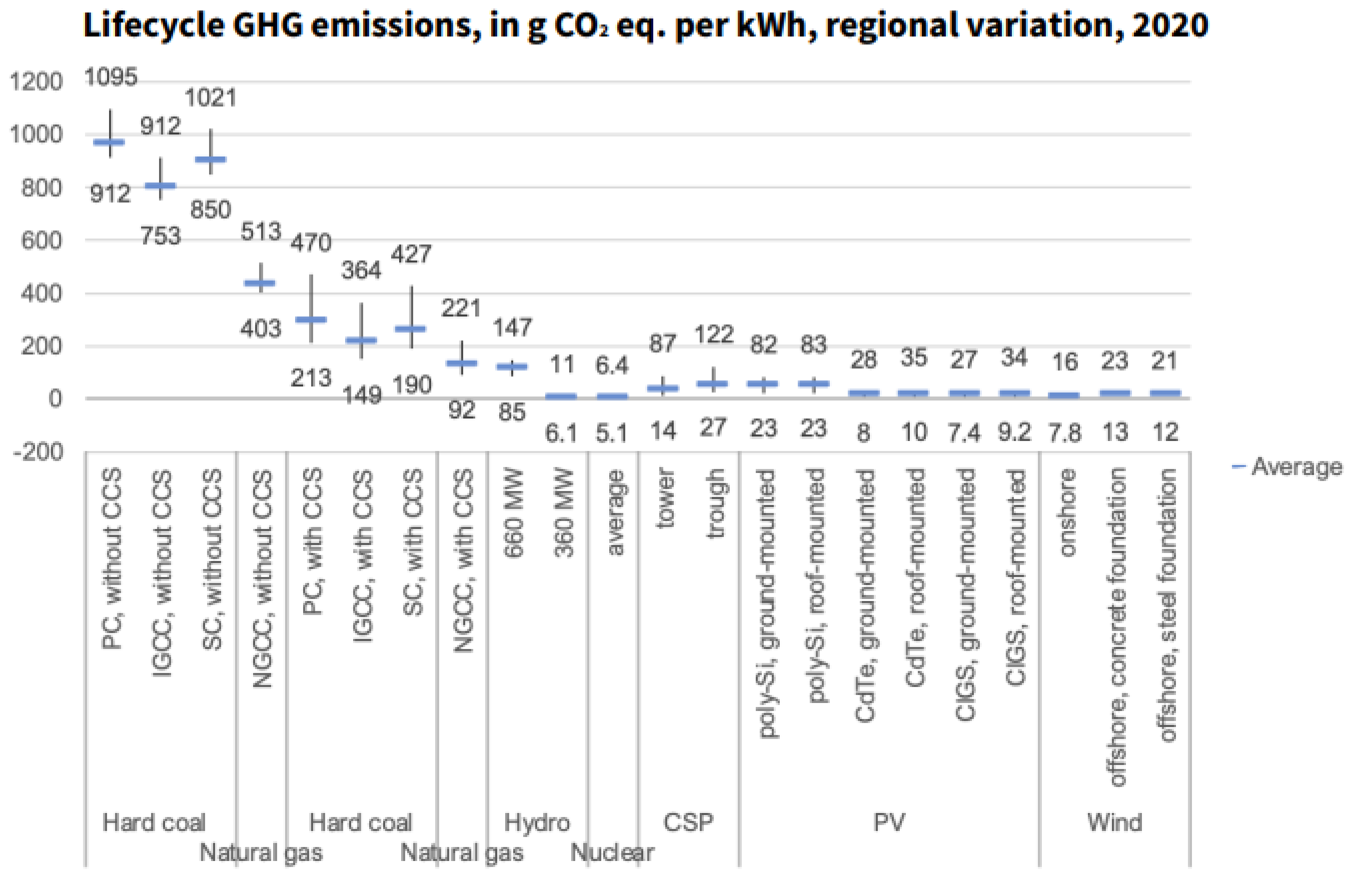
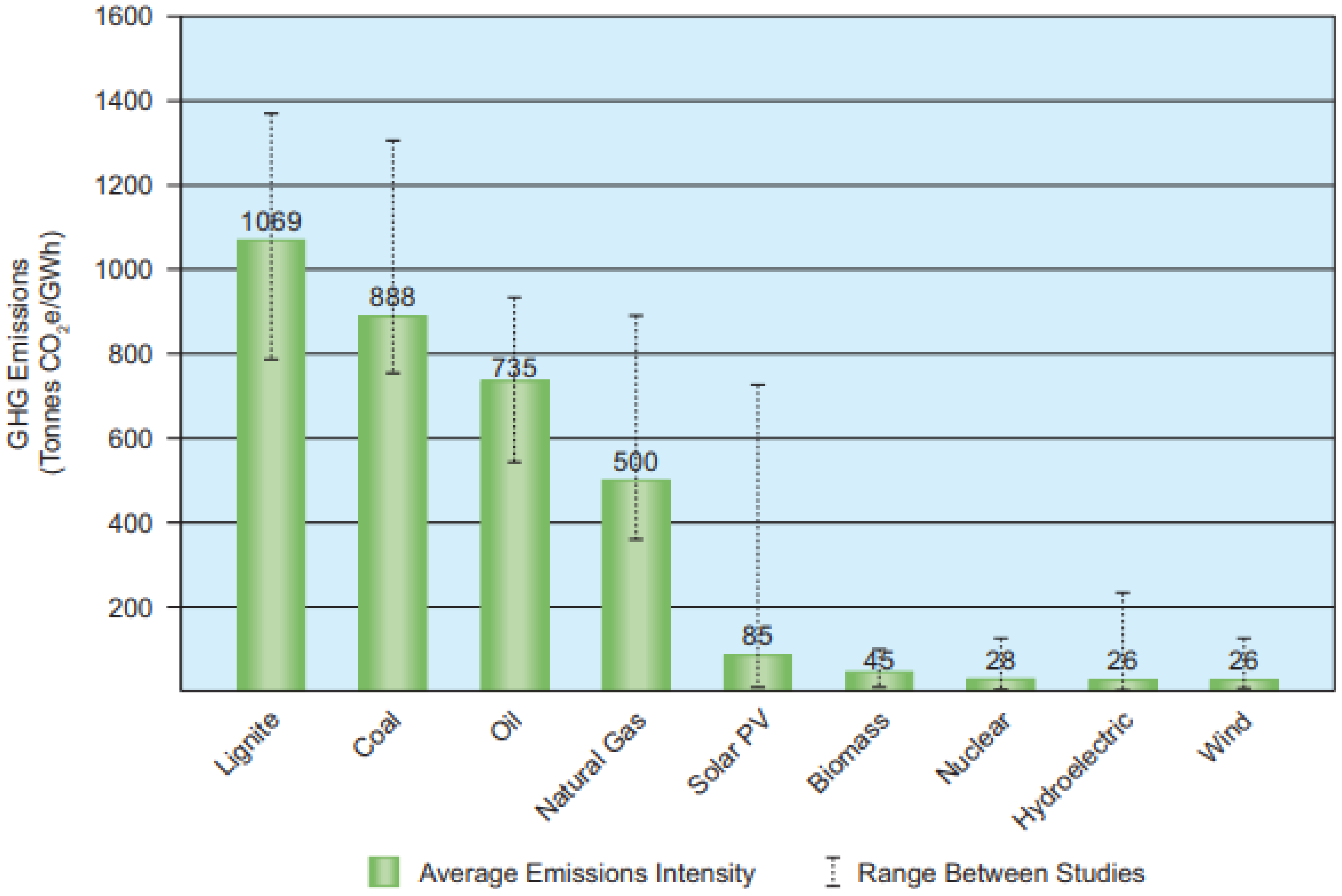
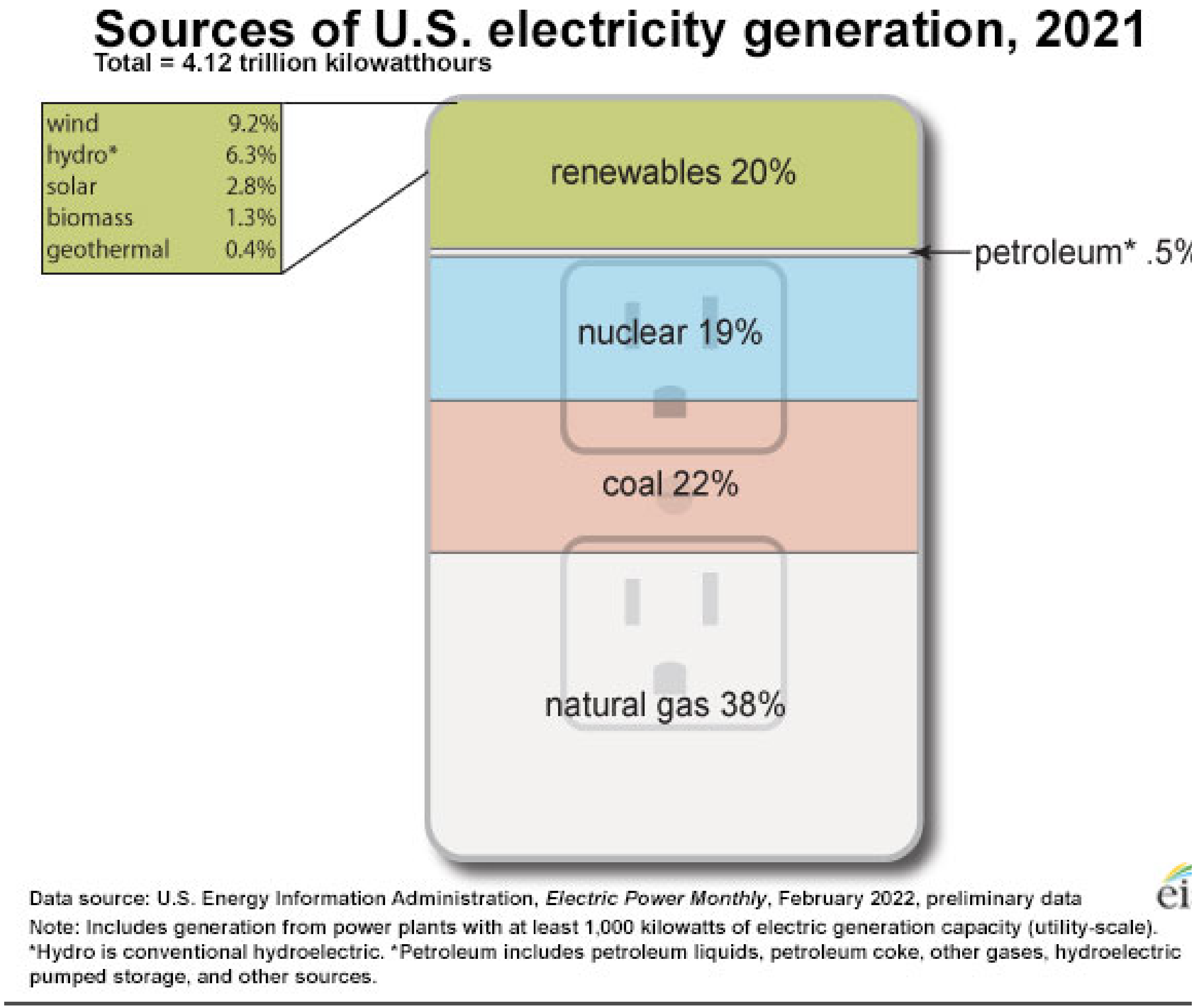
Supplemental Slides

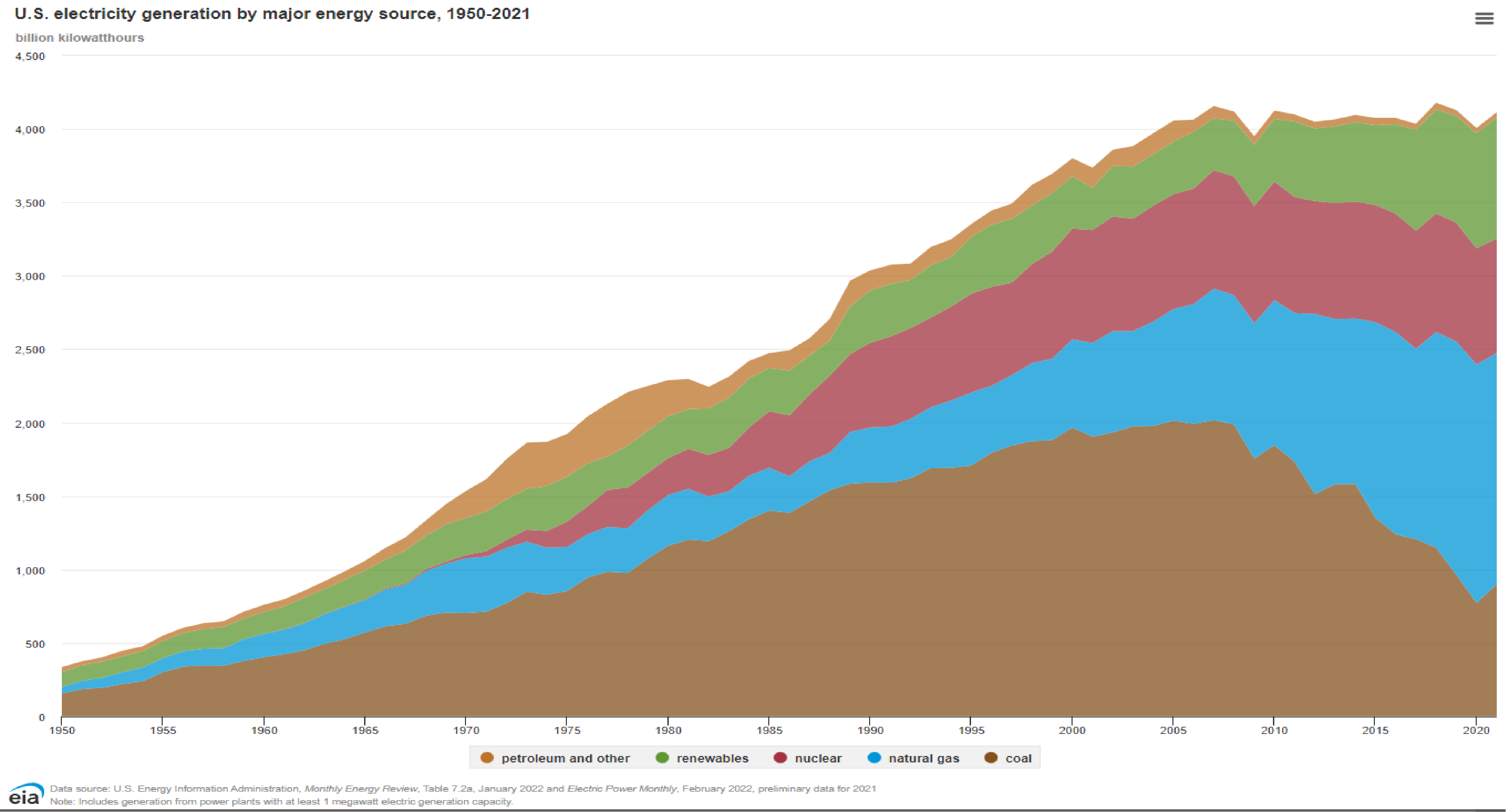


United Nations Economic Commission for Europe: https://unece.org/sites/default/files/2022-04/LCA_3_FINAL%20March%202022.pdf



World Nuclear Association: https://www.world-nuclear.org/uploadedFiles/org/WNA/Publications/Working_Group_Reports/comparison_of_lifecycle.pdf


Sources of U.S. electricity generation, 2021
Total = 4.12 trillion kilowatthours
wind 9.2%
hydro* 6.3%
solar 2.8%
biomass 1.3%
geothermal 0.4%
renewables 20%
petroleum* .5%
nuclear 19%
coal 22%
natural gas 38%
Data source: U.S. Energy Information Administration, Electric Power Monthly, February 2022, preliminary data
Note: Includes generation from power plants with at least 1,000 kilowatts of electric generation capacity (utility-scale).
*Hydro is conventional hydroelectric. *Petroleum includes petroleum liquids, petroleum coke, other gases, hydroelectric pumped storage, and other sources.


U.S. electricity generation by major energy source, 1950-2021
billion kilowatthours
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
petroleum and other
renewables
nuclear
natural gas
coal
eia
Data source: U.S. Energy Information Administration, Monthly Energy Review, Table 7.2a, January 2022 and Electric Power Monthly, February 2022, preliminary data for 2021
Note: Includes generation from power plants with at least 1 megawatt electric generation capacity.

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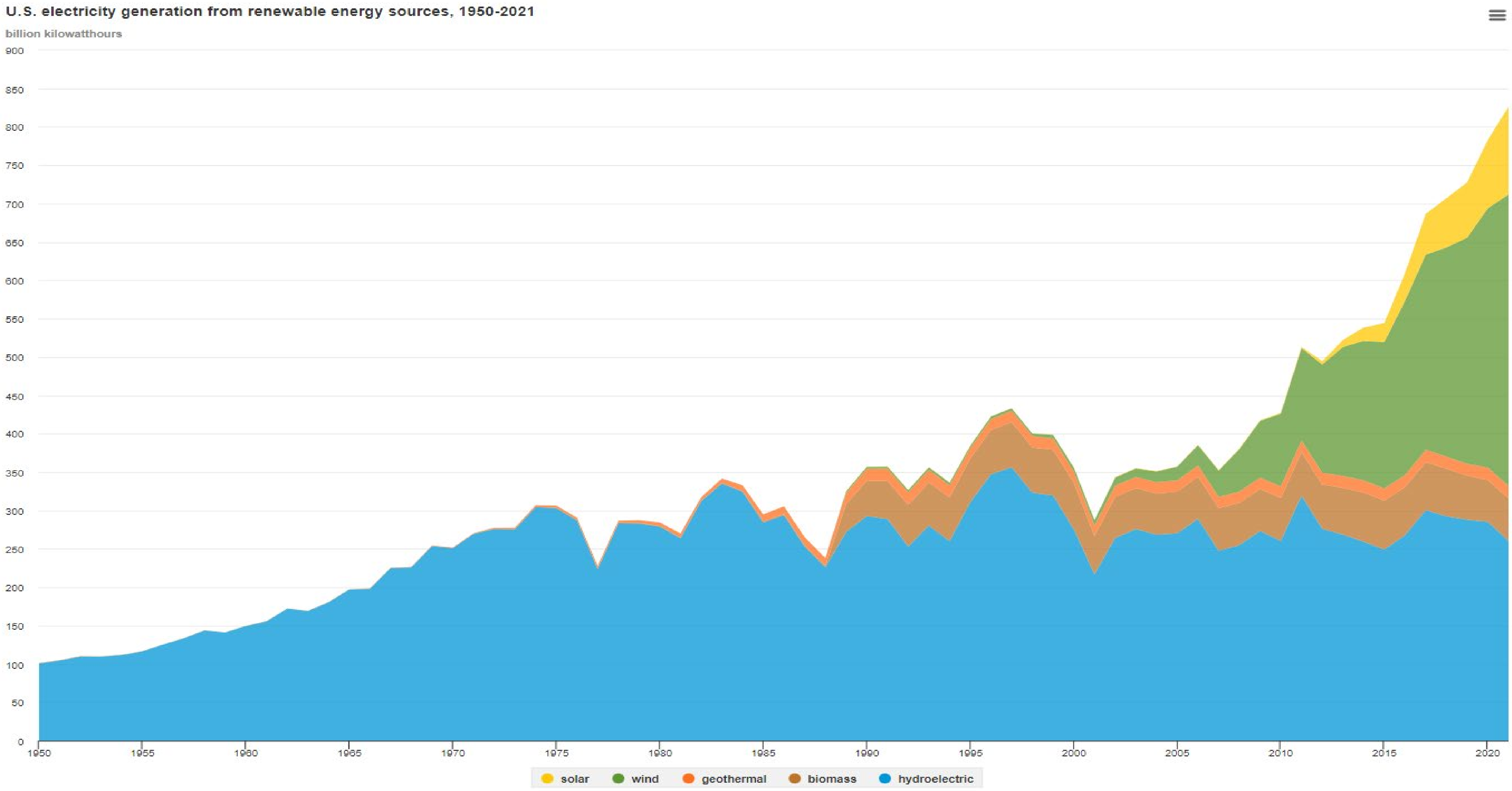

Data source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 7.2a, January 2022 and *Electric Power Monthly*, February 2022, preliminary data for 2021
Note: Includes generation from power plants with at least 1 megawatt electric generation capacity. Hydroelectric is conventional hydropower.