



LOS ALAMOS

County of Los Alamos

1000 Central Avenue
Los Alamos, NM 87544

Agenda - Final Board of Public Utilities

*Steve Tobin, Chair; Cornell Wright, Vice-chair;
Stephen McLin, Eric Stromberg, and Charles Nakhleh, Members
Philo Shelton, Ex Officio Member
Steven Lynne, Ex Officio Member
Theresa Cull, Council Liaison*

Thursday, January 26, 2023

5:30 PM

Zoom ~ <https://us06web.zoom.us/j/87919866718>
& Council Chambers

SPECIAL TOWN HALL

Members of the public wishing to attend remotely may participate and provide public comment via Zoom:

Webinar Link: <https://us06web.zoom.us/j/87919866718> Webinar ID: 879 1986 6718

One tap mobile :

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PUBLIC COMMENTS:

Please submit written comments to the Board at bpu@lacnm.us. Oral public comment is accepted during the two periods identified on the agenda and after initial board discussion on a business item, prior to accepting a main motion on an item. Oral comments should be limited to four minutes per person. Requests to make comments exceeding four minutes should be submitted to the Board in writing prior to the meeting. Individuals representing or making a combined statement for a large group may be allowed additional time at the discretion of the Board. Those making comments are encouraged to submit them in writing either during or after the meeting to be included in the minutes as attachments. Otherwise, oral public comments will be summarized in the minutes to give a brief succinct account of the overall substance of the person's comments.

1. **CALL TO ORDER**

2. **PUBLIC COMMENT**

This section of the agenda is reserved for comments from the public on Consent Agenda items or items that are not otherwise included in this agenda.

3. **PRESENTATIONS**

3.a. **Introductions by Philo Shelton, Utilities Manager**

[16272-23-b](#) Future Energy Generation for Los Alamos

Presenters: Philo Shelton, Utilities Manager, Jordan Garcia, Deputy Utilities Manager - Electric Production and Engineering Associate Ben Olbrich, Engineering Associate

3.b. Q&A by Presenters

3.c. Participant Survey by Cathy D'Anna, Public Relations Manager

4. PUBLIC COMMENT

This section of the agenda is reserved for comments from the public on any items.

5. ADJOURNMENT

If you are an individual with a disability who is in need of a reader, amplifier, qualified sign language interpreter, or any other form of auxiliary aid or service to attend or participate in the hearing or meeting, please contact Human Resources at 505-662-8040 as soon as possible.

*Complete Board of Public Utilities agenda packets, past agendas, videos, legislation and minutes can be found online at <https://losalamos.legistar.com>.
Learn more about the Board of Public Utilities at <https://ladpu.com/BPU>.*



County of Los Alamos

Los Alamos, NM 87544
www.losalamosnm.us

Staff Report

January 26, 2023

Agenda No.:

Index (Council Goals): * 2022 Council Goal - Protecting our Environment and Improving our Open Spaces, Recreational, and Cultural Amenities; DPU FY2022 - 1.0 Provide Safe and Reliable Utility Services; DPU FY2022 - 5.0 Achieve Environmental Sustainability

Presenters: Philo Shelton, Utilities Manager, Jordan Garcia, Deputy Utilities Manager - Electric Production and Engineering Associate Ben Olbrich, Engineering Associate

Legislative File: 16272-23-b

Title

Future Energy Generation for Los Alamos

Body

The Board of Public Utilities (BPU) is hosting a Town Hall meeting to discuss electric generation resources for the future. Department of Public Utilities (DPU) will present information to support a community discussion about the County's goals and requirements for meeting future electrical loads.

Why is this important?

The San Juan Generating Station closed down in September 2022. Before this coal plant near Farmington closed down, DPU had 4% ownership and 36 MW of dedicated power from it. For now, that power is being replaced through other contracts/agreements. DPU has a current contract for 25 MW with a mix of coal, wind and solar for a couple of years. There may be carbon free resources out there that would better fit our energy portfolio more appropriately in the future than power purchased on the open market. DPU is focused on 2025 and beyond for these replacement resources.

DPU has a goal to reach carbon-neutrality by 2040. That's only 17 years away! If we are going to achieve this goal, we need to start now. Currently, carbon neutral power resources being explored are hydro, wind, solar, geothermal, and nuclear.

BPU has some big decisions to make regarding the Carbon Free Power Project (CFPP), a proposed nuclear electric generation facility to be constructed at Idaho National Laboratory that will utilize Small Modular Reactor (SMR) technology developed by NuScale Power. While Los Alamos County has a commitment to the project with avenues to exit it without penalty, it is a very big decision and we want public input on it.

At the end of 2022, NuScale and Fluor delivered the class 3 project cost estimate on the CFPP to UAMPS. NuScale also delivered the Standard Design Application (SDA) for the 6-module plant configuration with a total capacity of 462MW. These are very significant milestones which have led to the completion of the following activities:

-
1. Evaluating the cost estimate by UAMPS and its owner's engineers
 2. Updating the CFPP financial model with the cost estimate data
 3. Running the Economic Competitive Test (ECT)
 4. Amending the Development Cost Reimbursement Agreement (DCRA)
 5. Revising the Budget and Plan of Finance (BPF)

This revised BPF provides another contractual off-ramp for Los Alamos County to decide in February 2023 whether to continue participating in the CFPP. The next contractual off-ramp will be during the Combined Operating and Licensing Application (COLA) submittal decision, scheduled for January 2024. The new price target is \$89/MWhr in 2022 dollars and there is a subscription guarantee of 80% in order for the project to advance forward contractually.

Background Information about the CFPP:

The CFPP design configuration that will be part of the Phase I Combined Operating and Licensing Application (COLA) submittal is the 6-module plant with a total capacity of 462MW. When the Board of Public Utilities and County Council voted in July 2021 to continue participating in the CFPP, the plant had a target levelized cost of electricity of \$58/MWh in 2020 dollars. It was hoped that the 462MW plant configuration would allow for the project to get fully subscribed sooner and reduce UAMPS' subscription risk. The next contractual off-ramp for the participants was planned at the Class 3 Project Cost Estimate, at the time planned to occur in September 2022, now planned for February 2023.

In July 2021 DPU recommended to Board and Council that we continue to participate in the CFPP at the same level of investment approved the previous year by Board and Council at \$1.26 Million for the Phase I COLA submittal. Given LAC's current level of investment, LAC's share of the CFPP is 1.8 MW, subject to change as total subscription changes.

LAC initially requested 8 MW's in the CFPP when this project began based on our current asset mix, forecasted load and the goal to be carbon neutral electrical energy provider by 2040. This level of subscription was studied in the 2017 Integrated Resource Plan at \$65/MWh that resulted in a 3% higher cost over the 20-year planning period. At \$58/MWh, the 2021 IRP update also determined that the CFPP is a feasible option when compared to alternatives.

In 2021, DPU staff expected that severe drought conditions affecting hydroelectric facilities across the west would continue, threats of wildfire and extreme weather patterns would increase, and constraints on the electric grid would increase as traditional dispatchable base load resources were replaced with renewable "intermittent" resources, causing extreme volatility in the electric markets and higher prices. We had already experienced an August 2020 heat wave which caused market prices to reach \$1,650 per megawatt hour costing the power pool approximately \$1.4 million dollars over a 10-day period. At the time historical average market prices were \$45/ MWh. In June of 2021 another heat wave had market prices at \$1,750 per MWh costing the power pool an additional \$800k over a 1-day period. Staff's expectation of continued high prices were correct. In the summer of 2022 market power purchases were in the range of \$450/MWh for several weeks. Given the continued retirement of coal-fired power plants, including the County's largest single generation resource, the San Juan Generating Station, and ongoing disruptions to the PV panel supply, DPU staff do not anticipate seeing any relief from high prices in the coming year.

DPU is committed to considering all viable resources that are able to supply Los Alamos County with a carbon neutral, reliable and diversified generation portfolio. While the projected CFPP cost increases with material and interest rate hikes, so have the cost of other new generation resources.

Alternatives

Other the next month, the County has three options to consider; choose to increase subscription, maintain current subscription, to reduce subscription, or exit the project and pursue other carbon free dispatchable resources.

Fiscal and Staff Impact

Informational only at this time. Fiscal impact can be calculated based on desired level of participation at the \$89/MWHR in 2022 dollars. For Federal Fiscal Year 2023, there was \$165 million appropriated for the DOE match funding at 79% of project costs and this level of funding will fund the project to the COLA submittal milestone.

There is no staff impact since resource planning is part of our regular duties.

Attachments

A - Special Town Hall Presentation

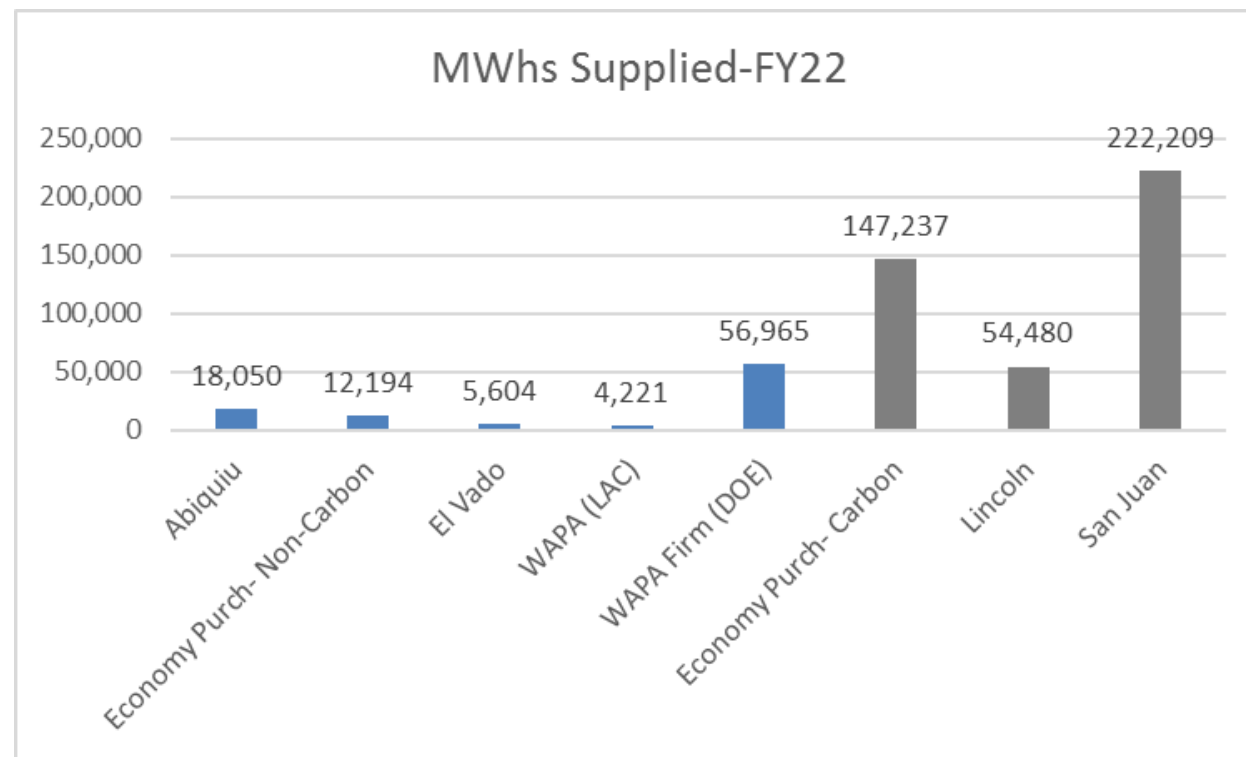
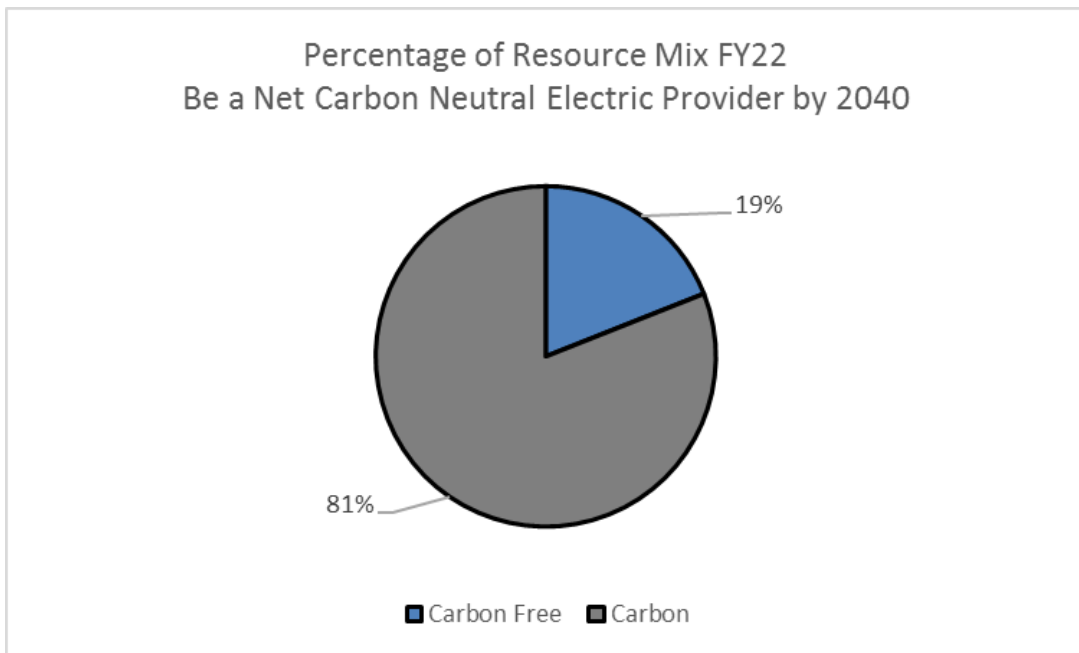
TOWN HALL MEETING
regarding
FUTURE ENERGY GENERATION FOR
LOS ALAMOS

January 26, 2023

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.

Current Resource Mix- Goal of Carbon Neutrality by 2040



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:**

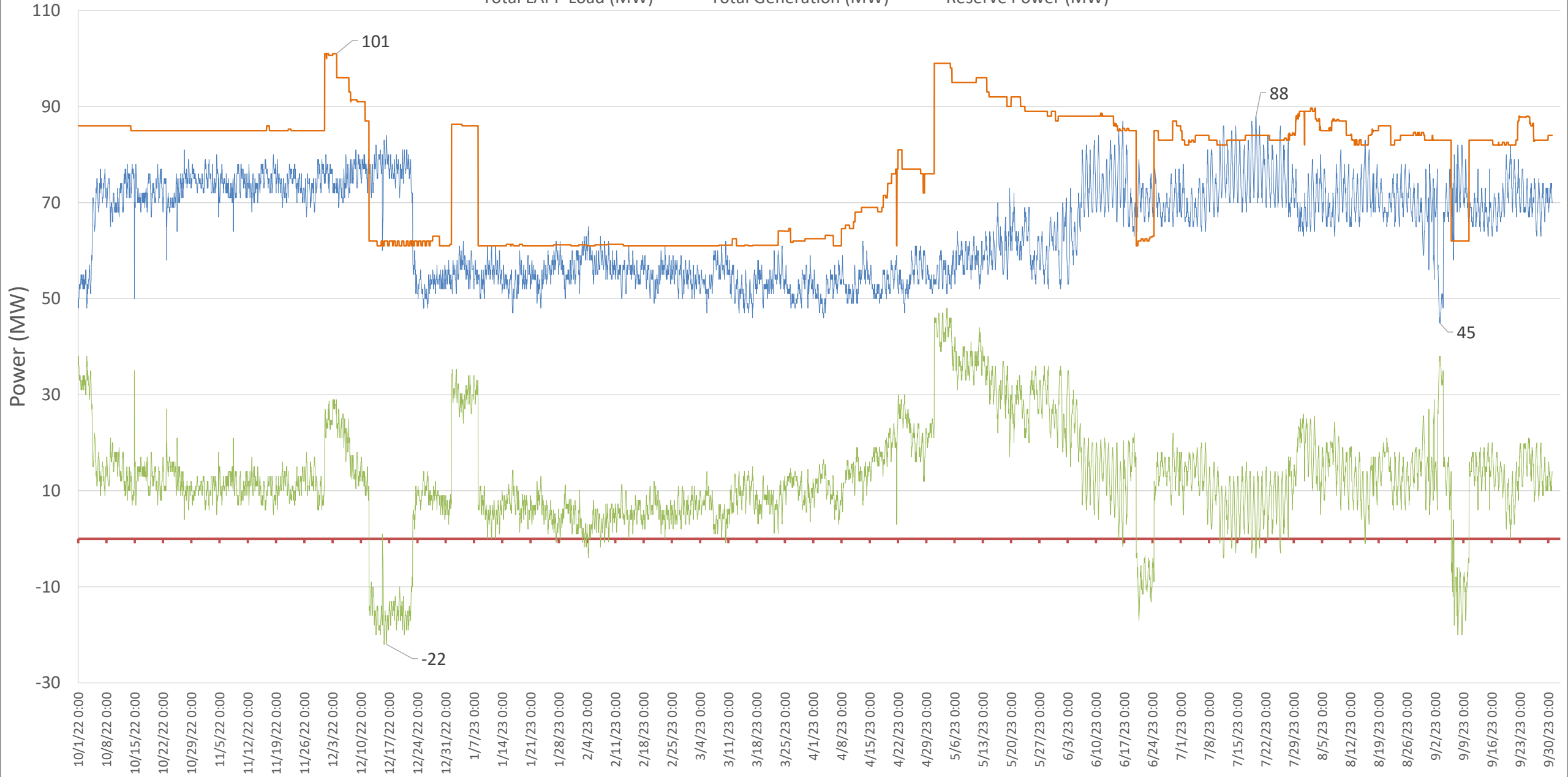
- Board of Public Utilities (BPU)
- LAC and LANL
- Public process



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

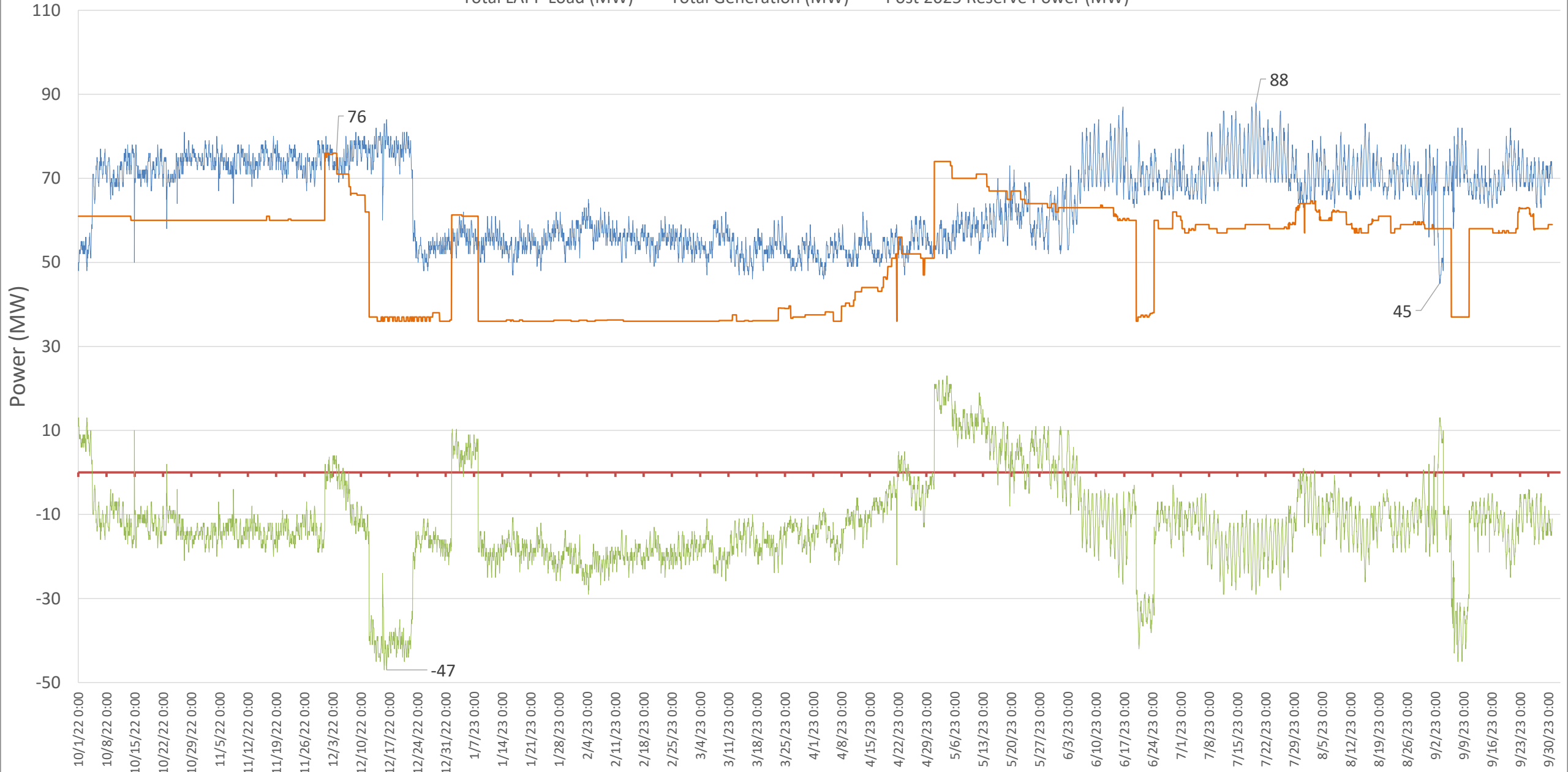
Electric Load and Generation Forecast

— Total LAPP Load (MW) — Total Generation (MW) — Reserve Power (MW)



Electric Load and Generation Forecast w/o 25MW PPA

— Total LAPP Load (MW) — Total Generation (MW) — Post 2025 Reserve Power (MW)



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.

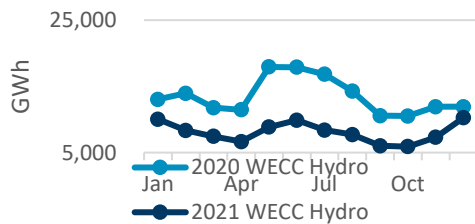
- Los Alamos County’s Balancing Authority (BA) PNM is in the Southwest Reserve Sharing Group (SRSRG), one of the three reserve sharing groups in WECC in addition to the California Independent System Operator (CAISO), and the Northwest Power Pool (NWPP).
- The North American Electric Reliability Corporation (NERC)’s 2021 Long-term Reliability Assessment has shown that CAISO, NWPP, and SRSRG 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.



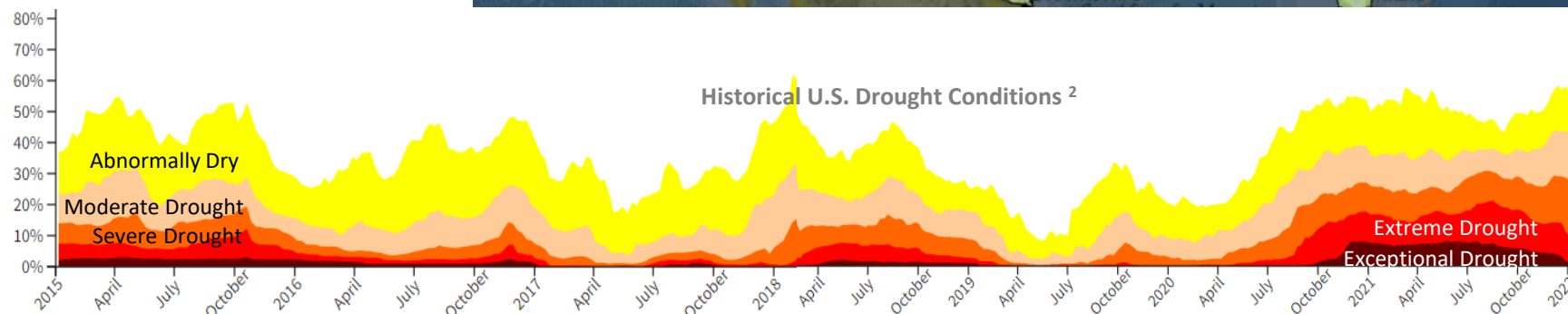
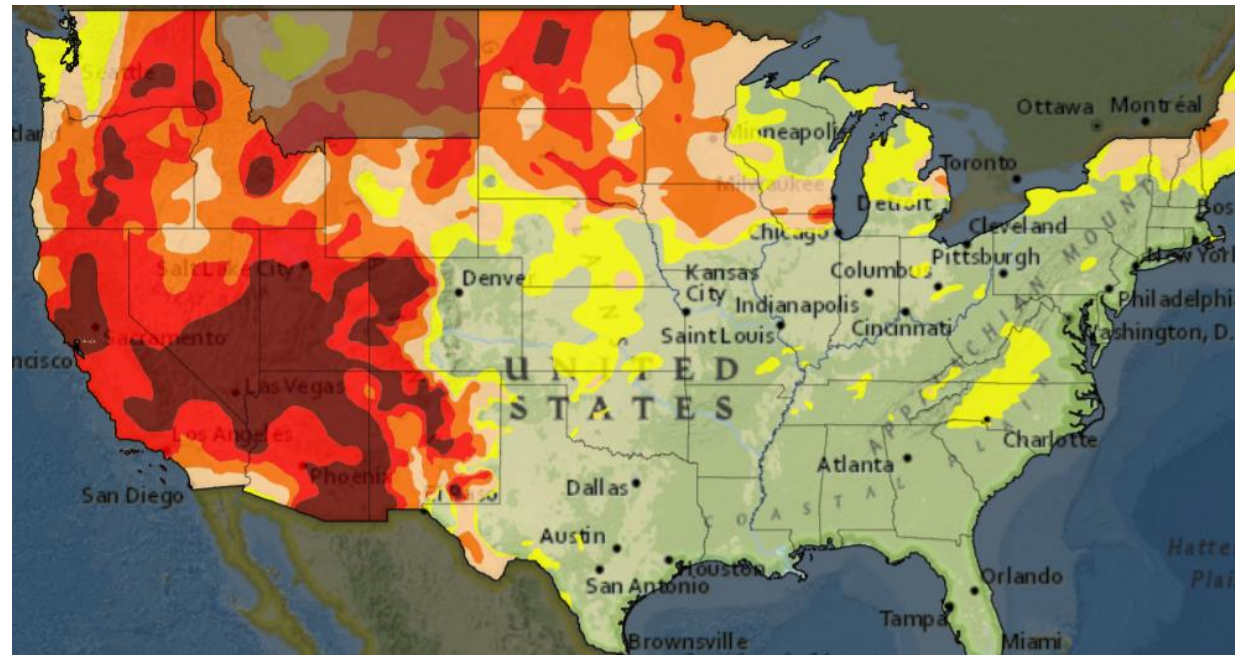
Recent Drought Conditions Caused Low Hydro Output in WECC Market

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



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.

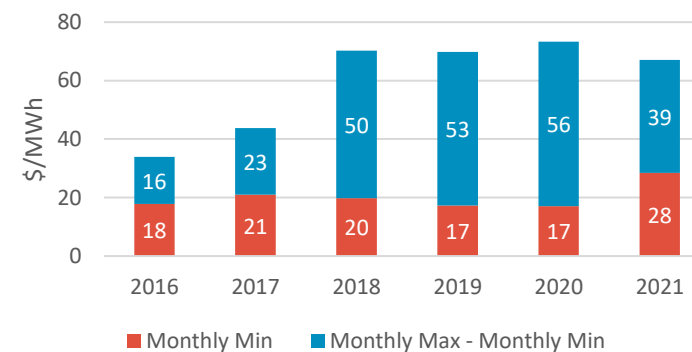
- The PNM BA area has experienced increasing power prices from an annual average of \$27/MWh in 2016 to \$50/MWh in 2021.
- The drought conditions have in general correlated with higher power prices.
- Due to lack of storage and redundancy in gas infrastructure, the gas supply in the southwest region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

Historical Average PNM Four Corners Prices

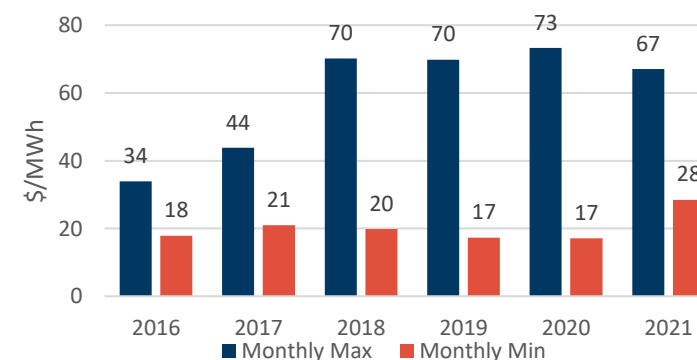
\$/MWh	2016	2017	2018	2019	2020	2021	Avg
Jan	26	32	32	38	27	30	31
Feb	22	26	29	70	24	62	37
Mar	18	21	28	35	25	28	26
Apr	18	24	24	22	19	32	24
May	21	28	20	17	17	31	23
Jun	29	32	27	23	22	49	31
Jul	33	35	70	31	28	67	43
Aug	34	44	63	32	73	59	48
Sep	31	37	33	34	43	66	40
Oct	32	36	38	33	40	60	39
Nov	26	31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



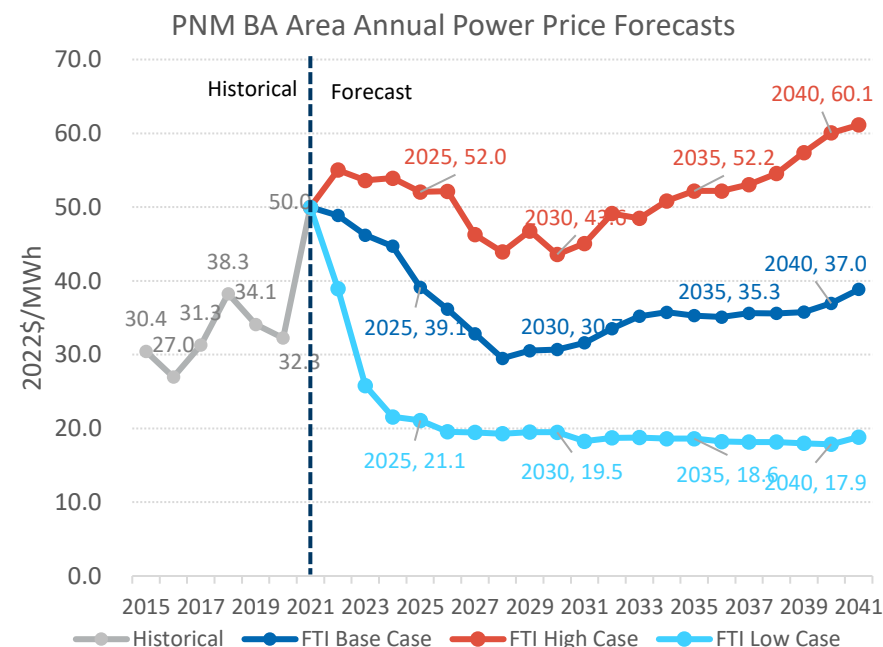
PNM BA Area Annual Power Prices Forecast

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.

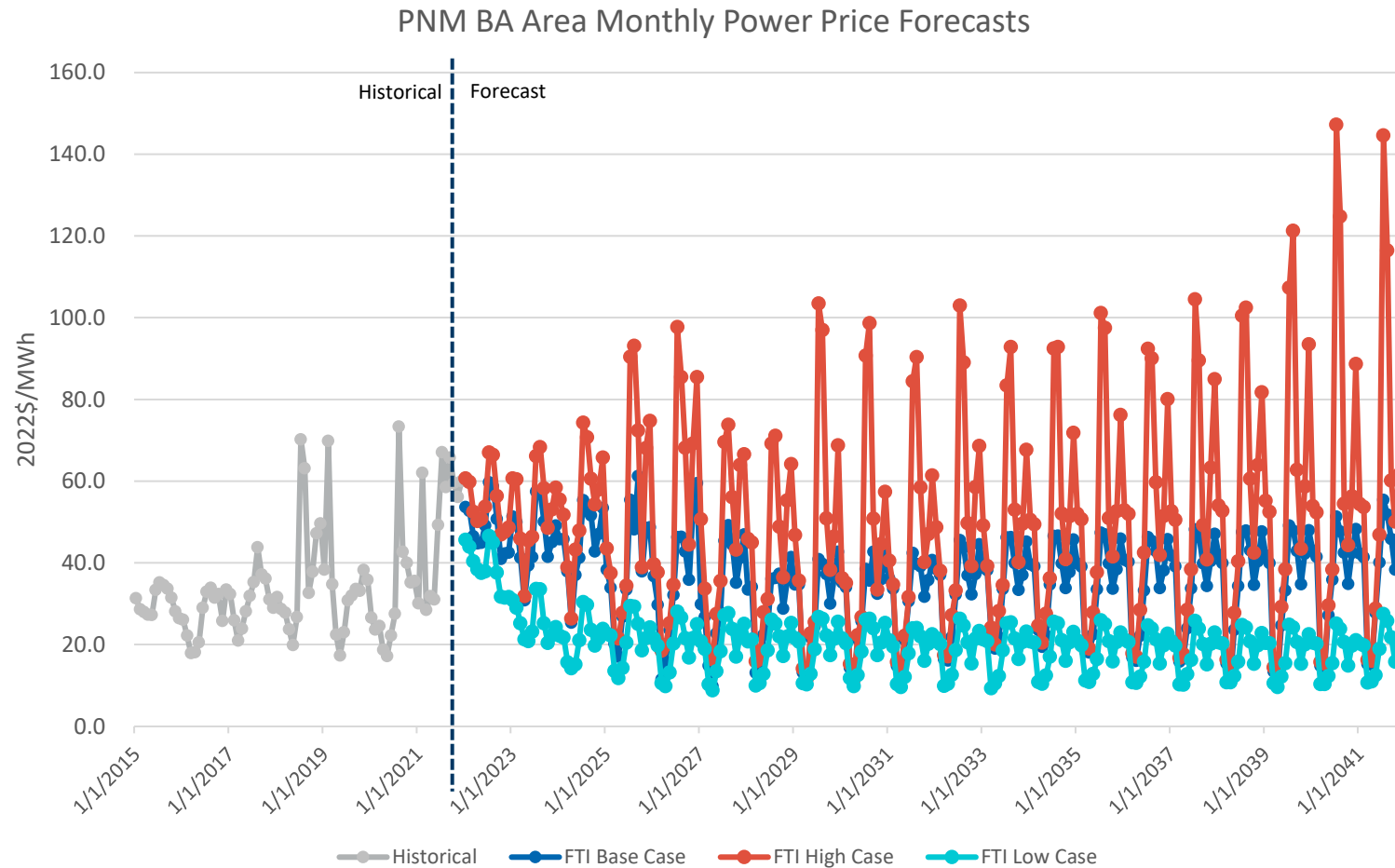
State and Representative Utilities	Renewables Portfolio Standard Target
New Mexico State	New Mexico’s Energy Transition Act calls for 100 percent zero-carbon resources for investor-owned utilities by 2045, and rural electric cooperatives by 2050.
PNM	100% by 2040 Voluntary; 100% by 2045 Mandatory
El 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



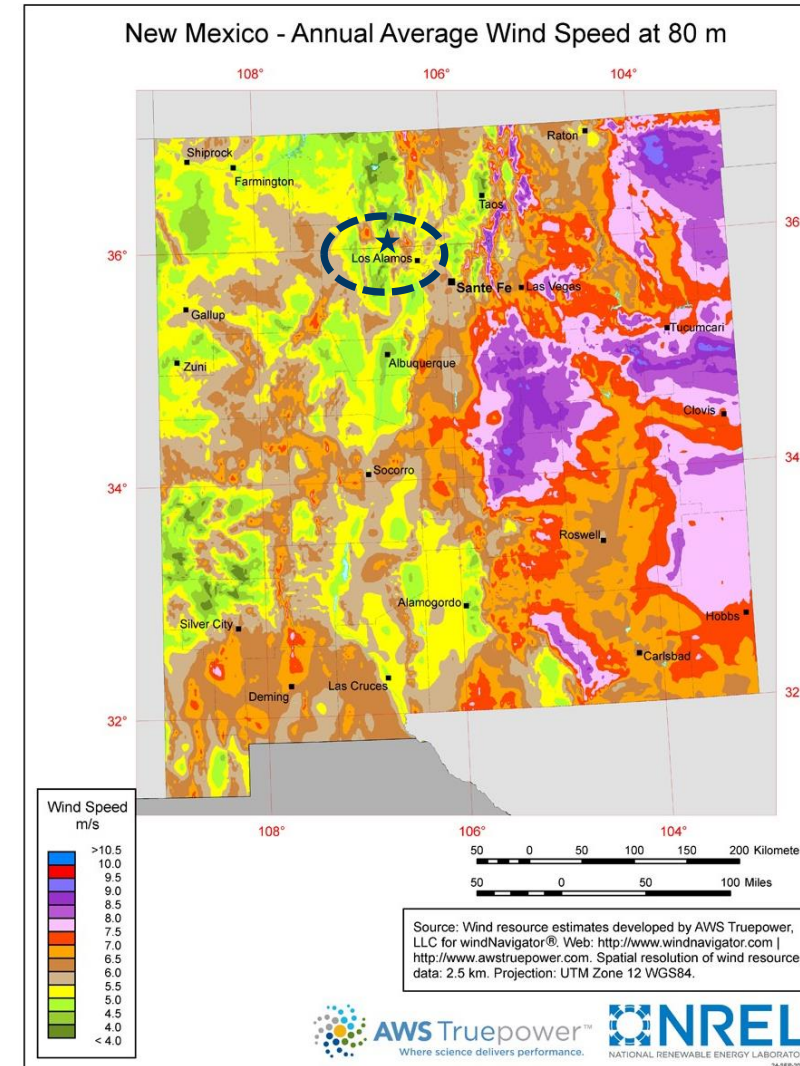
Resources being investigated currently

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

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	Off Peak	All Hour
		7:00-22:00	0-6:00; 23:00	
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 (%)	Month												Avg
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

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 Idefonso Pueblo
 - NGI-NTUA Generation Inc.
 - Jicarilla Energy Center
 - UNIPER
 - Mercuria Energy
 - Four Corners
 - San Juan
 - UAMPS
 - Affordable Solar
 - CREDA

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

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

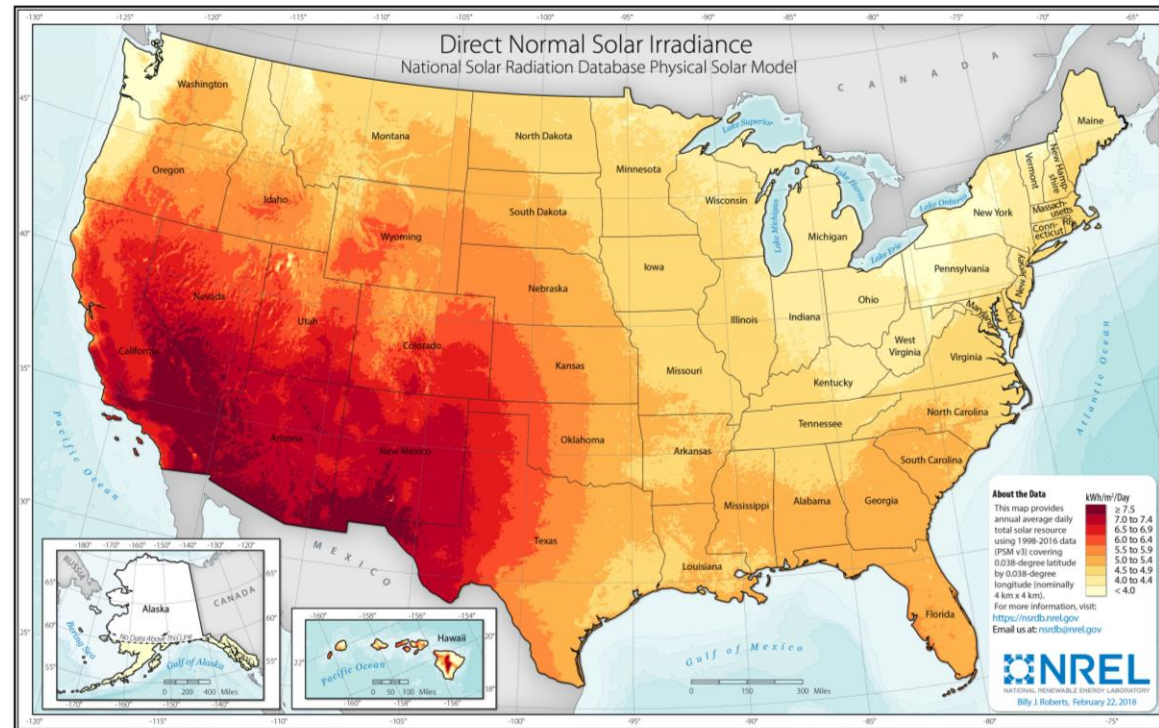
- 7-9MW of PV on LANL Site
- DOE/NNSA would lease land to LAC
- LAC would develop the PV site
- DOE/NNSA would install interconnection power lines
- LAC has engaged a PV developer for initial concept exploration of suitability and cost
- LAC has requested a battery study for potential locations within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

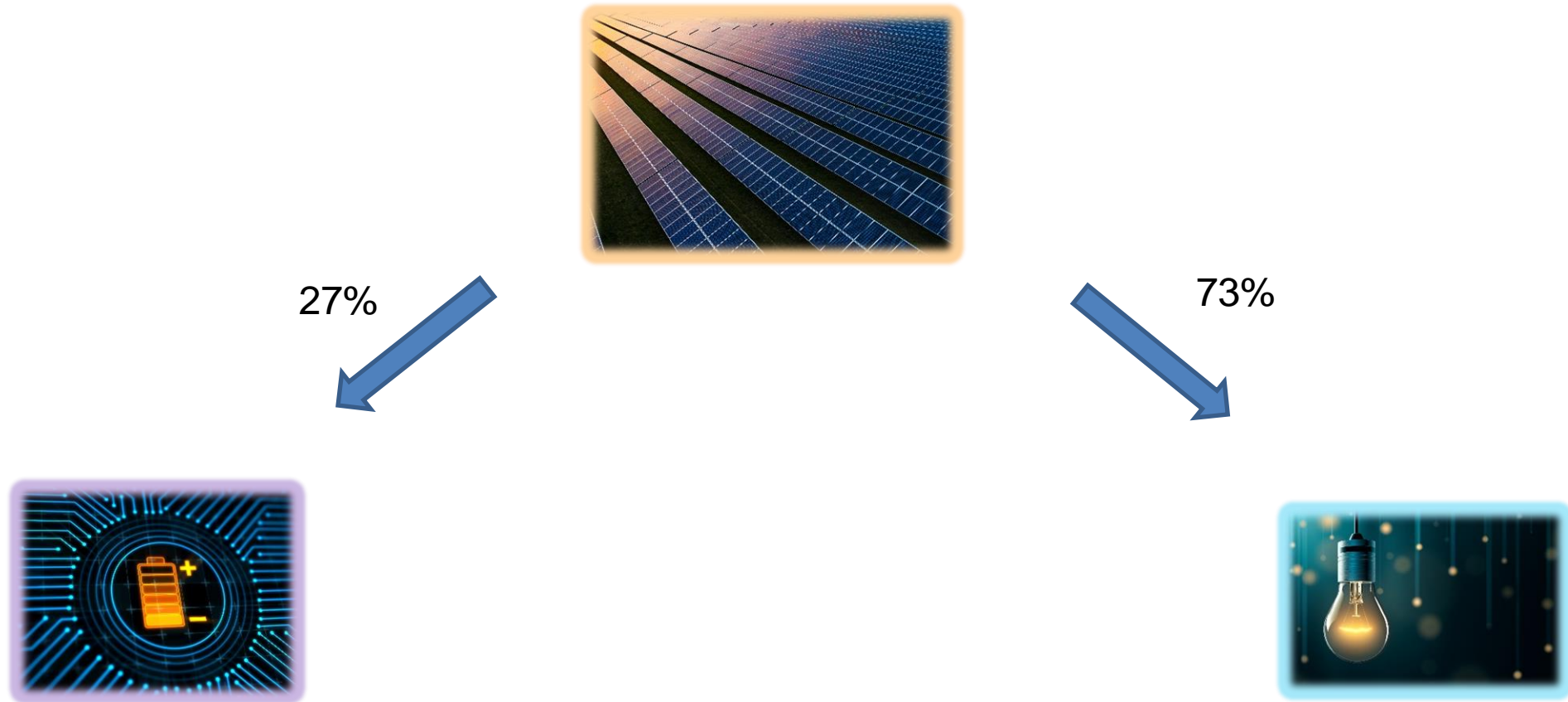
- Even though solar resources generally generate during the peak hours (7:00-22:00), they are typically not reliable to serve the evening portion of the super peak hours (13:00-20:00).

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%

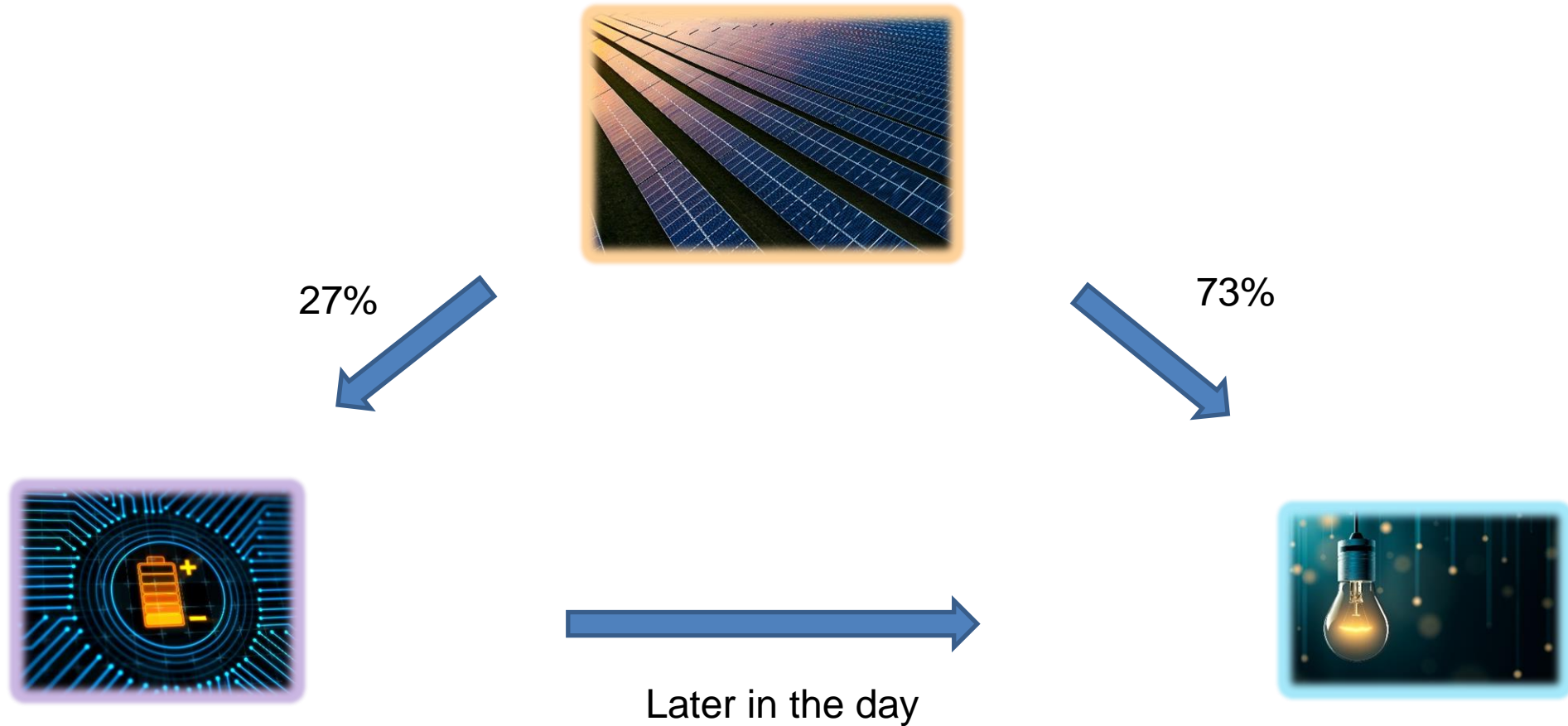
Capacity Factor (%)	Month												Avg	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%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

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

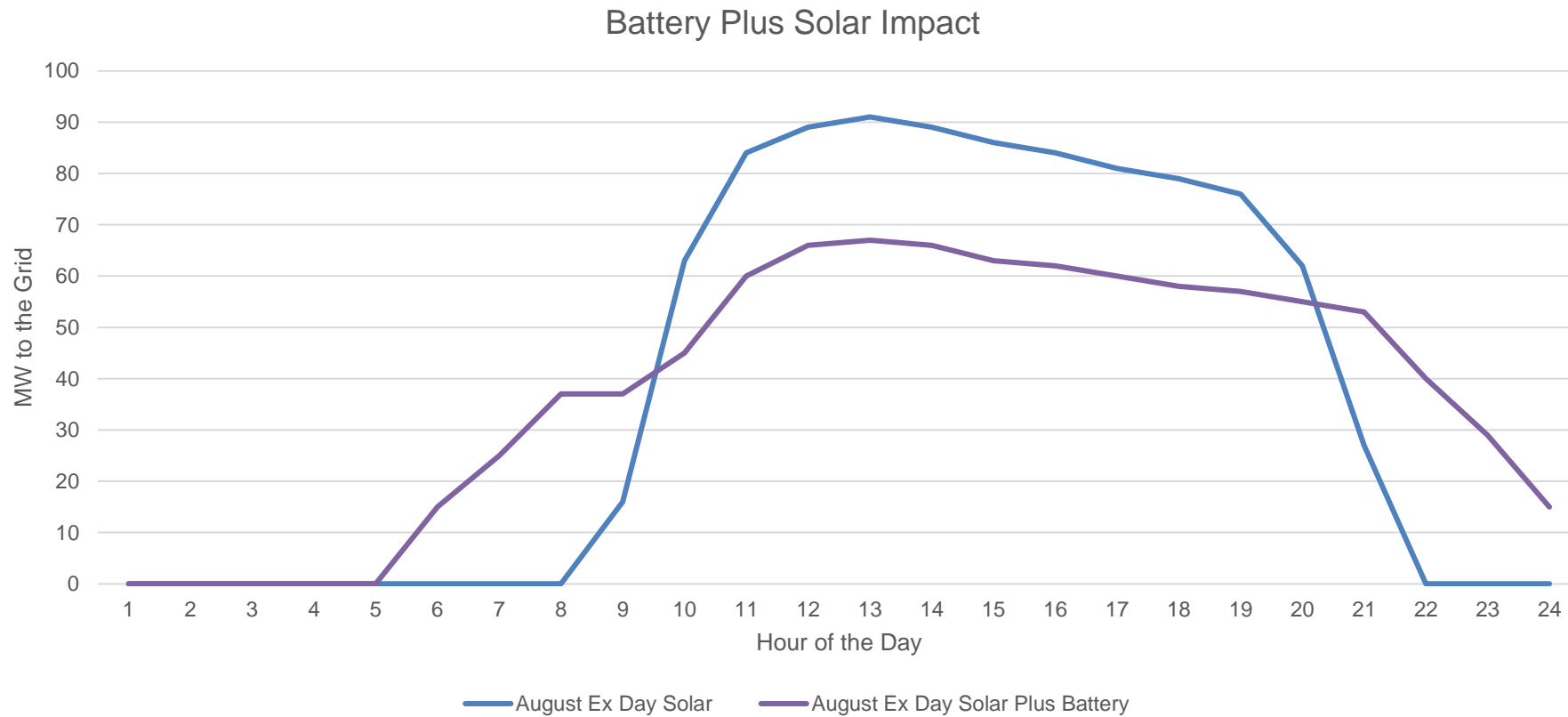
Solar and Storage Example Scenario



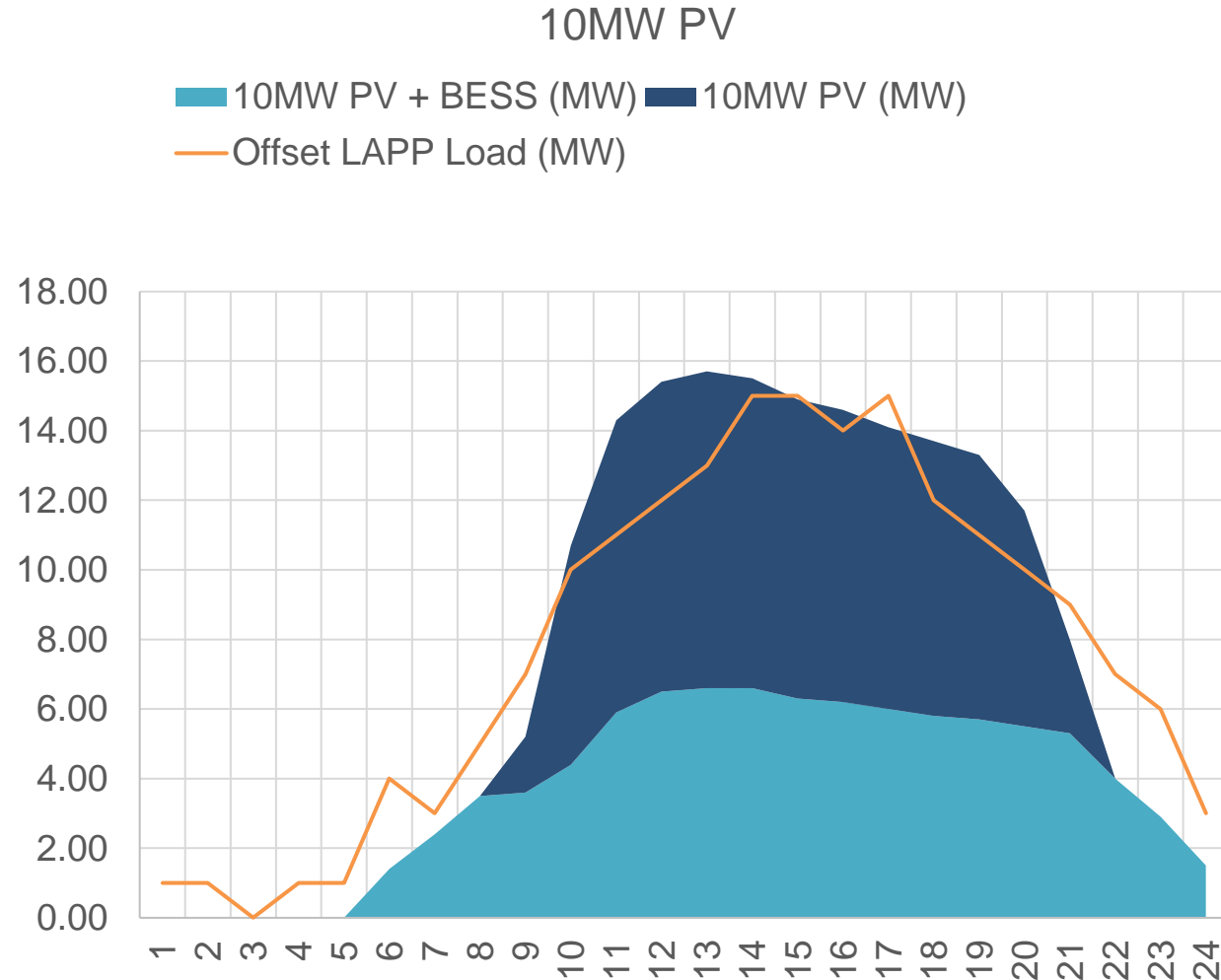
Solar and Storage Example Scenario



Solar and Storage Profile Example



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

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

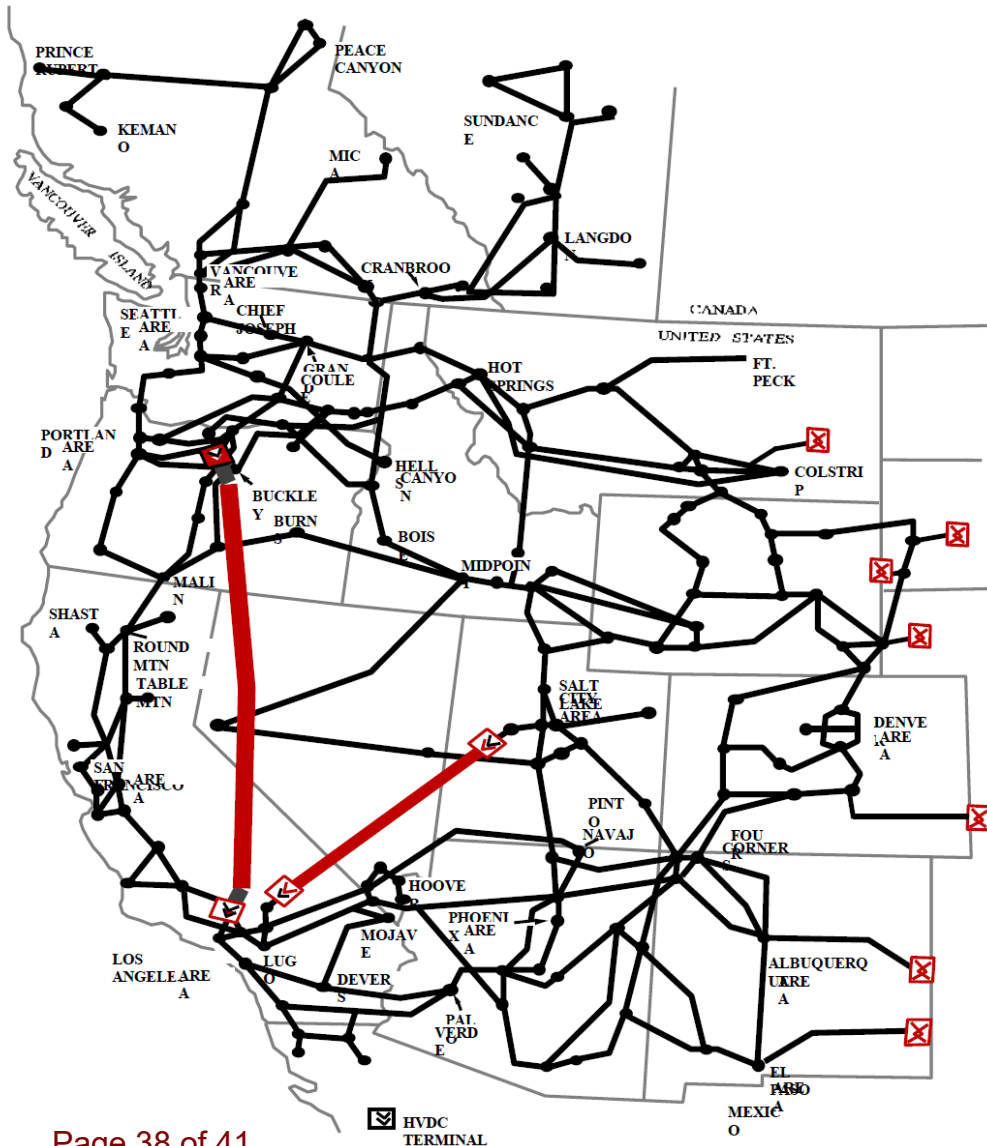
LAC Exploration of Gas Generation

- 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

Transmission Considerations





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

Transmission

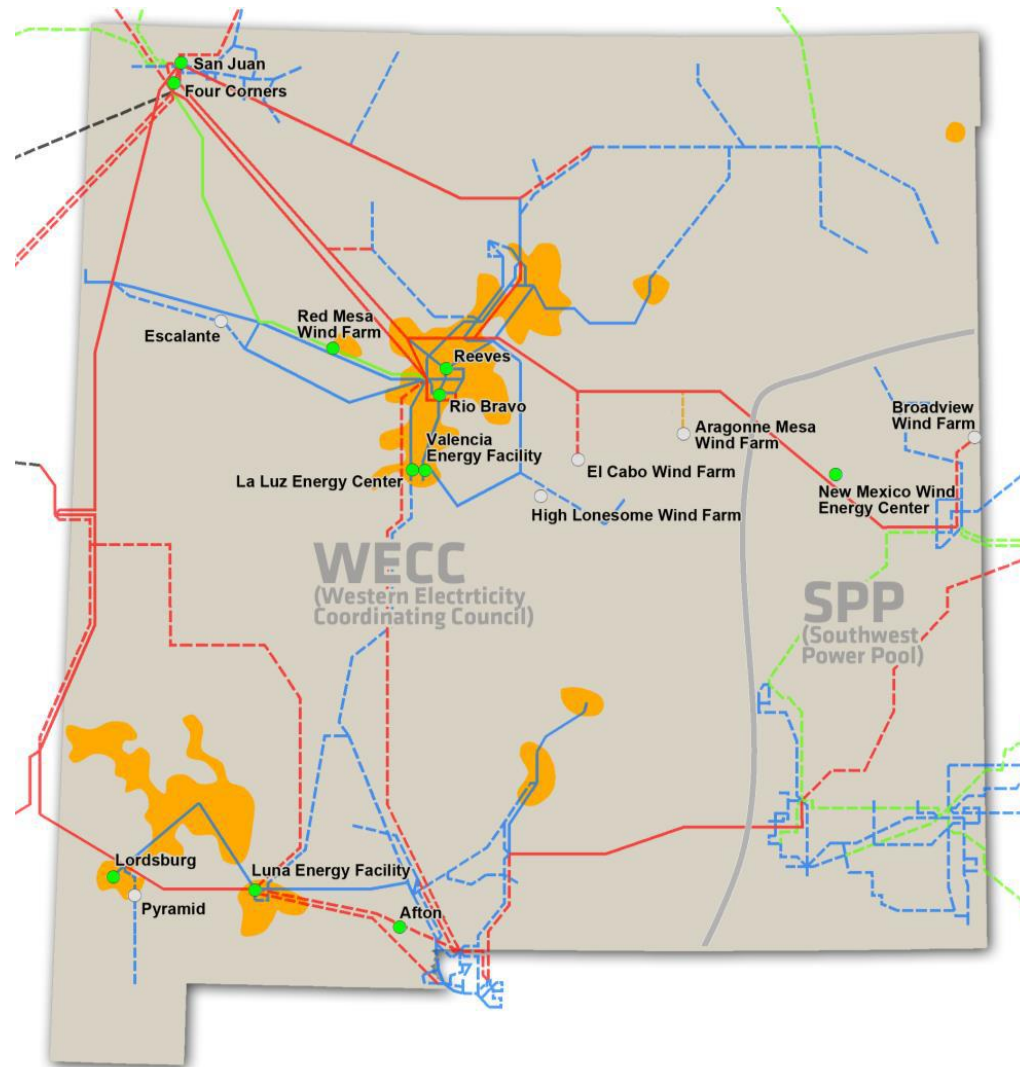
Existing Transmission

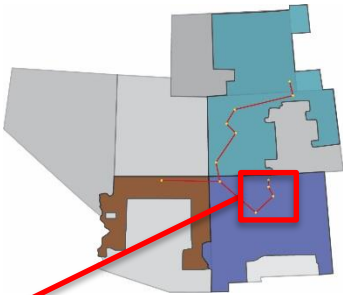
-  PNM 115kV
-  Other 115kV
-  PNM 230kV
-  Other 230kV
-  PNM 345kV
-  Other 345kV
-  Other 500kV

Existing Generation






-  PNM
-  Other

PNM Service Areas





Pancaking Transmission Rates

-  NORA Electric Co-op Transmission \$3.47/MWh
-  TSGT Substation \$0.50/MWh
-  JMEC \$2.00/MWh
-  PNM Approx. \$6.00/MWh
-  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