Power Supply Resource Investigation and IRP Implementation Update

April 5, 2023

Power Supply

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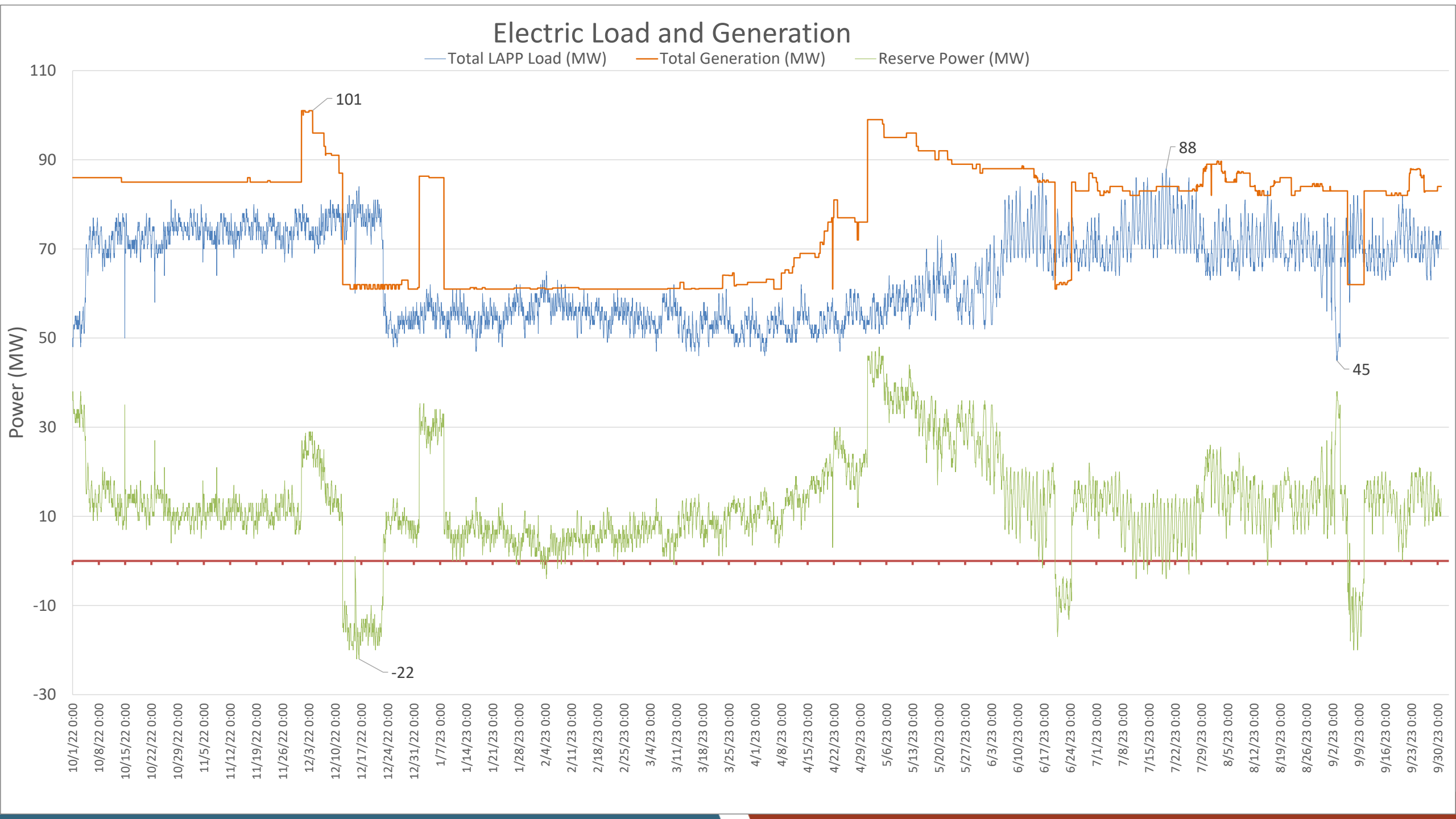
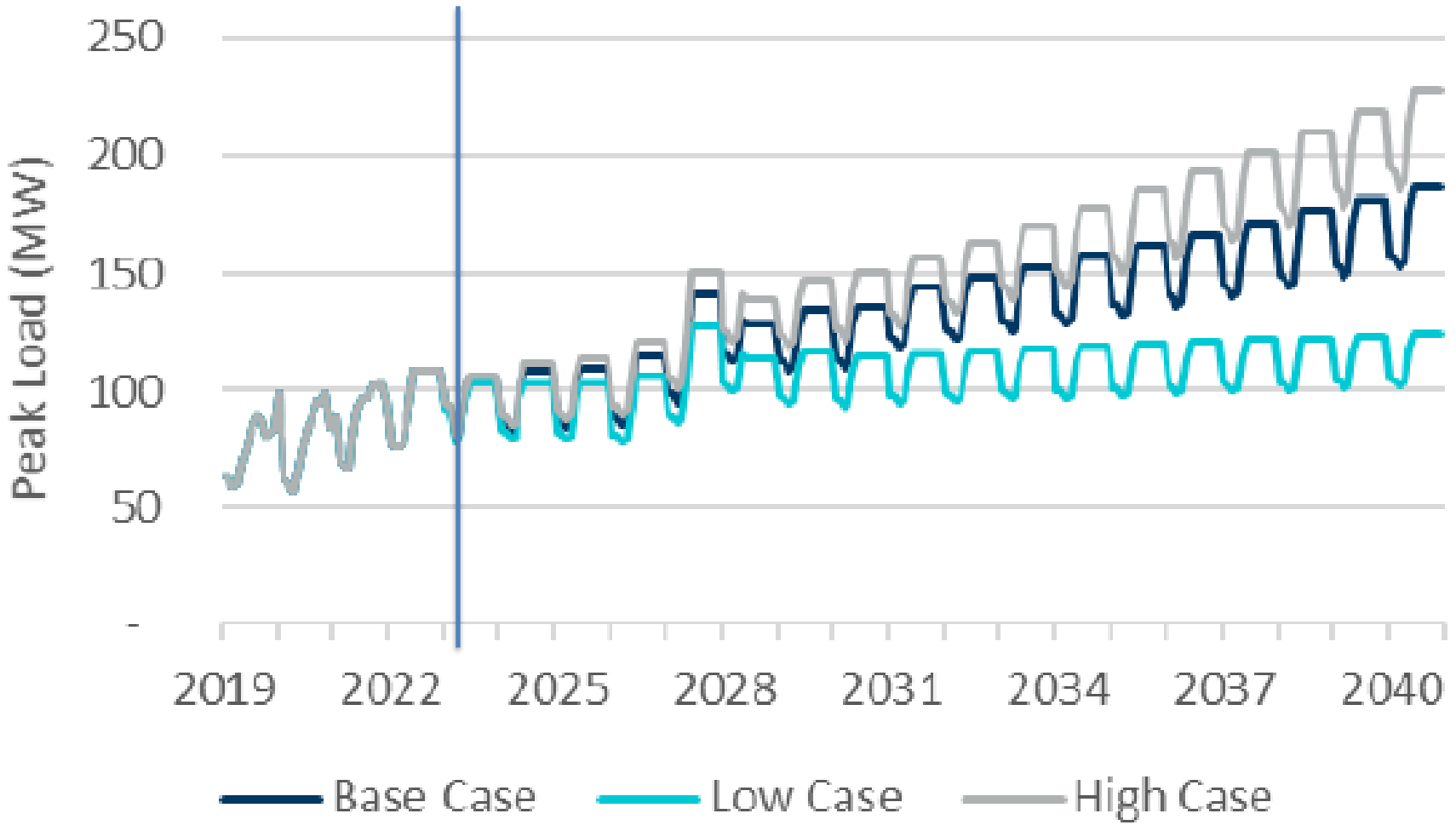
Load and Generation

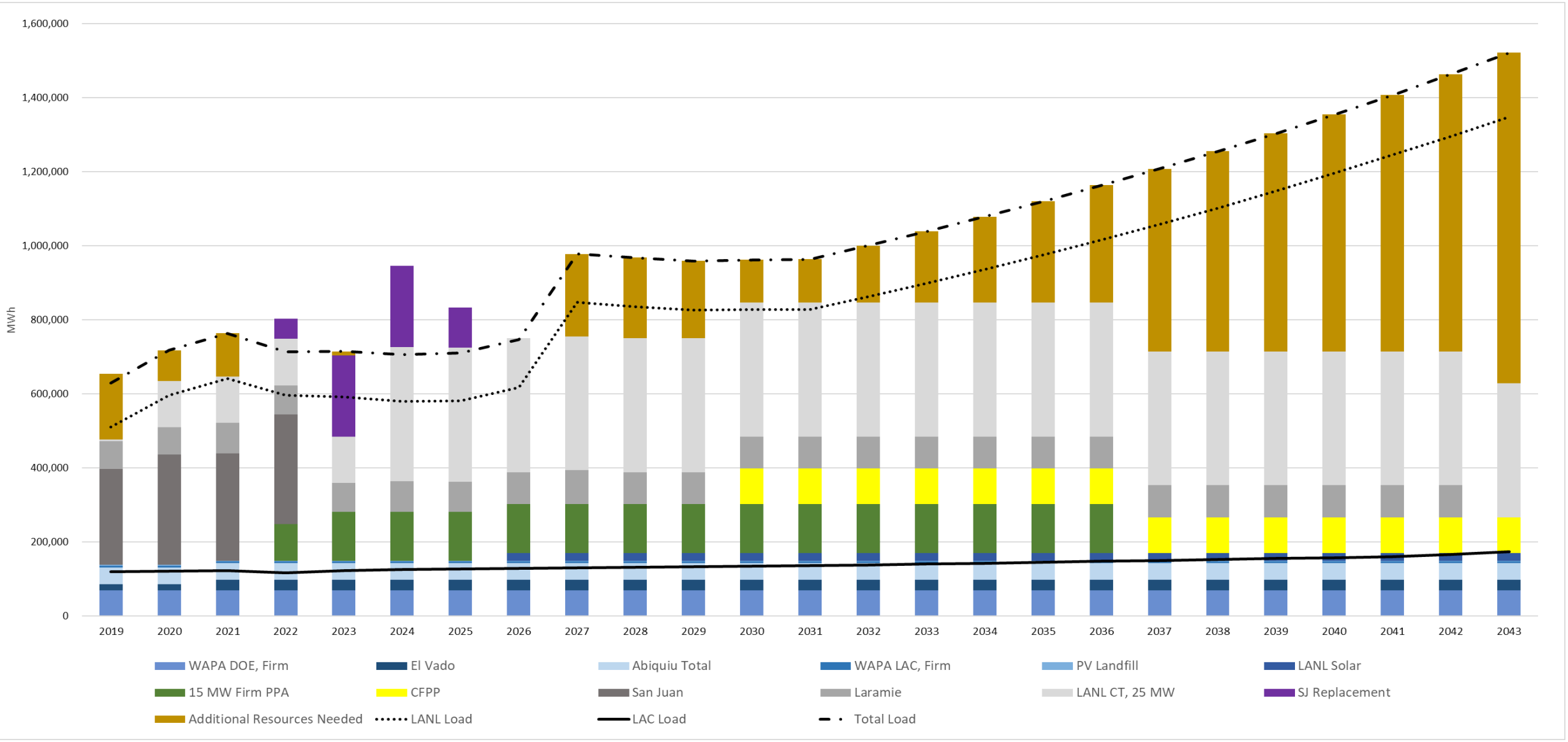
- Base Load for the Power Pool is roughly 45 MW
- Summer Peak Load and Winter Peak Load are very close in terms of MWs
- LANSCE is one of the largest loads, 25 MW from May through December, however the Lab's CT is planned to offset this load
- LAPP is transitioning to a positive reserve margin.
  - Excess Capacity from dispatchable resources is preferred for optimization of resource fleet


Electric Load and Generation
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

LAPP Peak Load Forecast



LAPP Future Load and Generation Resources



IRP Identified Need

Year	Storage	Solar	Wind	SMR	Total
	MW	MW	MW	MW	MW
2025	30	70	50	0	150
2027	30	85	105	0	220
2030	30	85	105	8	228
2035	35	240	105	8	388
2040	55	380	135	8	578
2041	55	380	135	8	578

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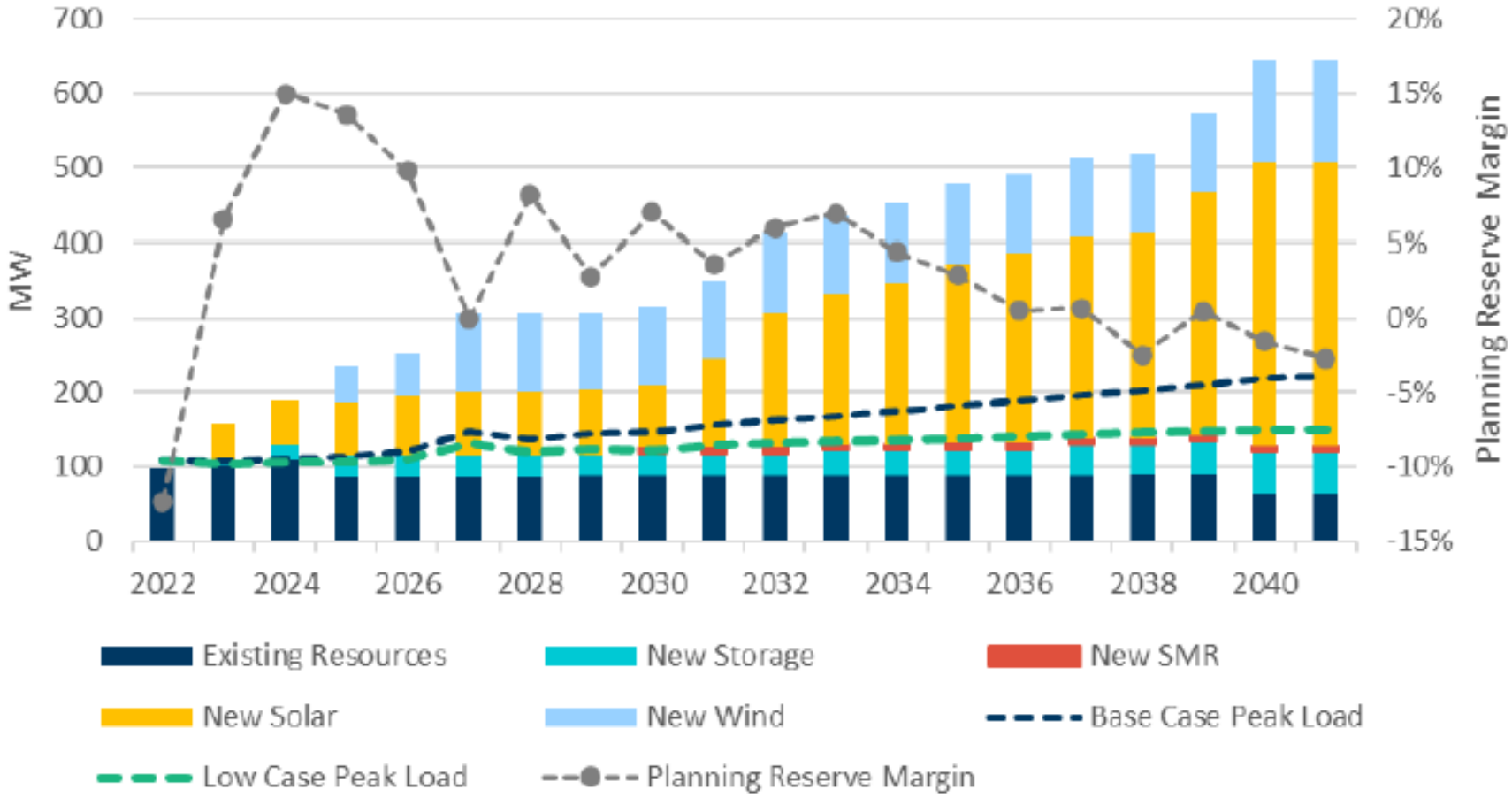
IRP Identified Preferred Resources



If wind projects cannot be competitively procured due to lack of availability, transmission constraints, or high all-in costs with firm transmission, alternative options of solar and battery storage should be explored.

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Future Resource 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.

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CFPP

- Resolution 23-03 was approved by County Council on February 7, 2023
- CFPP continues to be on schedule and just under budget as it enters the next phase of project development on March 1st
- All but one CFPP participants remained in the project
- UAMPS continues actively seeking subscription, backstopped by the NuScale subscription reimbursement

ATC PPA

- Consider 2-year 25 MW PPA as bridge resource until 2027
  - Dependent upon other resource availability
- Gives time to acquire and construct resources per the IRP Implementation plan
- Availability and cost under evaluation

Solar on LANL Site

- 8 - 9 MW estimated PV
- Proceeding on a non accelerated timeline, COD 2025 or later
  - DOE prepares land lease, geotechnical study, interconnection planning (next 6 months)
  - DPU prepares RFP, Power Pool makes selection
  - BPU & CC approvals needed
- $80 – 95 (with escalator)/ MWh estimated
  - Board Input necessary for LAC's execution of contract and share of output

Solar + Battery-UAMPS & General

- UAMPS currently investigating 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

Geothermal

- UAMPS staff received interest from four companies, that are going to respond to an RFI/RFP
- Anticipate evaluation findings from UAMPS in April
- Power Pool has expressed interest for 10MW

Natural Gas

- UAMPS is performing a feasibility study
  - Planned completed date TBD
  - Power Pool has expressed interest for 10MW
- EP staff continue seeking opportunities outside of UAMPS
- Resource adequacy considerations mean that larger capacities of PV + BESS may need greater natural gas generation capacity

Pumped Hydro-No Changes, monitoring

- FLASHES first considered by DPU in 2020
- Several projects in pre-construction development
  - 30MW / 120MWh
  - 20MW / 90MWh
  - 20MW / 80MWh
- Customers are interested in long duration storage with grid recharge and without renewables
- Developer may complete a formal offer to FLASHES' first customer in the next six months

Exploring Large-Scale PV and Battery

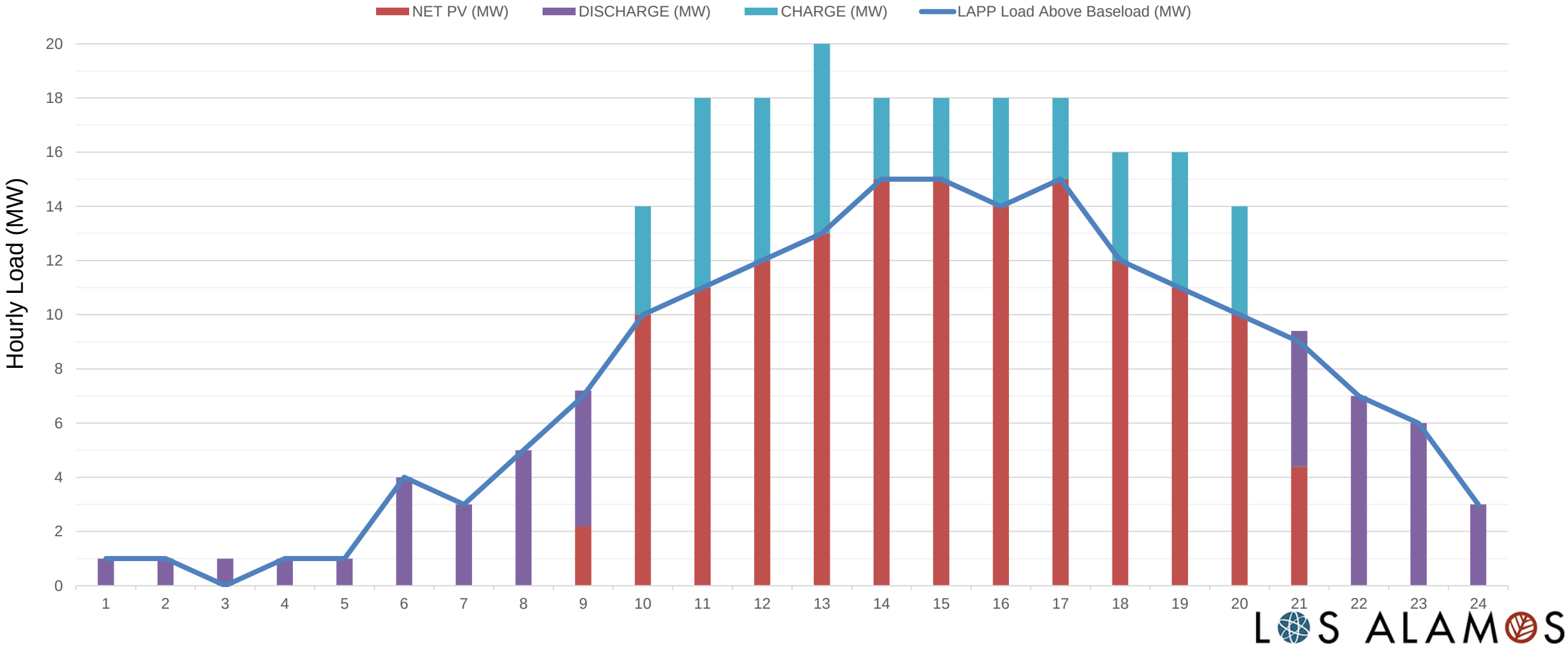
- Possible site in the FC area
  - Mid $30's pricing
  - Delivery using existing transmission contracts
  - Option to add battery
- Potentially concerning
  - We have to take a big block
  - Will need risk mitigation strategies
  - Energy profile is when costs are less
- Discussing Firming contracts with 3rd party

Monitoring Solar Partnerships

- In the past Los Alamos County was approached by representatives of San Ildefonso for a potential solar resource
- San Ildefonso is applying for grants
- San Ildefonso has contacted PNM to investigate interconnection

Load Following with Solar + Storage

22MW PV, 12MW/48MWh BESS



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Intermittent Resources and Operations

- The IRP discussed how the addition of Intermittent resources would impact Operations
  - We need to discuss the addition of employees
  - Potential farming out of some roles and responsibilities
  - Any combination of the two listed above
- Evaluate effects of major weather disruption events
  - Conduct risk assessment

Brand New Markets

- 4 new markets are being introduced in the West.
  - Markets +: is an new proposed RTO market being introduced by SPP
  - CAISO RTO: would be a new RTO market being introduced by CAISO
  - CAISO EDAM (Energy Day Ahead Market): the brother or sister to the EIM that we are currently operating in
  - WRAP (Western Resource Adequacy Program): New market based on capacity. Offered by Western Power Pool formerly Northwest Power Pool

Banking Turmoil/Financing Turmoil

- The recent banking crisis has been forefront in the news.
  - Energy transition projects need to review where funds are obtained to assure project solvency.
- LAC will need to assess how this potential crisis affects risk with Counterparties and Resource Ownership Structure moving into the Future.

Operational Path Forward

- Continue search for Solar, Wind, BESS, and Thermal resources bearing in mind the new developments with the IRA and Markets
- Evaluate current Operations for needs as our resource mix changes
- Continue to evaluate CFPP's viability
- Explore Partnerships with other entities
- 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

The End

Backup Slides

IRP Identified Need

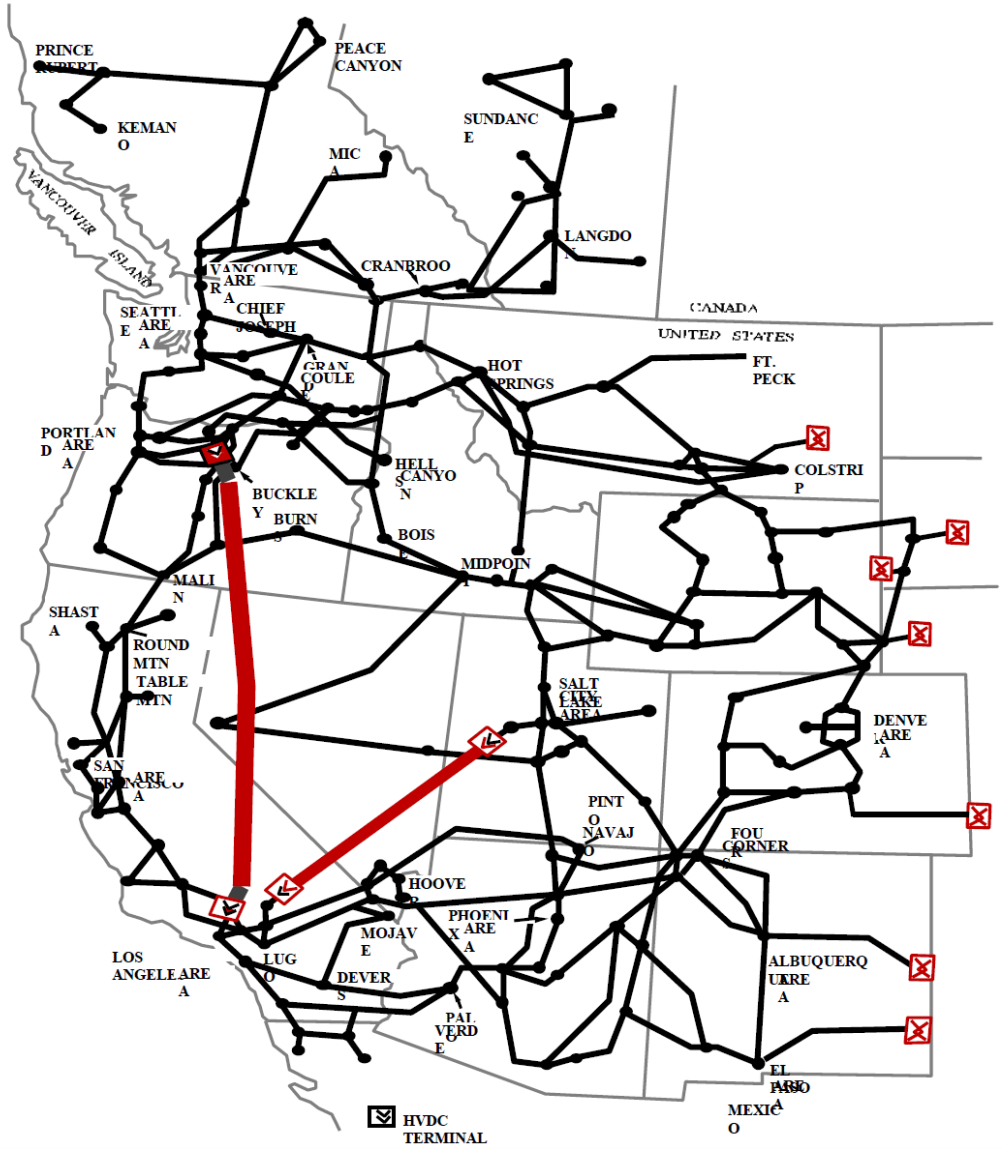
- 20 Year Outlook
  - 55MW (4 hour) Battery Storage- Capacity Adjusted 9 MW
  - 380MW Solar - Capacity Adjusted 114MW
  - 135MW Wind - Capacity Adjusted 54MW
  - 8MW SMR/CFPP -Capacity Adjusted 7.6MW
- 5 Year
  - 30MW Battery Storage - Capacity Adjusted 5MW
  - 85MW Solar - Capacity Adjusted 25.5 MW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

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

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

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

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Transmission

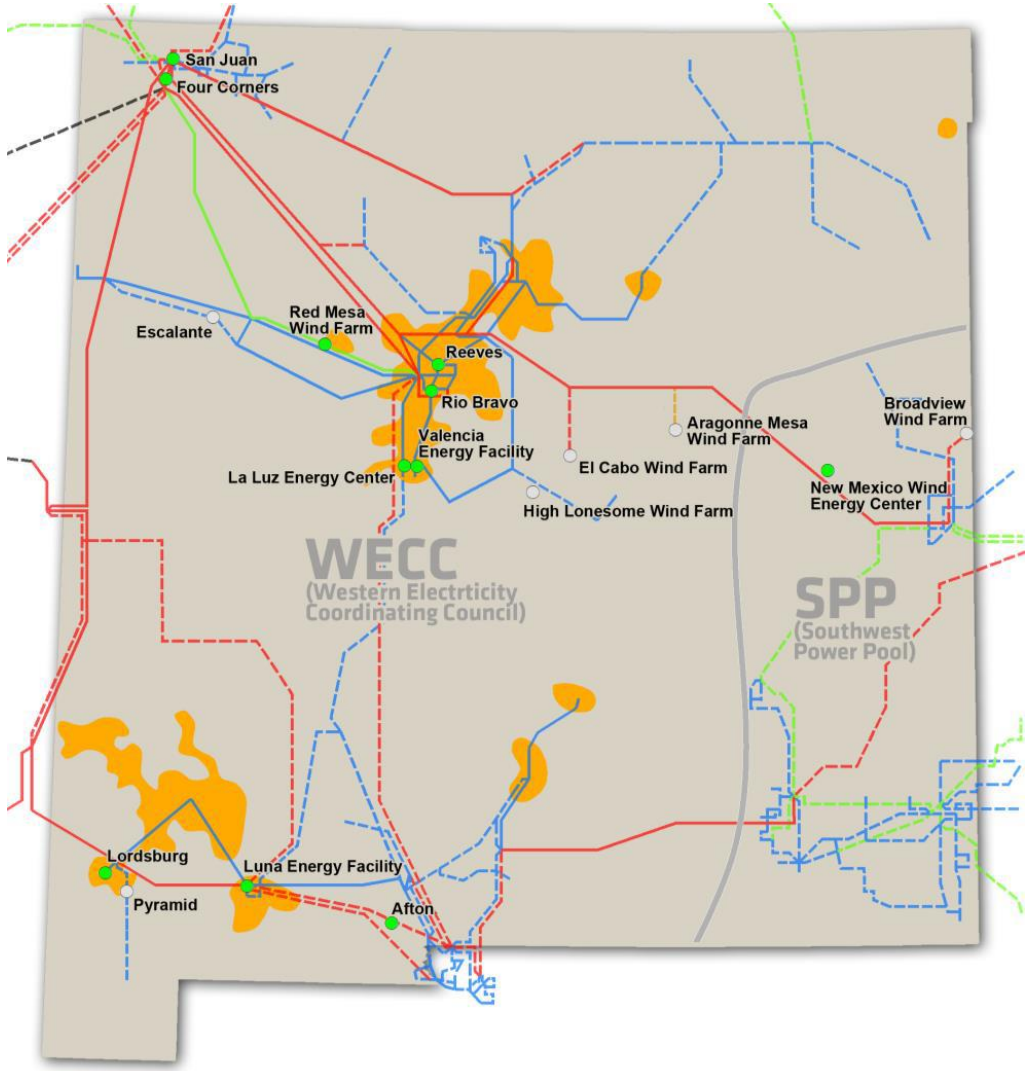
Existing Transmission

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

Existing Generation

- PNM
- Other

PNM Service Areas



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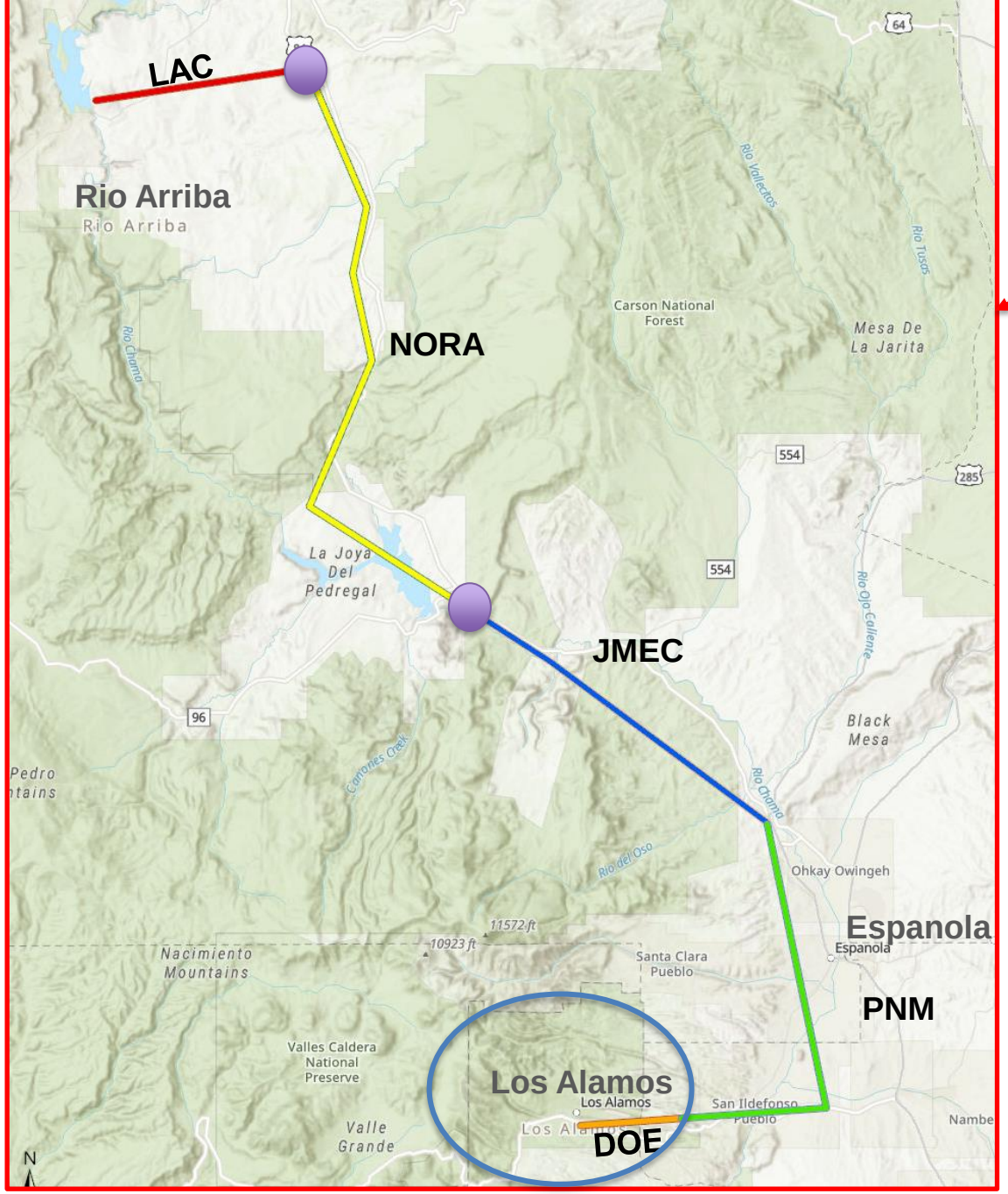

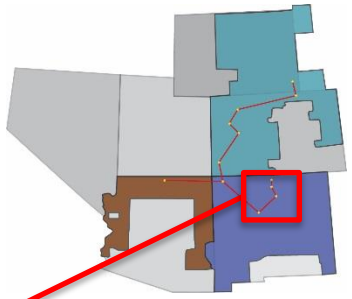

Pancaking Transmission Rates

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

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Solar and Storage Example Scenario

27%

73%

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Solar and Storage Example Scenario

27%

73%

Later in the day

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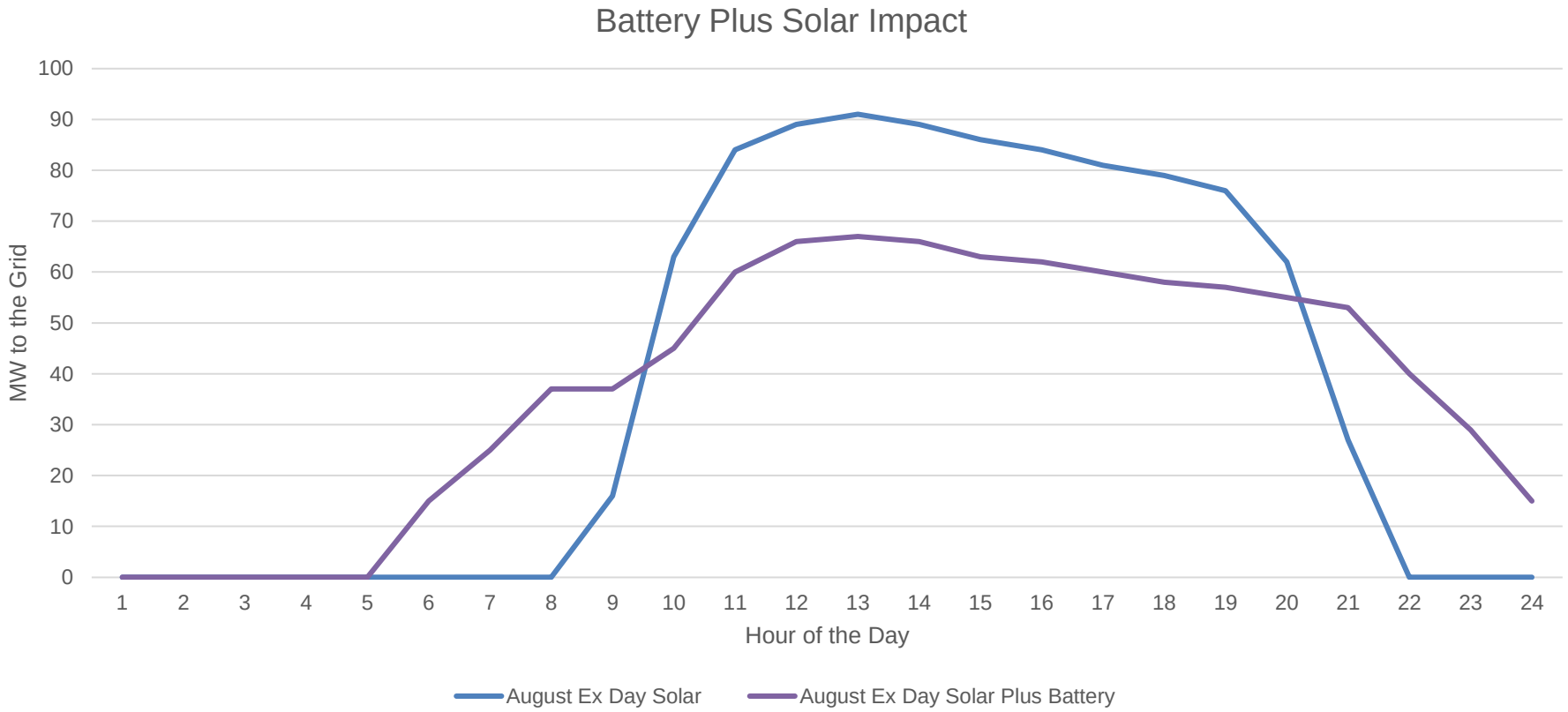
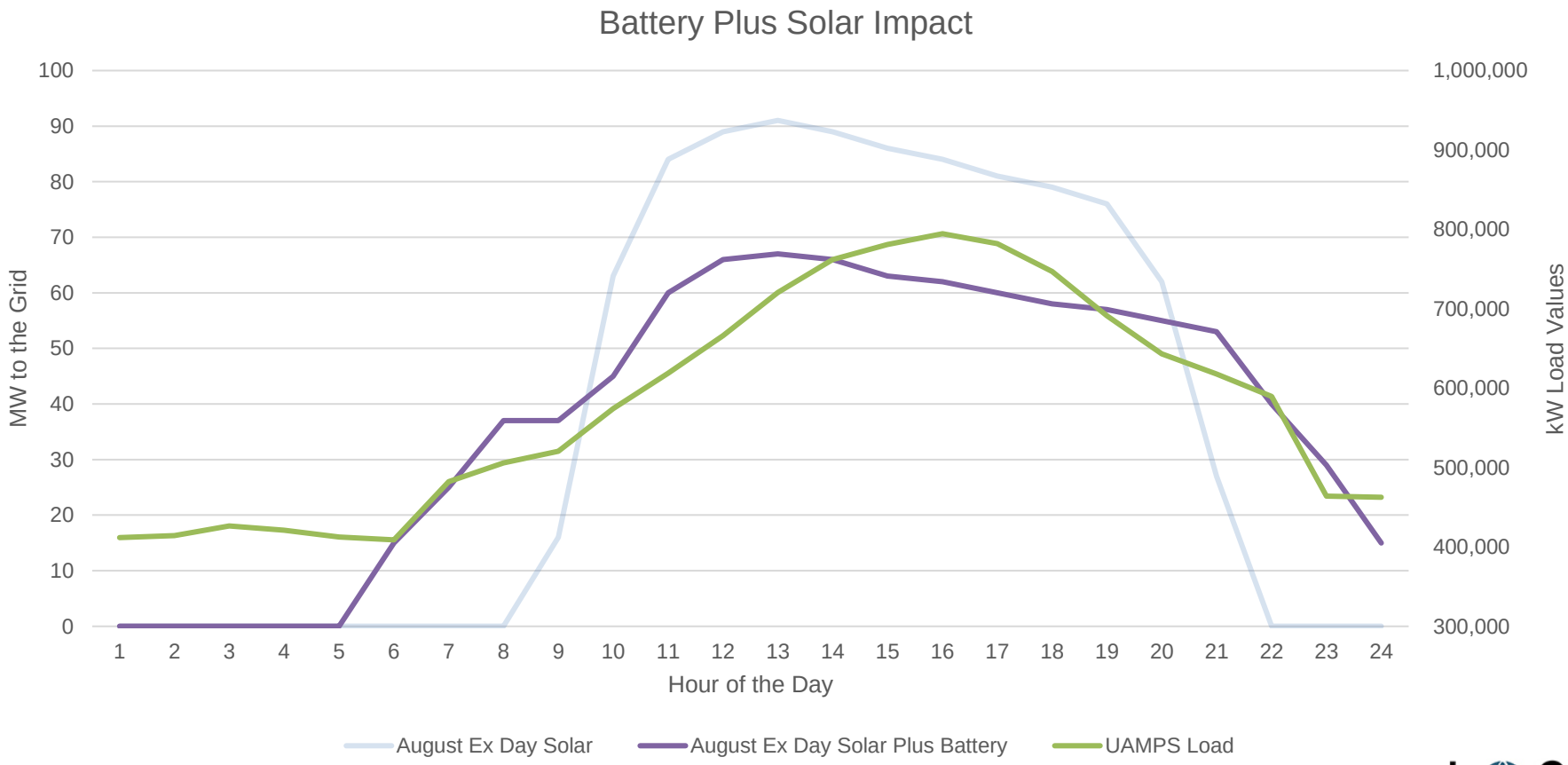
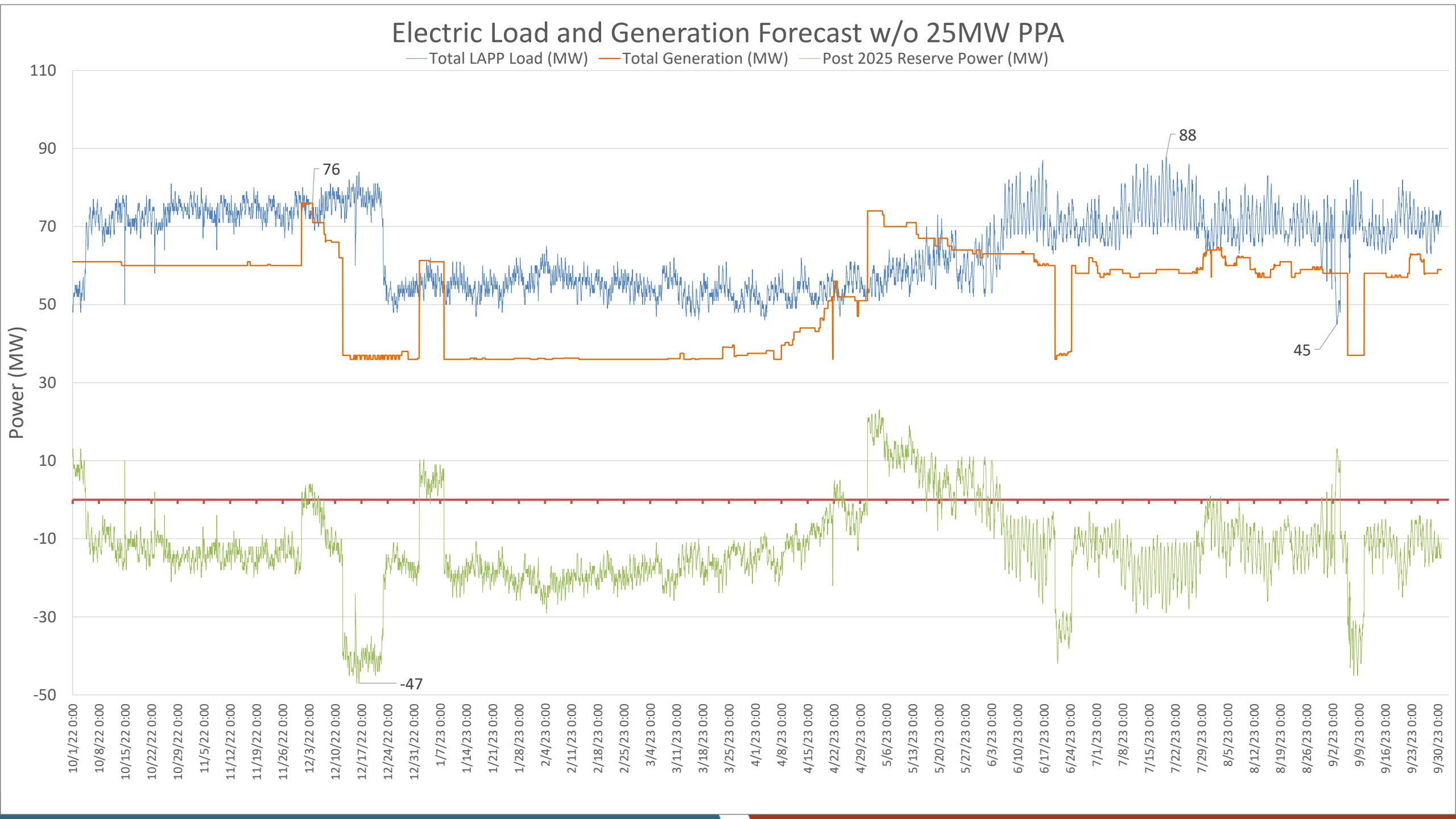
Solar and Storage Profile Example

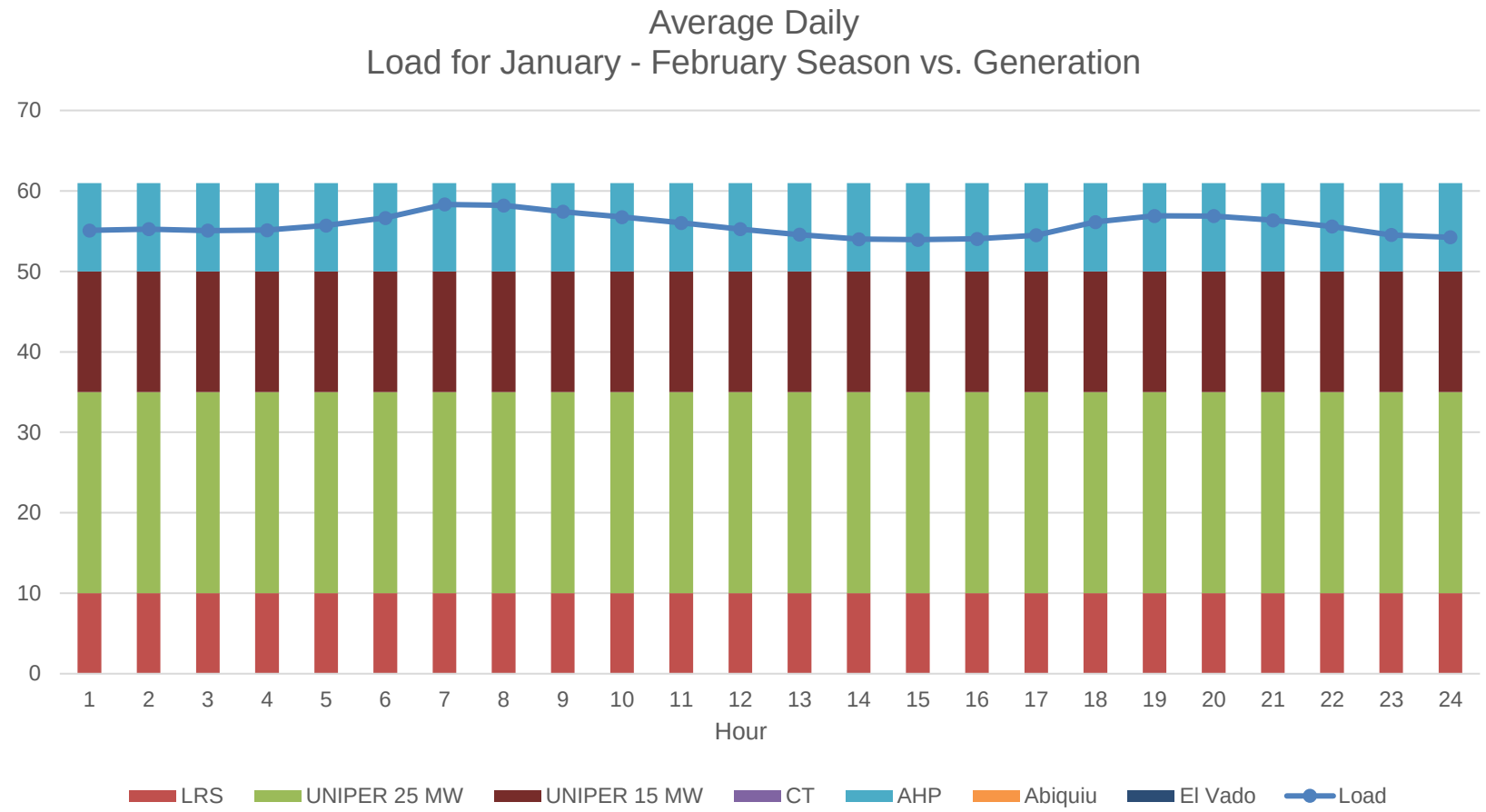


Solar and Storage Profile with Load



Electric Load and Generation Forecast w/o 25MW PPA




Average Daily
Load for January - February Season vs. Generation
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Hour
LRS
UNIPER 25 MW
UNIPER 15 MW
CT
AHP
Abiquiu
El Vado
Load

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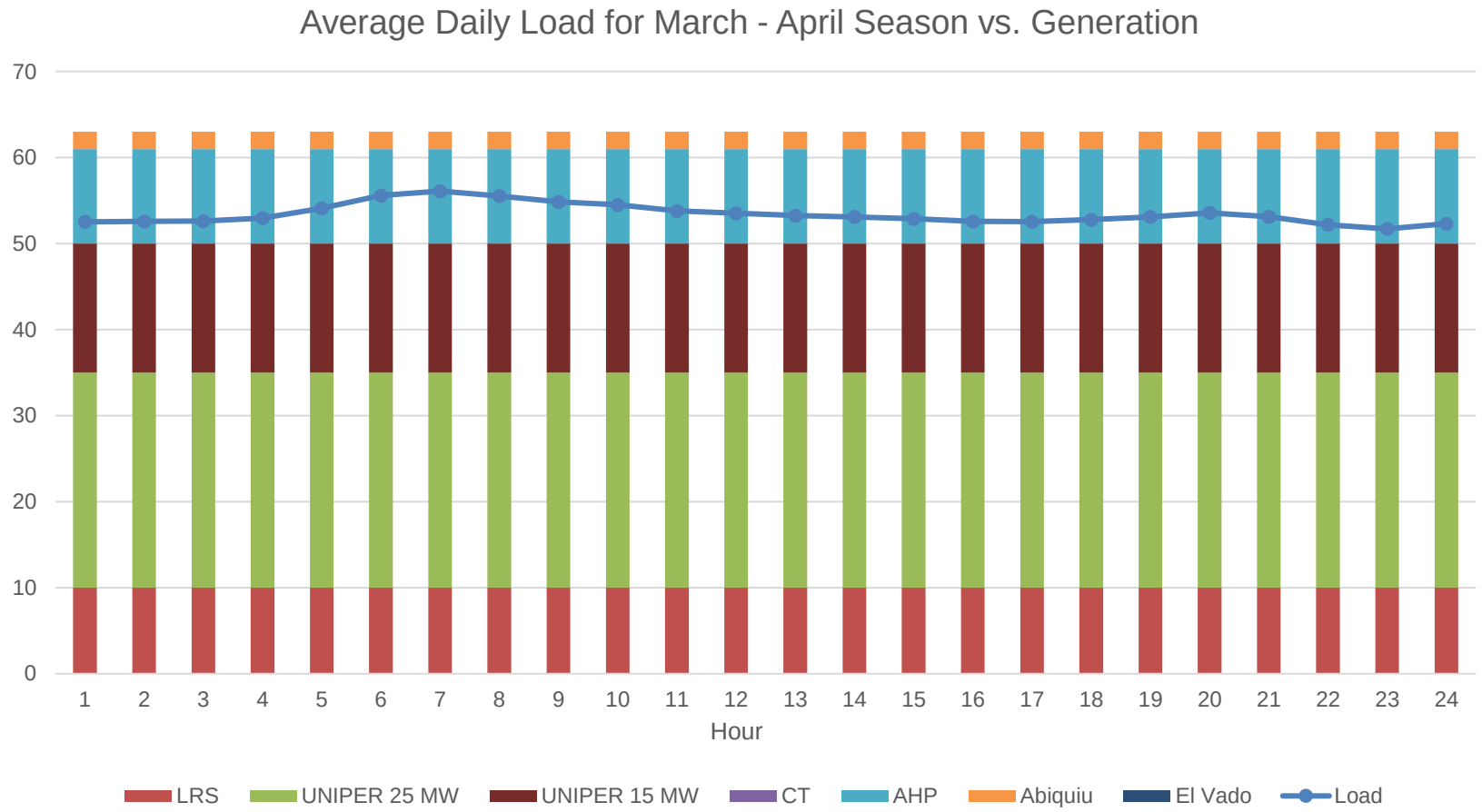

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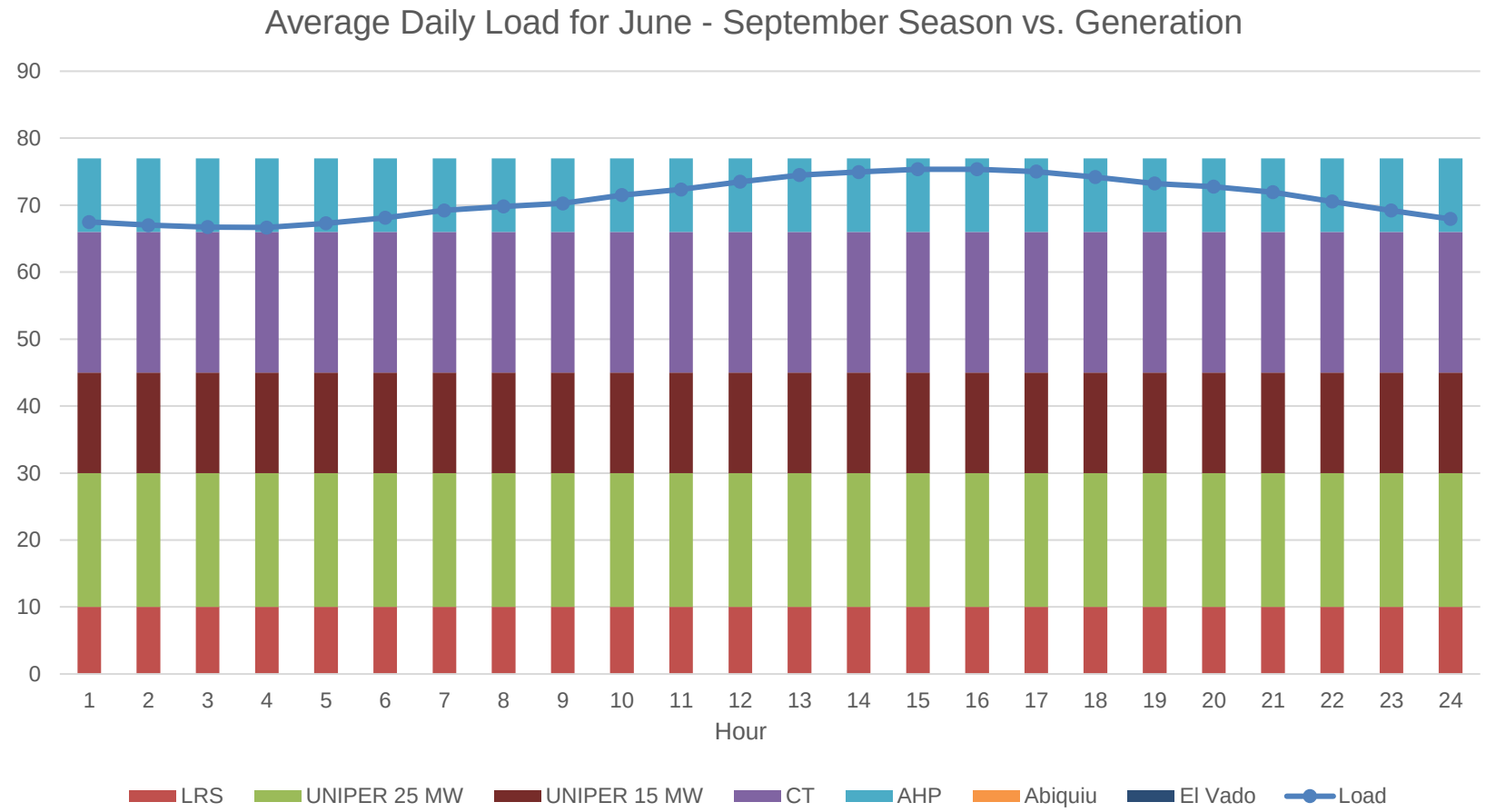
Average Daily Load for June - September Season vs. Generation
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
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16
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21
22
23
24
Hour
LRS
UNIPER 25 MW
UNIPER 15 MW
CT
AHP
Abiquiu
El Vado
Load

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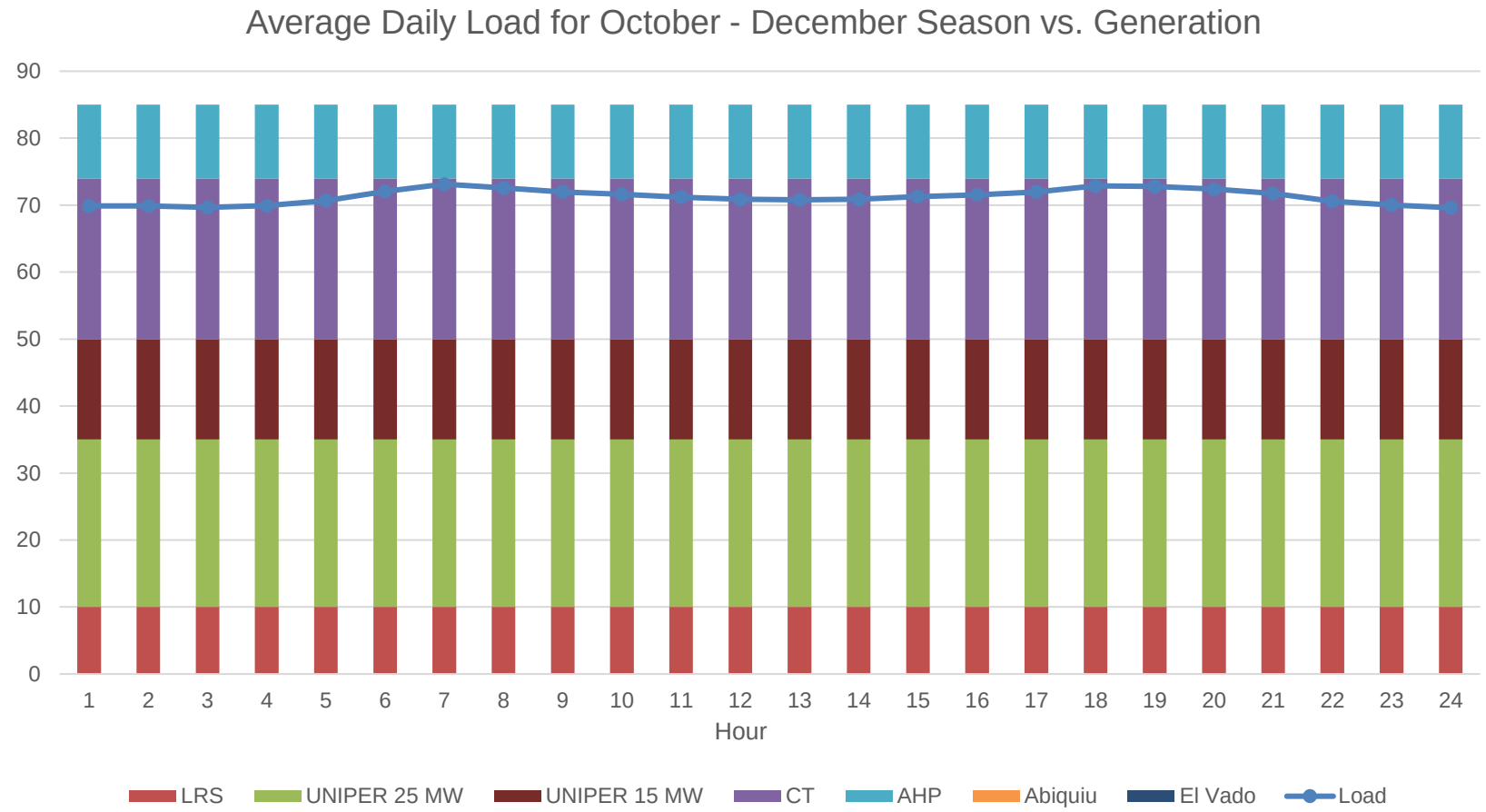

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