Integrated Resource Planning Preliminary Results Discussion

Presented to: Los Alamos County

June 26, 2017

ATTACHMENT A

Agenda

- Executive Summary
- IRP Approach
- Stochastic Inputs
- Stochastic Portfolio Assessment
  - Cost
  - Risk
  - Environmental
  - Operational
- Appendix

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Executive Summary

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Key Recommendations

- The County needs not to be in any rush to commit to new resources until several uncertainties regarding Small Modular Nuclear Reactors (SMNRs), solar and storage are resolved.
- San Juan cannot compete in the current market and should be retired early. Laramie River is an economic plant as a must run unit throughout the planning horizon.
- There are benefits to the partnership post 2025 that can create a win-win situation for LANL and LAC. But the current sharing arrangement would need to change to benefit both parties to the contract.
- The most balanced portfolio that meets renewable goals and carbon reduction targets is a portfolio that relies on solar and storage (based on current indicative bids).
- A portfolio with SMNRs could be competitive, if risk mitigation measures to protect ratepayers from cost overruns and schedule delays are in place.
- Hence, the optimal approach is to preserve optionality by continuing to pursue SMNR risk mitigation measures and preserve the ability to take advantage of declining solar and storage costs.
- Beyond building new renewable/ clean energy capacities to meet the carbon neutral goal and renewable objectives, additional gas-fired generation capacity, Combined Cycle (CC) or Reciprocating Internal Combustion Engines (RICE) involves upfront capital investment in a soft market, and is not advised unless control of resources is a priority to LAPP.
- However, RICE could be considered for firming or balancing purposes.

Balanced Score Card Summary

Criteria		Cost	Risk	Environmental	Operational	Overall
S1	CC, Solar/ Storage					
S2	CC, Solar/ Storage					
S3	RICE, Solar/ Storage					
S4	CC, RICE, Solar/ Storage					
S5	RICE, Solar/ Storage, SMNR					
S6	CC, RICE, Solar/ Storage, SMNR					
S7	CC, RICE, Solar/ Storage, SMNR					
S8	RICE, Solar PV					
S9	Solar/ Storage					
S10	Solar/ Storage, SMNR					
S11	CC, Solar / Storage (LAC not in compliance)					

Score Rating: Favorable Neutral Unfavorable

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Stochastic Portfolios 8, 9 and 10 Explore Renewable-Focused New Builds with Market Purchases

Portfolio	San Juan 4 Exit Date	LRS Exit	LAPP New Builds	Reserve Margin (2017-2036)
S8: Solar Firmed with RICE **Short Capacity**	2022	No Exit	**Large RICE:** • 2017- 18 MW; 2025- 18 MW; 2030- 18 MW **Solar PV:** • 2017- 25 MW; 2025- 25 MW; 2030- 25 MW	LAPP Summer: 9% LAPP Winter: -5%
S9: Solar with Storage **Short Capacity**	2022	No Exit	**Solar with Storage (onsite)**: • 2017- 13 MW; 2025- 8 MW • 2030- 6 MW	LAPP Summer: -11% LAPP Winter: -26%
S10: SMNR, Solar with Storage **Short Capacity**	2022	No Exit	**Solar with Storage (onsite)**: • 2017- 13 MW; 2025- 4 MW **Nuclear (offsite)**: • 2026- 16 MW	LAPP Summer: -9% LAPP Winter: -23%

- Staged new build of solar capacities is best to achieve 90 percent carbon neutral by 2036 for LAC and 30 percent on-site renewable generation during 2025-2036 for LANL.
- The firming mechanism could be either battery storage or on-site RICE units. On-site RICE units are more expensive but allow more flexibility during prolonged weather events when solar PV does not generate.
- A phased approach to add smaller and incremental capacity resources on a need basis provides overall lower cost benefits for LAPP as well as maintain flexibility in the face of future uncertainties.
- If SMNR costs can be capped and development risks can be mitigated, it could be considered especially in the event that local land becomes unavailable for the amount of solar needed to achieve renewable goals.

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Risk Integrated Resource Planning (RIRP) Approach

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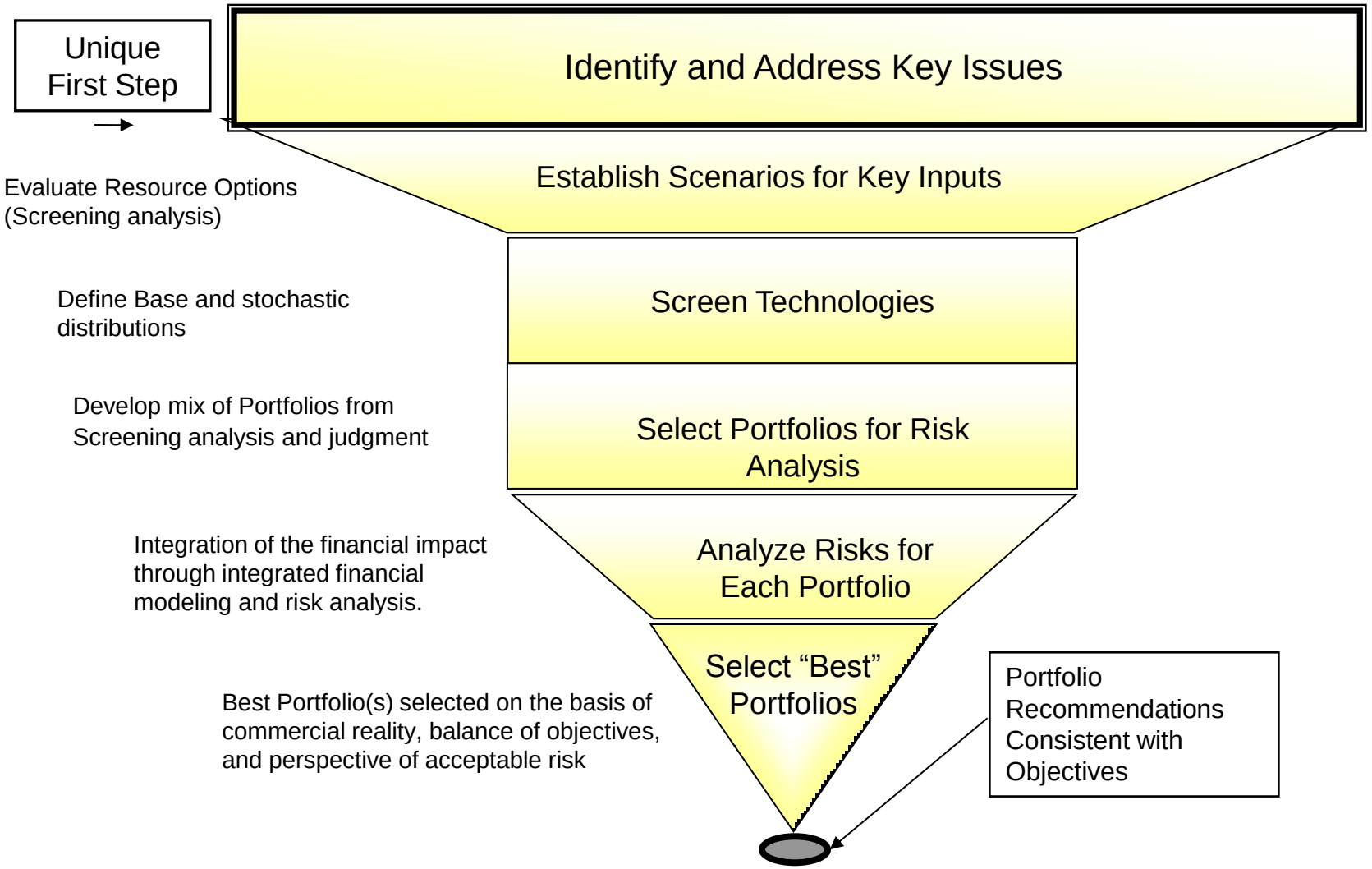
Pace Global's Structured RIRP Approach



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Step 1: Set Planning Objectives and Metrics

Objectives			Metrics
Cost	Cost	Minimize power supply costs	2017-2036 cost NPV
Risk	Cost Stability	Achieve cost stability	2017-2036 95th percentile cost NPV
Environmental	Environmental Stewardship	Increase renewable generation	2017-2036 renewable generation percentage
Operational	Transmission/ Largest Contingency	Reliance on transmission	Largest generation units depending on transmission
	Development Risks	Minimize project development risks	Project development uncertainties
	Control	Ensure reliability requirements with native capacity	2017-2036 reserve margin
	Weather Dependency	Decrease weather dependency	Availability of other generation resources during prolonged weather events

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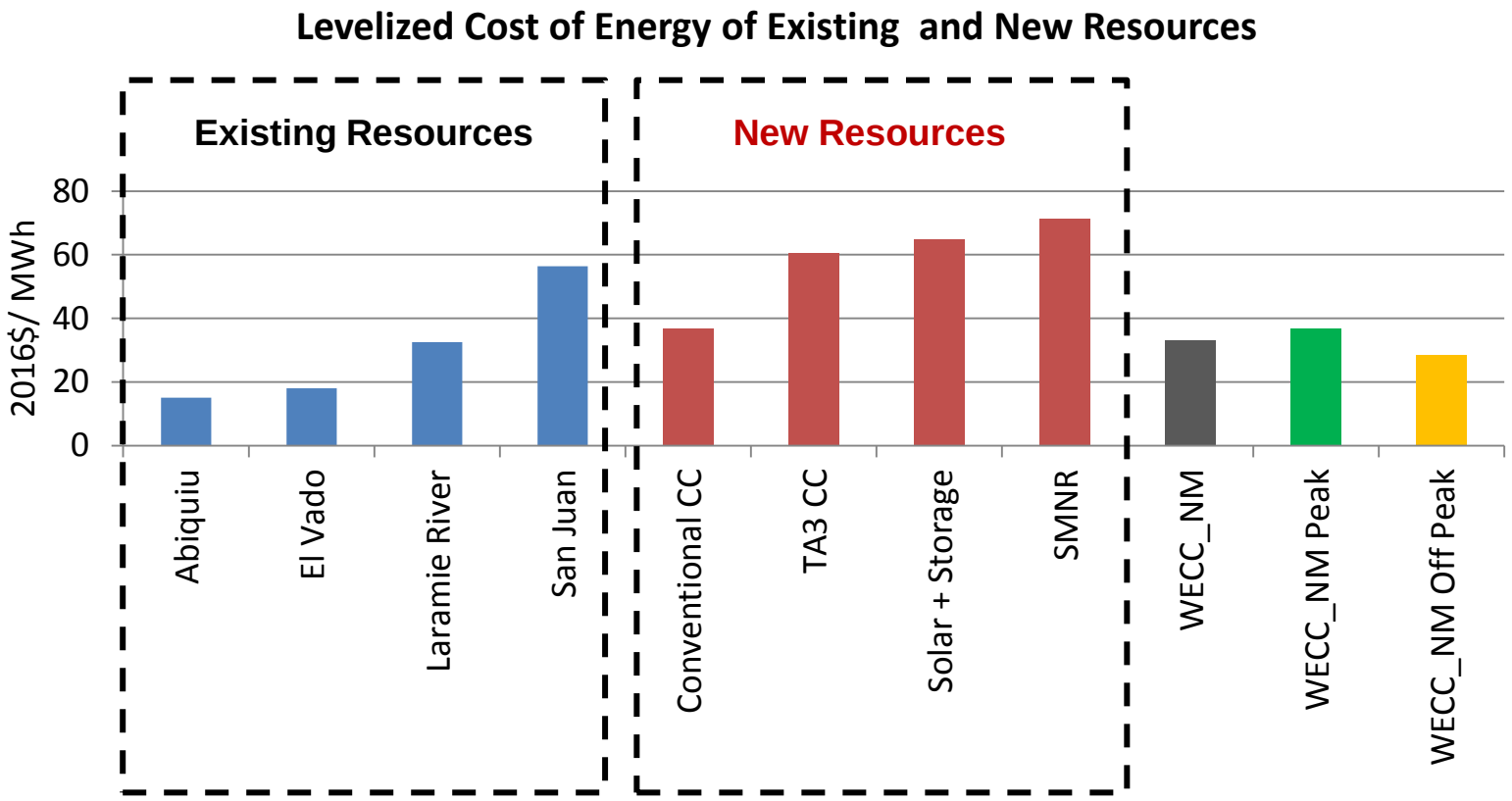
Issue 1: LCOE of Existing and New Resources shows LRS is in and SJGS 4 is out of the Money



Note: The average WECC New Mexico prices do not include any premium on block power purchases.

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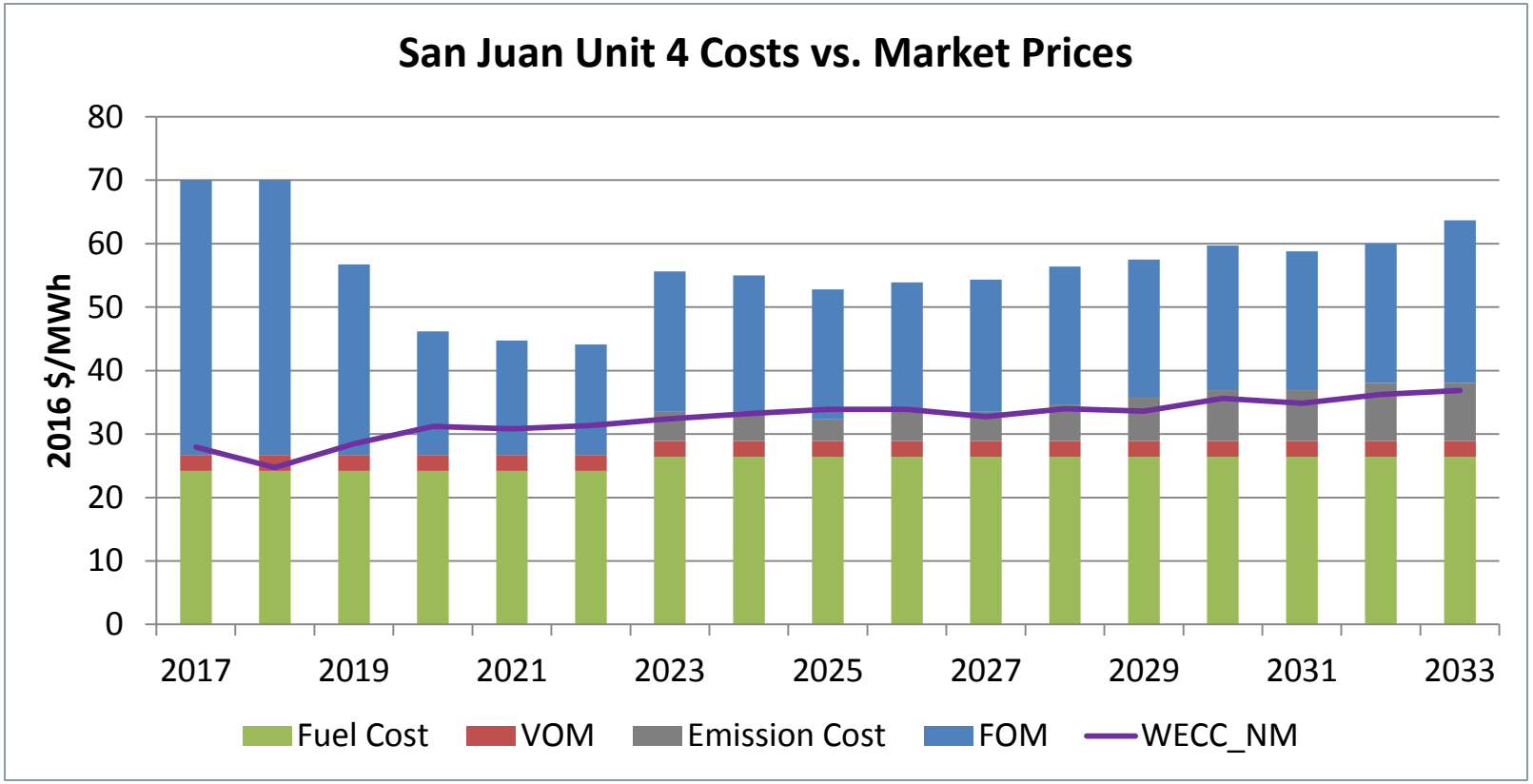
Issue 1a: SJGS 4 Early Exit is Economic Under Average Stochastic Market Prices



Note: San Juan unit 4 runs at minimum level during 2017-2033.

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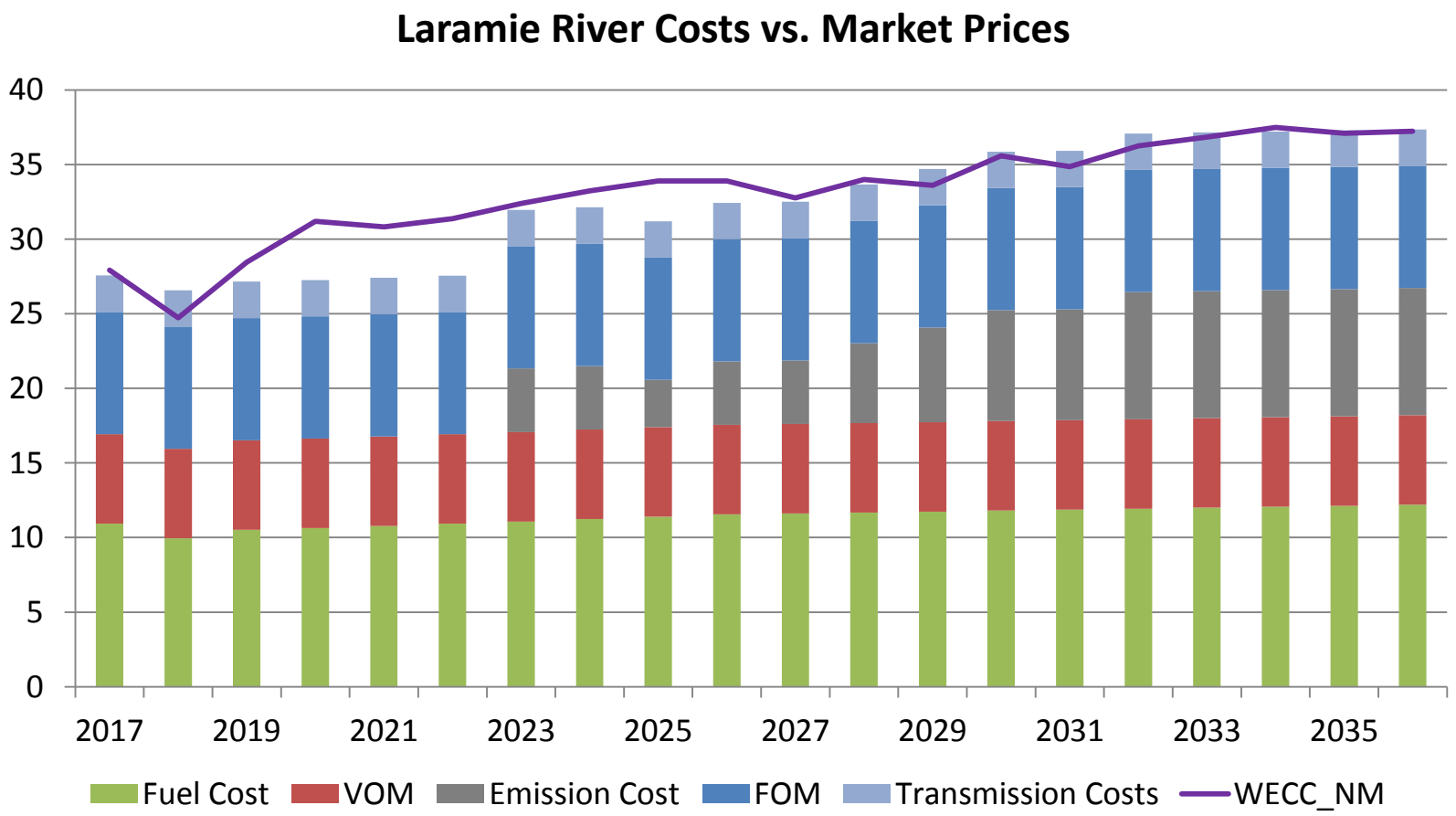
Issue 1b: LRS is Economic to Dispatch Under Average Stochastic Market Prices



Note: Above costs are based on LRS as a "must-run" unit during 2017-2036.

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Issue 2: Combined Portfolio is More Economic than Split Portfolios of LAC and LANL (Post 2025)

Portfolio	LAPP New Builds	Average Reserve Margin (2017-2036)	Total NPV Costs ($2016 Thousand)
D6 Base Portfolio	**Large CC:** • 2022- 50 MW • 2031- 30 MW **Solar with Storage**: • 2017- 13 MW; 2025- 8 MW • 2030- 6 MW	LAPP Summer:17% LAPP Winter: 3%	LAC : $ 63,993 LANL: $ 346,634 **Total : $ 410,627**
D7.1 (Split – LAC)	**Large CC:** • 2023- 5 MW **Solar with Storage:** • 2017- 3 MW; 2030- 6 MW	LAC Summer:85% LAC Winter: 9%	LAC: $ 56,883
D7.2 (Split – LANL)	**Large CC:** • 2023- 60 MW • 2031- 15 MW **Solar with Storage:** • 2017- 10 MW; 2025- 7 MW	LANL Summer:2% LANL Winter: 3%	LANL: $ 359,935
D7 (LAC + LANL)			LAC : $ 56,883 LANL: $ 359,935 **Total : $ 416,819**

- Splitting post 2025 results in lower costs for LAC, but higher costs for LANL. This suggests potentially different allocation of costs among the two parties for a win-win solution.
- Additional analysis should be conducted once some major uncertainties are resolved, LAC and LANL have finalized the Preferred Resource Plant and are in position to negotiate the 2025 contract.

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Issue 4: Spinning Reserve Could be Purchased From Market or Provided through Onsite Generation Resources

- Based on Pace Global's estimates, building medium sized RICE units on site could provide spinning reserve at similar costs to market purchases.

Estimated Costs of Spinning Reserve Purchase		
Spinning Reserve Requirement	MW	7
Average Price	$/MW	20
Annual Cost of Spinning Reserve	$	$1,226,400

Note: Price of spinning reserve for 2016 ranges $18-22/MW.

Building Medium Sized RICE Unit for Spinning Reserve		
Size	MW	9
Capital Cost	2016$/kW	1,507
Total Costs	2016$	13,562,640
FOM	2016$/kW-year	19
Capital Costs Recovery over 15 Year	2016$MW-year	$1,136,096
All-in Costs of Providing Spinning Reserve	2016$MW-year	$1,155,573

Note: Capital cost recovery is calculated at 3% over 15 years.

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Step 4: Construct Candidate Stochastic Portfolios to Assess Remaining Core Issues in Risk Analysis

Focus	#	Capacity	New Builds
Least Cost	S1	Long	**Large CC (offsite):** 2023- 60 MW; 2031- 30 MW **Solar with Storage (onsite):** 2017- 13 MW; 2025- 8 MW; 2030- 6 MW
	S2	Short	**Large CC (offsite):** 2023- 50 MW **Solar with Storage (onsite):** 2017- 13 MW; 2025- 8 MW; 2030- 6 MW
Ownership Control	S3	At Load	**Large RICE (onsite):** 2023- 18 MW X 3; 2031- 18 MW **Solar with Storage (onsite):** 2017- 13 MW; 2025- 8 MW; 2030- 6 MW
	S4	At Load	**Large CC (offsite) and RICE (onsite):** 2023- 50 MW CC; 2031- 18 MW RICE **Solar with Storage(onsite):** 2017- 13 MW; 2025- 8 MW; 2030- 6 MW
Diversified Portfolios with SMNR	S5	At Load	**Large RICE (onsite):** 2023- 18 MW X 3; 2031- 18 MW; **Solar with Storage (onsite):** 2017- 13 MW; 2025- 4 MW **Nuclear (offsite):** 2026- 16 MW
	S6	At Load	**Large CC (offsite) and RICE (onsite):** 2023- 50 MW CC; 2031- 18 MW RICE **Solar with Storage (onsite):** 2017- 13 MW; 2025- 4 MW **Nuclear (offsite):** 2026- 16 MW
	S7	Short	**Large CC (offsite) and RICE (onsite):** 2023- 20 MW CC; 2031- 18 MW RICE **Solar with Storage (onsite):** 2017- 13 MW; 2025- 4 MW; **Nuclear (offsite):** 2026- 16 MW
Renewable-Focused New Builds	S8	Short	**Large RICE**: 2017- 18 MW; 2025- 18 MW; 2030- 18 MW **Solar PV**: 2017- 25 MW; 2025- 25 MW; 2030- 25 MW
	S9	Short	**Solar with Storage (onsite)**: 2017- 13 MW; 2025- 8 MW; 2030- 6 MW
	S10	Short	**Solar with Storage (onsite)**: 2017- 13 MW; 2025- 4 MW **Nuclear (offsite)**: 2026- 16 MW
Cost of Compliance	S11	At Load	**Large CC (offsite):** 2023- 50 MW; 2031- 37 MW **Solar with Storage (onsite):** 2017- 10 MW; 2025- 5 MW

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PACE GLOBAL®
A Siemens Business

Stochastic Portfolio Assessment

Mass-based Intrastate Trading

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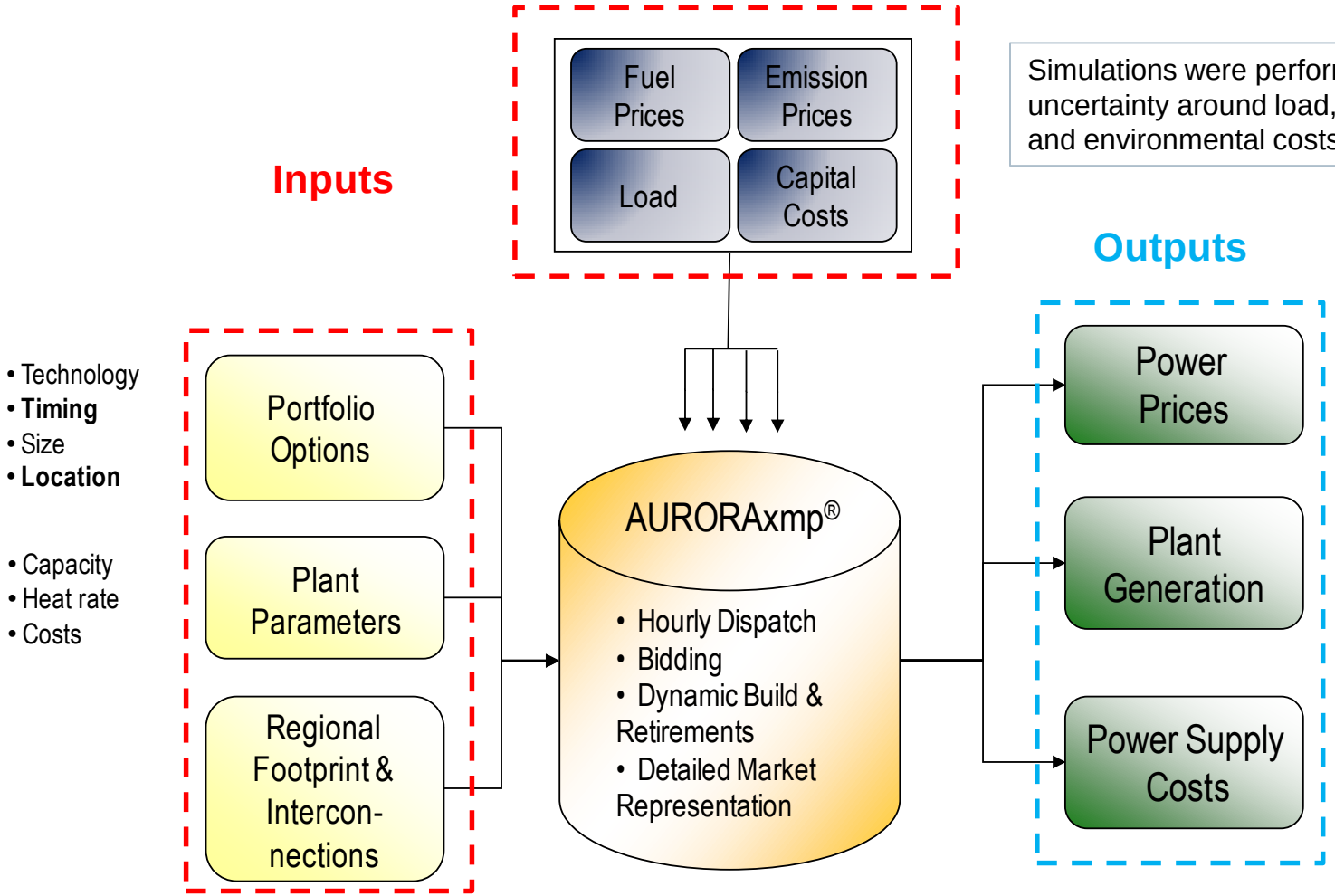
Step 5: Perform Stochastic Assessment



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Stochastic Inputs & Relevant Driver Variables

1. Load

- Peak Load
- Average Load

Driver Variables:
- Weather
- GDP / Personal Income
- DSM/ DER studies
- Data on *Quantum* events

2. Natural Gas

- Henry Hub
- Transco Zone 6
- CC Gate
- SoCal

Modeling based on:
- Hist. Volatility
- Hist. Mean Reversion
- Hist. Correlation
- Expert view on low, mid & high cases

3. Coal

- CAPP
- NAPP
- ILB
- PRB

Modeling based on:
- Hist. Volatility
- Hist. Mean Reversion
- Hist. Correlation
- Expert view on low, mid & high cases

4. CO_2

- National CO_2
- Regional (California and RGGI) CO_2

Modeling based on:
- Expert view on low, mid & high cases
- The 3 cases considered as 5th, 50th and 75th percentiles.

5. Capital Cost

- All relevant technologies included

Modeling based on:
- Expert view on low, mid & high cases
- The 3 cases considered as 5th, 50th and 95th percentiles.

Feedback and Correlation Analysis

A separate process to consider the effects of Coal & CO_2 prices on Natural Gas prices. The effects are based on historical and projected statistical relationships between gas-coal demand switching

Customization:

If client-specific load forecast is provided, we make use of it to come up with distributions around it.

To develop load projections for a specific regional footprint, we consider the customer classification, economic activity, etc. as well.

Fuel Commodity Distributions:

Three sets of distributions for each of low, mid and high cases

Combine the three sets of distributions into one set using probabilities of 15%, 70% and 15% respectively

To capture high-side and low-side satisfactorily

Distributions:

The distributions developed also take into account the probability of CO_2 program not taking effect.

High and low expert opinions are undertaken to capture high-side and low-side satisfactorily in the final distribution.

Distributions:

Parametric distribution is modeled as a Geometric Brownian Motion (GBM) model.

Quantum distribution is developed using the high and low cases in the expert opinion.

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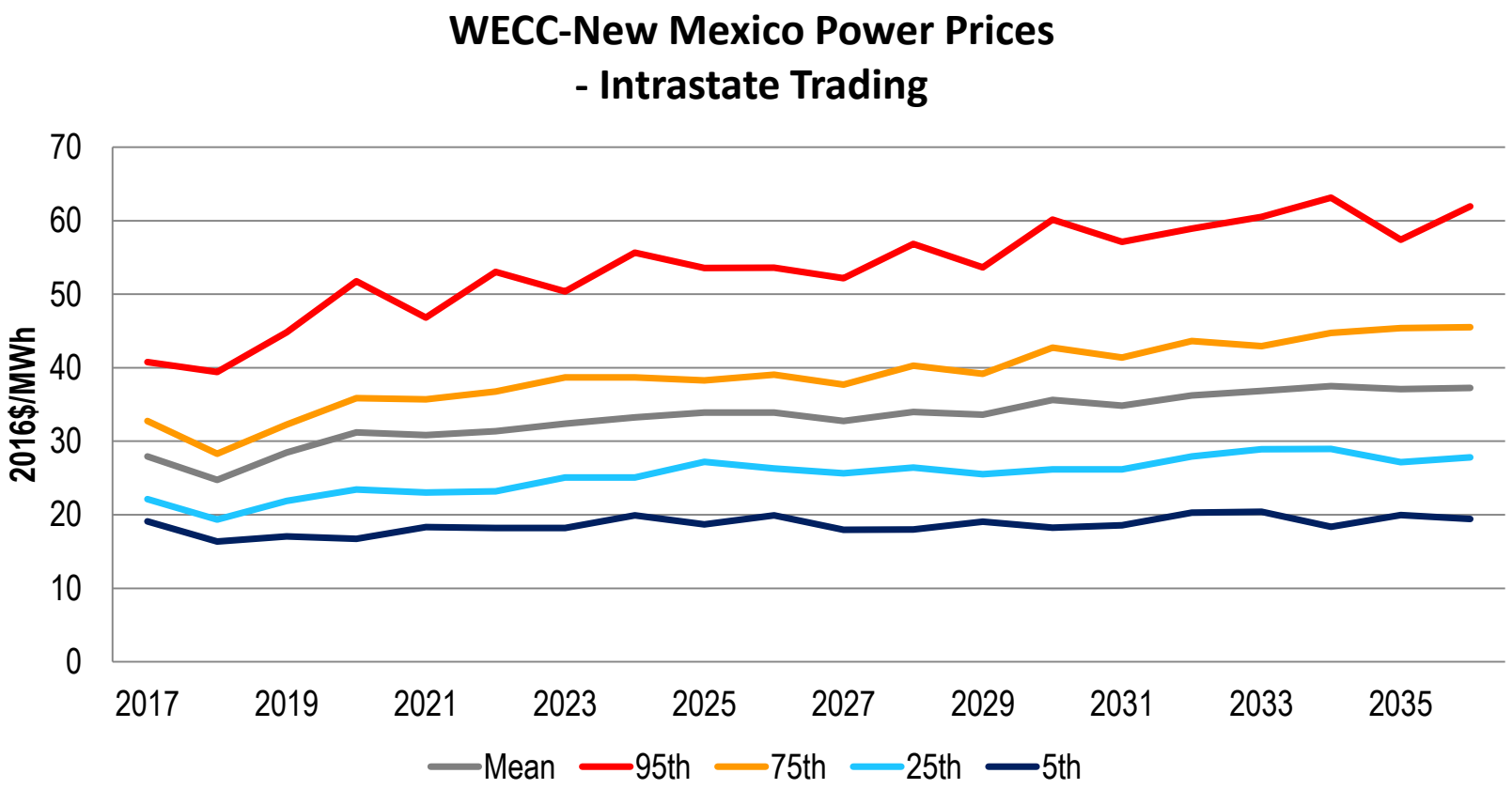
Pace Global Stochastic Analysis Indicates Power Prices in New Mexico Remain Below $50/MWh by 2036 (75th Percentile)



Note: The prices are under the mass-based intrastate stochastic results for the New Mexico power zone. The prices under the mass-based interstate stochastic results are similar but on average ~2% higher than what is shown in this slide.

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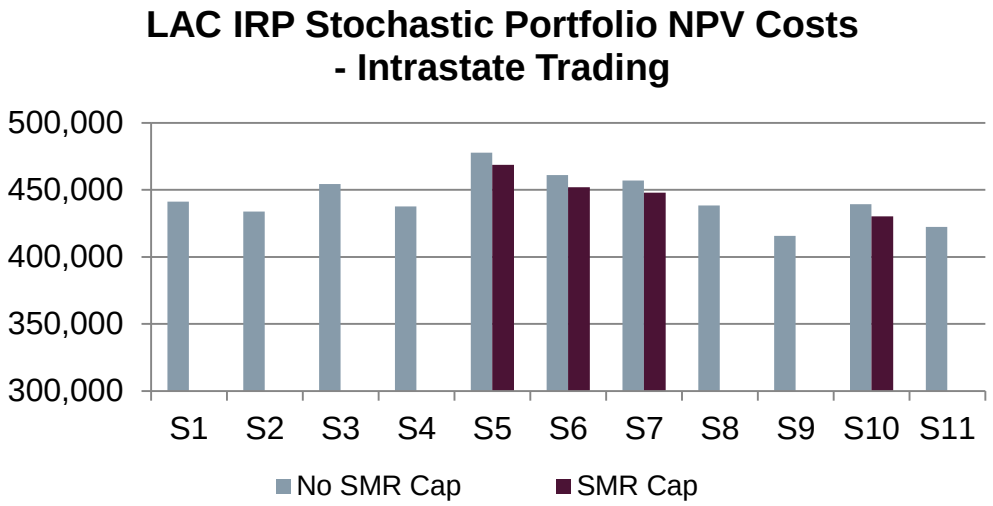
Cost Metric: 20-year Cost NPV Ranking



Stochastic Portfolios	
S1	CC, Solar with Storage
S2	CC, Solar with Storage
S3	RICE, Solar with Storage
S4	CC, RICE, Solar with Storage
S5	RICE, Solar with Storage, SMR
S6	CC, RICE, Solar with Storage, SMR
S7	CC, RICE, Solar with Storage, SMR
S8	RICE, Solar PV
S9	Solar with Storage
S10	Solar with Storage, SMR
S11	CC, Solar with Storage (LAC not in compliance)

Stochastic Portfolios - Intrastate Trading	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
NPV Costs without SMR Cap (thousand $2016)	441,317	433,814	454,448	437,774	477,805	461,131	456,975	438,432	415,770	439,223	422,502
Percentage Above Lowest Cost Portfolio	6.14%	4.34%	9.30%	5.29%	14.92%	10.91%	9.91%	5.45%	0.00%	5.64%	1.62%
Index Ranking without SMR Cap (0-10 Scale)	4.12	2.91	6.23	3.55	10.00	7.31	6.64	3.65	0.00	3.78	1.09
Assessment without SMR Cap	🟡	🟢	🟡	🟡	🔴	🔴	🟡	🟡	🟢	🟡	🟢
NPV Costs with SMR Cap (thousand $2016)	441,317	433,814	454,448	437,774	468,763	452,089	447,932	438,432	415,770	430,181	422,502
Index Ranking with SMR Cap (0-10 Scale)	4.82	3.41	7.30	4.15	10.00	6.85	6.07	4.28	0.00	2.72	1.27
Assessment with SMR Cap	🟡	🟡	🟡	🟡	🔴	🔴	🟡	🟡	🟢	🟢	🟢

20-year Cost NPV Ranking

🟢 Index < 3.33

🟡 Index 3.34 – 6.67

🔴 Index > 6.67

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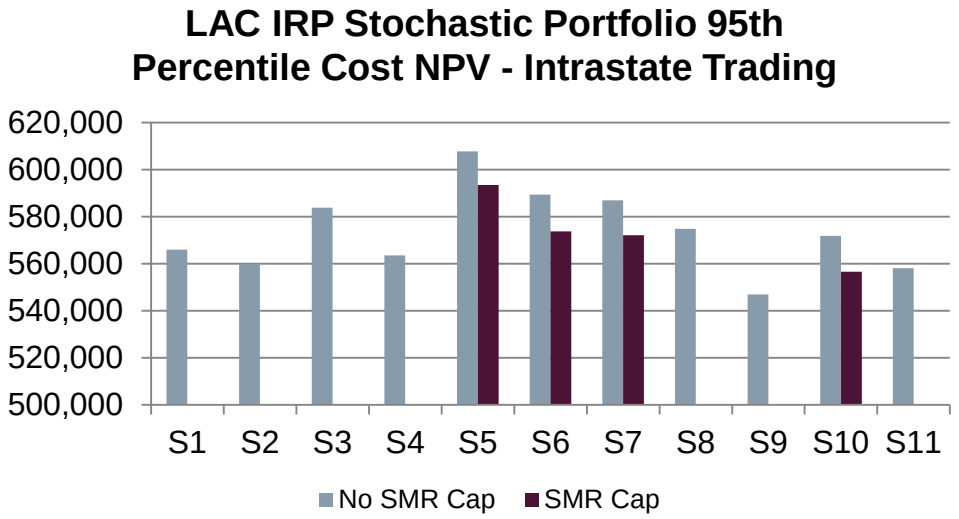
Risk Metric: 95th Percentile 20-year Cost NPV Ranking



Stochastic Portfolios	
S1	CC, Solar with Storage
S2	CC, Solar with Storage
S3	RICE, Solar with Storage
S4	CC, RICE, Solar with Storage
S5	RICE, Solar with Storage, SMR
S6	CC, RICE, Solar with Storage, SMR
S7	CC, RICE, Solar with Storage, SMR
S8	RICE, Solar PV
S9	Solar with Storage
S10	Solar with Storage, SMR
S11	CC, Solar with Storage (LAC not in compliance)

Stochastic Portfolios - Intrastate Trading	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
95th Percentile without SMR Cap (thousand $2016)	565,965	559,901	583,737	563,512	607,668	589,369	586,982	574,870	546,975	571,765	558,009
Percentage Above Lowest Cost Portfolio	3.5%	2.4%	6.7%	3.0%	11.1%	7.8%	7.3%	5.1%	0.0%	4.5%	2.0%
Index Ranking without SMR Cap (0-10 Scale)	3.13	2.13	6.06	2.72	10.00	6.98	6.59	4.60	0.00	4.08	1.82
Assessment without SMR Cap	🟢	🟢	🟡	🟢	🔴	🔴	🟡	🟡	🟢	🟡	🟢
95th Percentile with SMR Cap (thousand $2016)	565,965	559,901	583,737	563,512	593,428	573,680	572,084	574,870	546,975	556,616	558,009
Index Ranking with SMR Cap (0-10 Scale)	4.09	2.78	7.91	3.56	10.00	5.75	5.41	6.00	0.00	2.08	2.38
Assessment with SMR Cap	🟡	🟢	🔴	🟡	🔴	🟡	🟡	🟡	🟢	🟢	🟢

95th Percentile 20-year Cost NPV Ranking

🟢 Index < 3.33

🟡 Index 3.34 – 6.67

🔴 Index > 6.67

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Environmental Metric: LAC Renewable Generation Share Ranking in 2036

Stochastic Portfolios	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
LAC RPS Level in 2036	94%	94%	94%	94%	95%	95%	95%	91%	94%	95%	30%
Assessment (Green: LAC in compliance; red: LAC out of compliance)	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴

Stochastic Portfolios	
S1	CC, Solar with Storage
S2	CC, Solar with Storage
S3	RICE, Solar with Storage
S4	CC, RICE, Solar with Storage
S5	RICE, Solar with Storage, SMR
S6	CC, RICE, Solar with Storage, SMR
S7	CC, RICE, Solar with Storage, SMR
S8	RICE, Solar PV
S9	Solar with Storage
S10	Solar with Storage, SMR
S11	CC, Solar with Storage (LAC not in compliance)

Renewable Generation Share in 2036 Ranking

🟢 In Compliance with Interim Carbon Neutral Goal 🔴 Out of Compliance with Interim Carbon Neutral Goal

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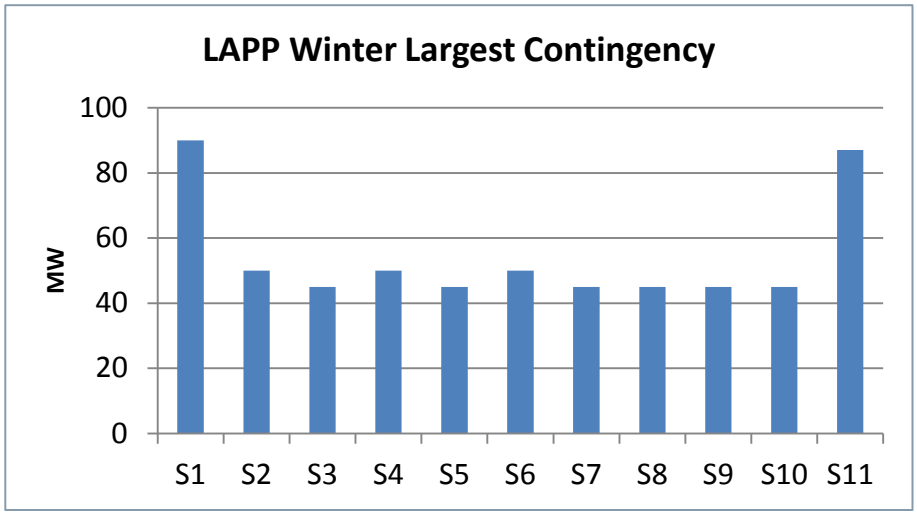
Operational Metric 1: Transmission/Largest Contingency Risk Ranking



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S6	CC, RICE, Solar with Storage, SMR
S7	CC, RICE, Solar with Storage, SMR
S8	RICE, Solar PV
S9	Solar with Storage
S10	Solar with Storage, SMR
S11	CC, Solar with Storage (LAC not in compliance)

- The largest contingency captures unit level generation risk and site level transmission risks in worst case scenarios.

Stochastic Portfolios	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
Largest Contingency	90	50	45	50	45	50	45	45	45	45	87
Percentage Above Best Portfolio	100%	11%	0%	11%	0%	11%	0%	0%	0%	0%	93%
Index Ranking (0-10 Scale)	10.00	1.11	0.00	1.11	0.00	1.11	0.00	0.00	0.00	0.00	9.33
Assessment (Green < 3.33; Yellow 3.34-6.67; Red > 6.67)	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴

Transmission/ Largest Contingency Ranking

🟢 Index < 3.33

🟡 Index 3.34 – 6.67

🔴 Index > 6.67

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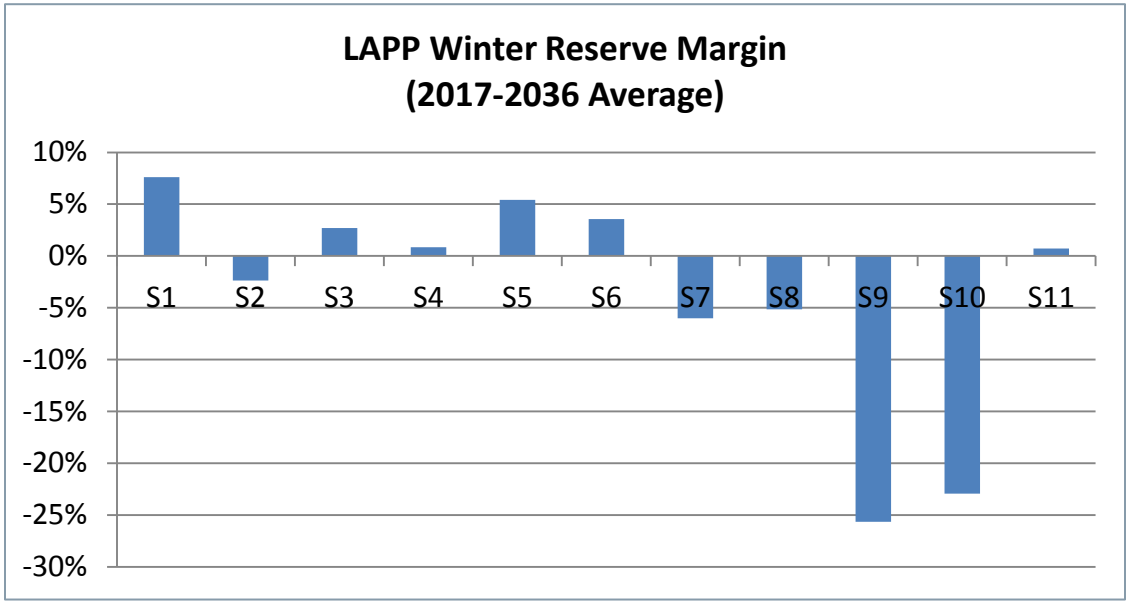
Operational Metric 2: Control Risk (Average Reserve Margin Ranking)



Stochastic Portfolios	
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S2	CC, Solar with Storage
S3	RICE, Solar with Storage
S4	CC, RICE, Solar with Storage
S5	RICE, Solar with Storage, SMR
S6	CC, RICE, Solar with Storage, SMR
S7	CC, RICE, Solar with Storage, SMR
S8	RICE, Solar PV
S9	Solar with Storage
S10	Solar with Storage, SMR
S11	CC, Solar with Storage (LAC not in compliance)

Stochastic Portfolios	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
Winter Reserve Margin	8%	-2%	3%	1%	5%	4%	-6%	-5%	-26%	-23%	1%
Index Ranking (0-10 Scale)	0.00	3.00	1.48	2.04	0.66	1.22	4.10	3.84	10.00	9.18	2.07
Assessment (Green < 3.33; Yellow 3.34-6.67; Red > 6.67)	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🟡	🔴	🔴	🟢

2017-2036 Average Reserve Margin Ranking

🟢 Index < 3.33

🟡 Index 3.34 – 6.67

🔴 Index > 6.67

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Operational Metric 3: Development Risks Assessment

Portfolio	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
New Resources	Solar	Solar	Solar	Solar	Solar	Solar	Solar	Solar	Solar	Solar	Solar
	Storage	Storage	Storage	Storage	Storage	Storage	Storage		Storage	Storage	Storage
	CC	CC		CC		CC	CC				CC
			RICE	RICE	RICE	RICE	RICE	RICE			
					SMNR	SMNR	SMNR			SMNR	
Development Risk Assessment											

- SMNR project adds development risk to the portfolio because of technology, regulatory, cost, financing and schedule uncertainties. Portfolios with SMNR are rated red if development risk is un-mitigated and rated yellow-green if the development risk is mitigated.
- Offsite large CC could potentially add development risk, but at a much moderate level in comparison to SMNR.
- Portfolios S3, S8 and S9 utilizes new resources with proven technology to be built on site and therefore has the lowest development risk.

Stochastic Portfolios	
S1	CC, Solar with Storage
S2	CC, Solar with Storage
S3	RICE, Solar with Storage
S4	CC, RICE, Solar with Storage
S5	RICE, Solar with Storage, SMR
S6	CC, RICE, Solar with Storage, SMR
S7	CC, RICE, Solar with Storage, SMR
S8	RICE, Solar PV
S9	Solar with Storage
S10	Solar with Storage, SMR
S11	CC, Solar with Storage (LAC not in compliance)

Operational Metric 4: Weather Dependent Risks Assessment

Stochastic Portfolios	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
New Resources	Solar	Solar	Solar	Solar	Solar	Solar	Solar	Solar	Solar	Solar	Solar
	Storage	Storage	Storage	Storage	Storage	Storage	Storage		Storage	Storage	Storage
	CC	CC		CC		CC	CC				CC
			RICE	RICE	RICE	RICE	RICE	RICE			
					SMNR	SMNR	SMNR			SMNR	
Portfolio Weather Dependent Assessment											

- Portfolio 9 adds solar with storage as new resources and is exposed to the market when there is continued cloudy or rainy days.
- All other portfolios have either fossil or nuclear generation in addition to solar and are less weather dependent.

Stochastic Portfolios	
S1	CC, Solar with Storage
S2	CC, Solar with Storage
S3	RICE, Solar with Storage
S4	CC, RICE, Solar with Storage
S5	RICE, Solar with Storage, SMR
S6	CC, RICE, Solar with Storage, SMR
S7	CC, RICE, Solar with Storage, SMR
S8	RICE, Solar PV
S9	Solar with Storage
S10	Solar with Storage, SMR
S11	CC, Solar with Storage (LAC not in compliance)

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Operational Metrics (1-4) Summary

Criteria		Transmission/Largest Contingency Risk	Control	Development Risk	Weather Risk	Operational Metrics Summary
S1	CC, Solar with Storage					
S2	CC, Solar with Storage					
S3	RICE, Solar with Storage					
S4	CC, RICE, Solar with Storage					
S5	RICE, Solar with Storage, SMNR					
S6	CC, RICE, Solar with Storage, SMNR					
S7	CC, RICE, Solar with Storage, SMNR					
S8	RICE, Solar PV					
S9	Solar with Storage					
S10	Solar with Storage, SMNR					
S11	CC, Solar with Storage (LAC not in compliance)					

Score Rating: Favorable Neutral Unfavorable

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Balanced Score Card Summary

Criteria		Cost	Risk	Environmental	Operational	Overall
S1	CC, Solar/ Storage					
S2	CC, Solar/ Storage					
S3	RICE, Solar/ Storage					
S4	CC, RICE, Solar/ Storage					
S5	RICE, Solar/ Storage, SMNR					
S6	CC, RICE, Solar/ Storage, SMNR					
S7	CC, RICE, Solar/ Storage, SMNR					
S8	RICE, Solar PV					
S9	Solar/ Storage					
S10	Solar/ Storage, SMNR					
S11	CC, Solar / Storage (LAC not in compliance)					

Score Rating: Favorable Neutral Unfavorable

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Pivot Strategies

Strategy	Risk	Mitigation	Pivot Strategy
S9: Solar/ Storage	Land/ Storage cost	Consider SMNR or RICE	Portfolios S8 (Add RICE) or S10 (Add SMNR)
S10: SMNR	Contract/Price caps	Replace SMNR with Solar/Storage	Portfolio S9 (Solar with storage)
S8: Rice	High Gas Prices	Replace Gas with Solar/Storage	Portfolio S9 (Solar with storage)
	Need more control of resources	Building CC to fulfill load	Portfolio S2
	Land/Gas Prices	Replace Solar/Gas with SMNR	Portfolio S10
	SMNR/Gas Prices	Replace SMNR/Gas with Solar	Portfolio S9
	SMNR mitigation works	Focus on SMNR	Portfolio S10

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Appendix

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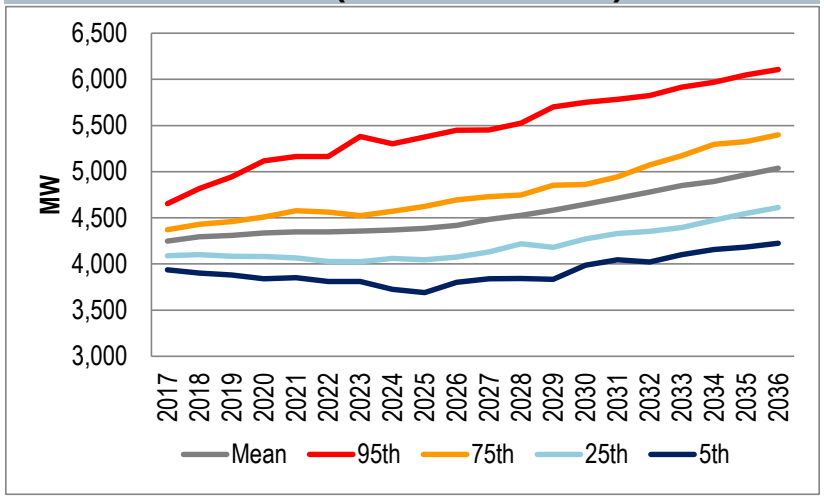
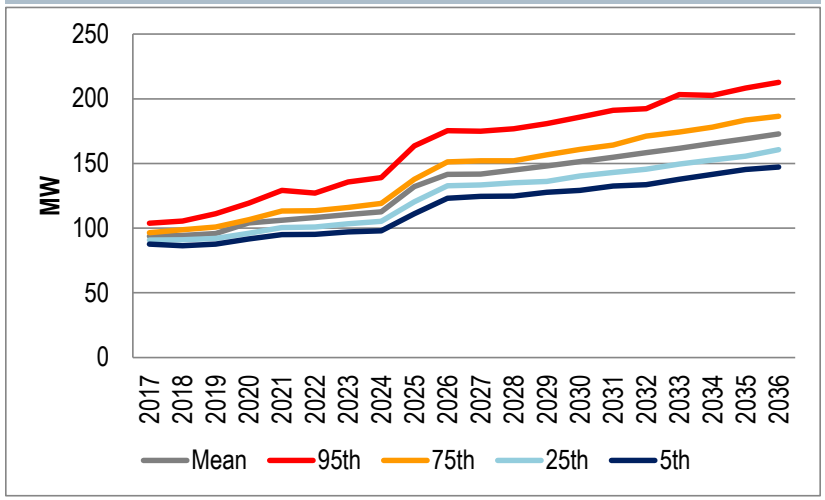
Stochastic Market Input Drivers for the 2017 LAC IRP

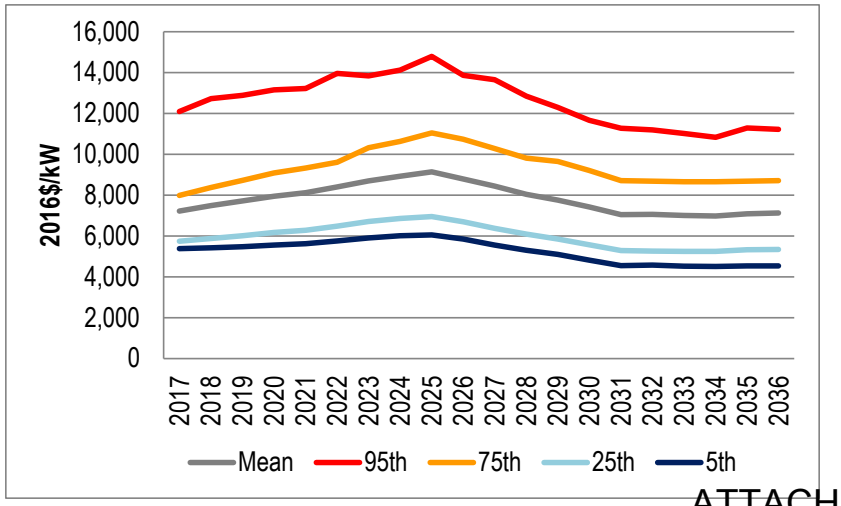
Demand (NM Peak Demand)



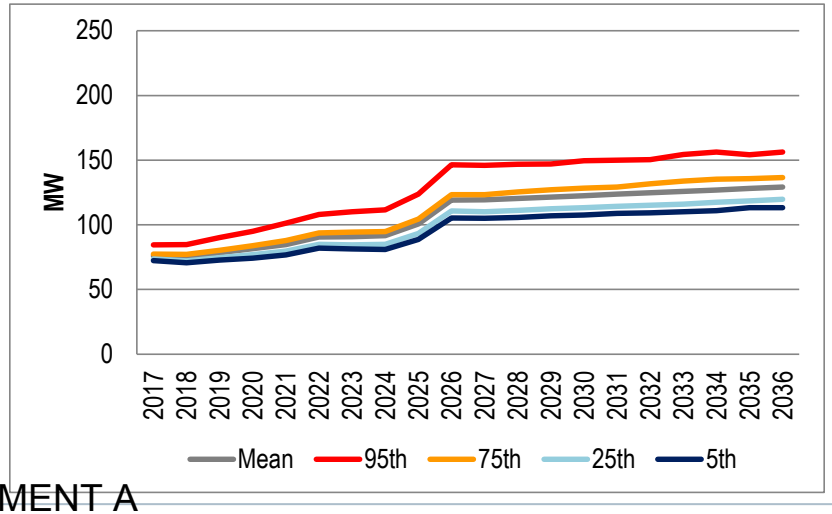
LAPP Peak Load



SMNR Capital Costs



LAPP Average Load



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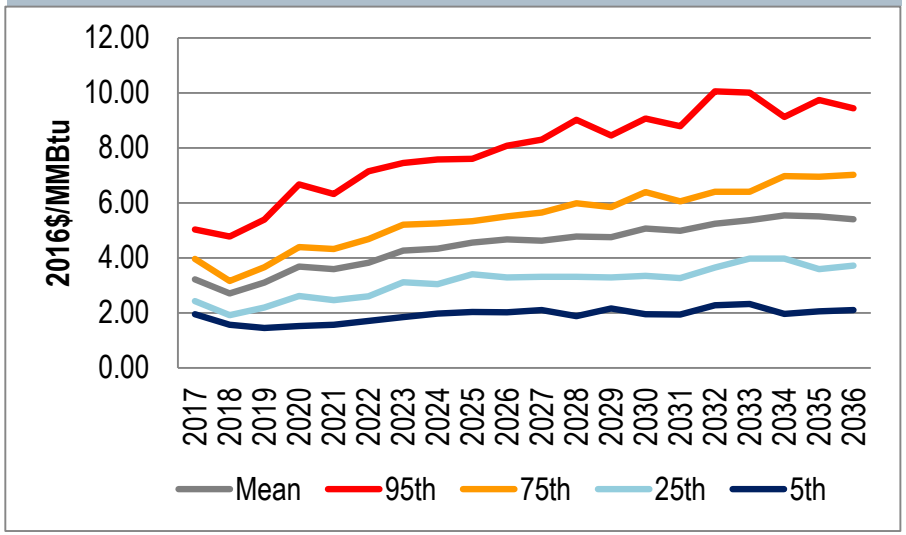
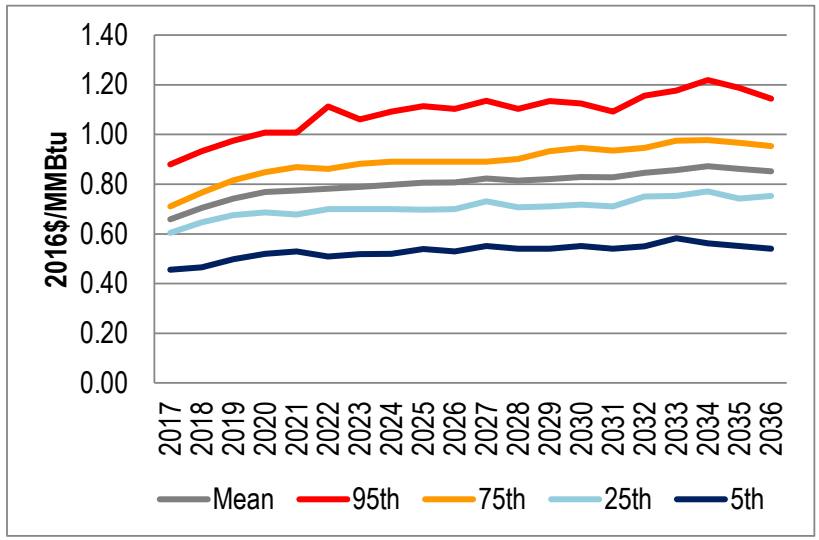
Stochastic Market Input Drivers for the 2017 LAC IRP

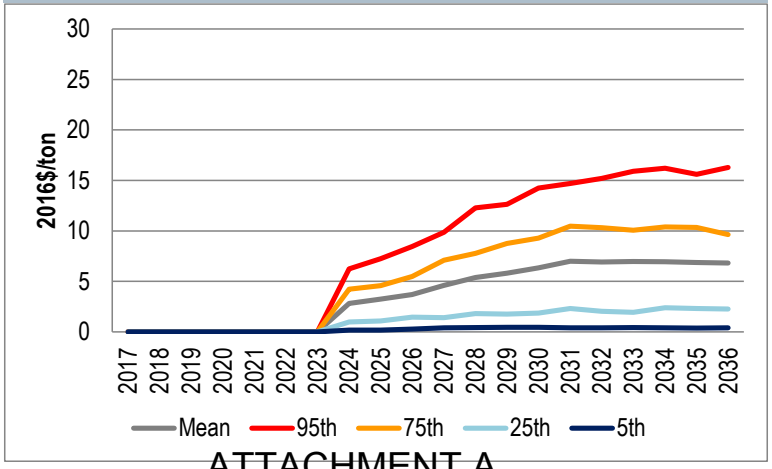
Delivered Gas Prices



PRB Coal Prices



Environmental Price (Mass Based CO_2)



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List of IRP Key Issues

1. Participation agreement in the coal-fired projects
    a) San Juan Generation Station Unit 4 (SJGS 4) participation beyond 2022, 2028, 2033
    b) Most economical time to exit the Laramie River Station (LRS) PPA by 2020, 2025 or no exit
2. How can Los Alamos and LANL move forward post 2025?
3. Participation in the UAMPS Carbon Free Power Project (CFPP) using Small Modular Reactor (SMNR); Transmission for the CFPP with all of the movement and discussions around a combined Independent System Operator (ISO)
4. Cost-effectively meet the requirements for reliable and economic operations inside the Balancing Area of the Public Service Company of New Mexico (PNM)
5. Possible options for DPU to meet the policies established by the adopted FER committee recommendation
6. What is the best portfolio of resources to meet DPU's goal of being carbon neutral by 2040?

Key Findings

Factors	Key Questions and Findings
Issue 1: Coal Assets Ownership	Decisions regarding SJGS 4 participation beyond 2022, 2028, 2033. Early exit of SJGS 4 is cost competitive. Most economical time to exit the LRS PPA by 2020, 2025 or no exit. Holding onto LRS PPA is cost competitive.
Issue 2: ECA Decisions	How can LAC and LANL move forward post 2025? ECA extension post 2025 provides lower NPV costs for LAPP during the study period. However, LANL benefits from joint operation while LAC benefits from separation, suggesting a win-win with a different allocation scheme.
Issue 3: CFPP SMNR	Participation in the UAMPS CFPP using Small Modular Reactor (SMNR)? Participation in the UAMPS CFPP using SMNR resulted in higher NPV costs in the stochastic analysis and introduces development risks. However, if the contract PPA price could be capped at acceptable levels and the development risks could be mitigated, the SMNR can be considered especially if local land becomes unavailable for solar.
Issue 4: Reliable and economic operations	Cost-effectively meet the requirements for reliable and economic operations inside the Balancing Area of the Public Service Company of New Mexico (PNM). LAC could either rely on market purchase for spinning reserve or build medium sized RICE units to provide.

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Key Findings (2/2)

Factors	Key Findings
Issue 5: Technology Options	Possible options for DPU to meet the policies established by the adopted FER committee recommendation • CC is cost competitive resources, but does not help advance the carbon neutral goal. • On-site solar firmed with storage with around-the-clock green energy is desirable at current indicative PPA prices. • If SMNR costs can be capped and development risks can be mitigated, it can be considered especially in the event that local land becomes unavailable for solar.
Issue 6: Preferred Resource Plan	What is the best portfolio of resources to meet DPU's goal of being carbon neutral by 2040? • On-site solar firmed with storage with around-the-clock green energy is desirable at current indicative PPA prices, but is exposed to market during prolonged weather events when solar does not generate. • On-site solar firmed with large RICE units offers more dispatch control and flexibility, but at a higher cost. • If SMNR costs can be capped and development risks can be mitigated, it can be considered especially in the event that local land becomes unavailable for the amount of solar needed.
View on Capacity vs Load Projections	Should LAPP build resource capacities to be long, at load or short? • The current market outlook does not reward portfolios with excess capacity. • Short positions (e.g. purchasing some from market is a prudent strategy considering load uncertainties due to distributed generation and weak overall market projections. • However, the IRP allows for new build flexibility if LANL's operation requires onsite generation and closer alignment of load and resources.