

Power Resources Board Retreat

May 29, 2024



1. Level Setting
2. Resource Adequacy
3. Renewable and Carbon-Free Energy and Associated Emissions
4. CAISO Market Overview
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Level Setting



What We Do



Primary Procurement Areas

Resource Adequacy

- Compliance product
- Mandated by California Public Utilities Commission (CPUC)

Renewable & Carbon-Free Energy

- RPS Compliance product: Renewable Energy Certificate (REC)
- Individual targets: add'l RECs & carbon-free energy

Physical & Financial Energy Hedges

- Transacted to minimize exposure to CAISO energy market volatility

Long-Term Offtake Agreements (Contracts)

- May include all or mix of three products above
- “Long-term” is 10+ year tenor
- Some volumes required for RPS and other compliance obligations
- Valuable to meet hedging goals and secure compliance products

Market &
Risk
Mgmt &
Oversight



Resource Adequacy



Resource Adequacy - Current Framework

- In 2024, Ava has two types of RA requirements: System and Flexible

System RA

- Interconnected to CAISO
- Imports: energy imported from outside CAISO area

Flexible RA

- Determined by resource ability to increase output during load ramp hours
- Battery storage resources are flex

*Local RA and Central Procurement Entity (CPE): Ava was responsible for a Local RA requirement in 2022 and years prior. Starting in 2023, CPE is responsible for Local RA procurement.



RA Slice of Day

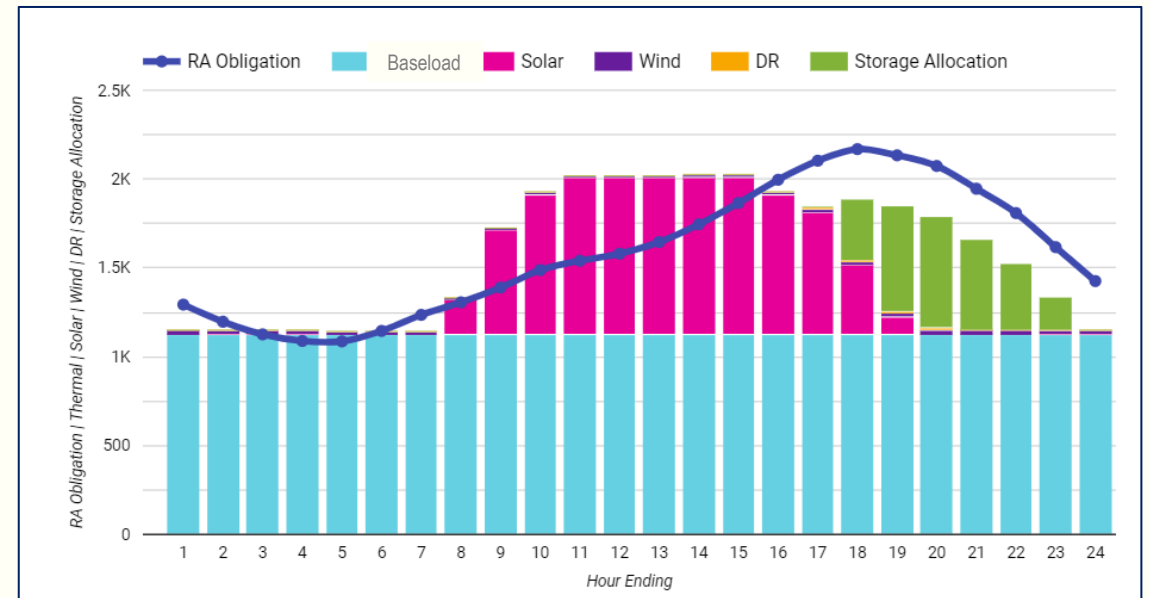
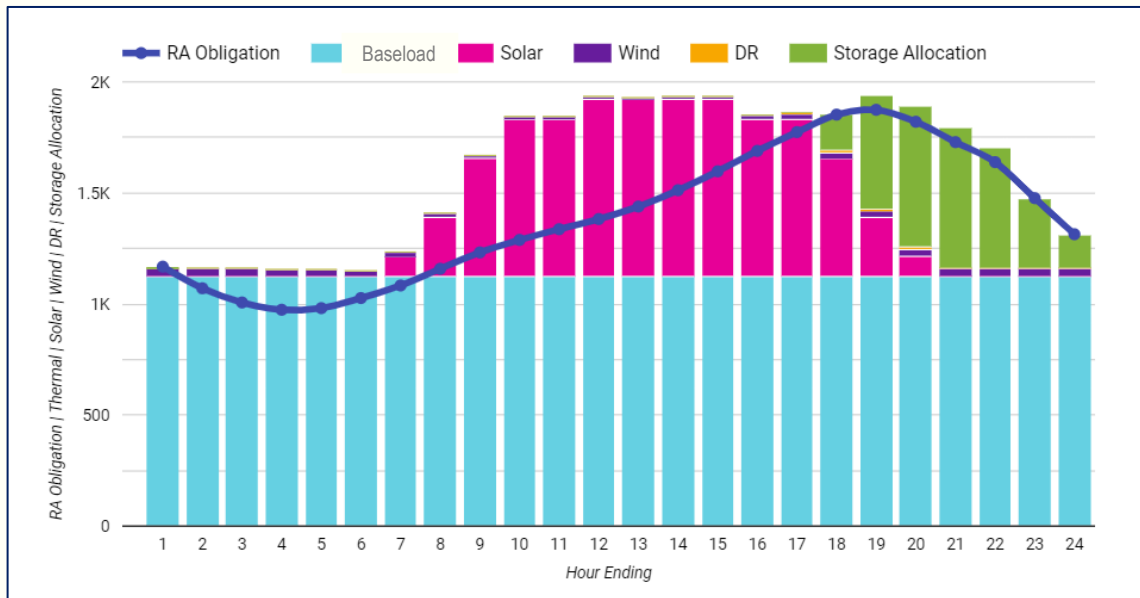
- In 2025, RA requirements will change to a Slice of Day structure.
- Intent of change to Slice of Day: Minimize customer cost, meet hourly reliability needs, be adaptable to a changing grid.
- RA obligations are based on Ava's hourly share of CAISO load for the “worst day” of each month.
- Solar and wind resource contributions are based on exceedance profiles.



RA Slice of Day and Storage

- In today's RA paradigm, storage had a stand-alone ELCC.
- In Slice of Day paradigm, storage resources can shift RA from hours of excess to hours of need.
- Excess RA from generating resources is required to “capacity charge” storage.
- Result: load serving entities must procure generation RA in excess of RA compliance obligation in some hours to “charge” storage for discharge in other hours

Two hypothetical months under Slice of Day:



Reliability Procurement Mandates

- Three CPUC procurement orders were issued to increase grid reliability.
- Incremental capacity to be procured from resources such as solar, wind, storage, hybrid, geothermal, demand response.

	Near-Term Reliability	Mid-Term Reliability	Supplemental Mid-Term Reliability
Compliance Term	2021-2023	2023-26	2026-27
Total Procurement (MW NQC)	3,300	11,500	4,000
Ava Requirement (MW NQC)	99.6	418	136
Penalty	none	Cost of New Entry	Cost of New Entry

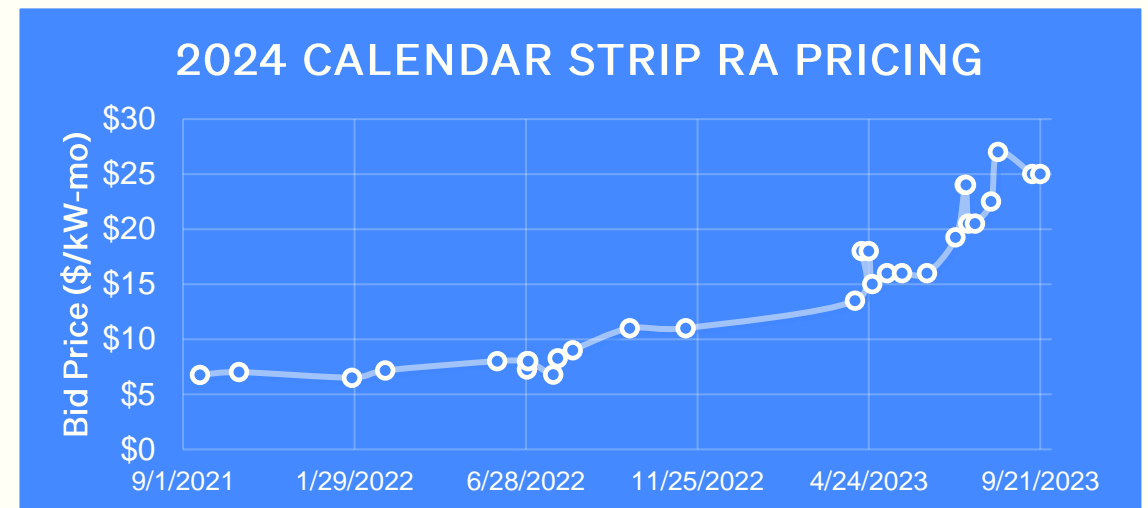


RA Challenges

1. Regulatory changes
2. System is short and dependent on import RA and new resources coming online
3. Challenges bringing new resources online
 - Demand for renewable and carbon-free energy is high
 - Development delays and risks due to interconnection, permitting, supply chain
4. Pricing at historical highs

Hour 19 Assessment in the Month of September		2023	2024	2025	2026
1	CAISO 1-in-2 Load	46,827	47,472	47,933	48,424
2	Reserve Margin (16% in '23, 17% after)	7,492	8,070	8,149	8,232
3	Total Hourly Demand	54,319	55,542	56,082	56,656
4	Existing Resources Except Wind and Solar	44,817	44,817	44,817	44,817
5	Supply from Wind	1,810	1,810	1,810	1,810
6	Supply from Solar	9	9	9	9
7	Estimated Completion of CPUC Mandated Procurement	1,750	6,431	10,381	11,755
8	Demand Response	1,274	1,274	1,274	1,274
9	Imports	5,500	5,500	5,500	5,500
10	Remove Diablo from Planning	-	-	(2,280)	(2,280)
11	OTC, Retired or Contracted by DWR	-	(3,757)	(3,757)	(3,757)
12	Total Hourly Supply	55,159	56,084	57,753	59,128
13	Surplus Supply (Deficit)	840	542	1,672	2,472
14	Incremental Demand with 2020 Equivalent Event	3,044	2,611	2,636	2,663
15	Add'l. Incremental Demand with 2022 Equivalent Event	1,639	1,662	1,678	1,695
16	Surplus Supply (Deficit) with Extreme Weather	(3,843)	(3,731)	(2,642)	(1,887)

CalCCA "California's Constrained Resource Adequacy Market: Ratepayers Left Standing in a Game of Musical Chairs"
https://cal-cca.org/wp-content/uploads/2023/09/CalCCA-Stack-Analysis-2023-2026-updated-9_15_23.pdf



Renewable and Carbon-Free Energy and Associated Emissions



Renewable & Carbon-Free Overview

Renewable Energy Credits (RECs):

- Represent clean energy attributes of renewable electricity
- Each REC is equivalent to one MWh of renewable electricity generated

Carbon-Free Energy:

- No regulatory compliance requirements
- Tracked using NERC e-tags and other forms of generation and scheduling evidence

PCC 1	Energy and REC are from same source and delivered into a California Balancing Authority (CBA) without any substitution
PCC 2	Substitute Energy not from the same source as REC
PCC 3	Electricity Products Not Qualified as PCC 1 or PCC 2, Including Unbundled RECs



Emissions: Current Accounting

2022 (actuals): Renewable: 49.4%; Carbon Free:71.4%; Unspecified Power: 28.4%
 2023: Renewable target: 54%; Carbon Free target: 76%; unspecified target: 24%
 Current 2024: Carbon Free target: 81% (can include RE or CO2 free)

Year	Bright Choice					CA-RPS %
	Renewable %	Carbon Free %	Unspecified %	TCR*-Emission Factor	PSDR Emission Factor	Renewable %
2018	41%	62%	38%	101	<i>n/a</i>	29%
2019	60%	87%	13%	135	<i>n/a</i>	31%
2020	40%	55%	45%	<i>n/a</i>	591	33%
2021	42%	60%	40%	<i>n/a</i>	564	36%
2022	45%	63%	37%	<i>n/a</i>	566	39%
2023	49%	66%	34%	<i>n/a</i>	521	41%
2024	52%	71%	29%	<i>n/a</i>	455	44%
2025	56%	76%	24%	<i>n/a</i>	387	47%
2026	60%	81%	19%	<i>n/a</i>	315	49%
2027	64%	85%	15%	<i>n/a</i>	241	52%
2028	67%	90%	10%	<i>n/a</i>	163	55%
2029	71%	95%	5%	<i>n/a</i>	83	57%
2030	75%	100%	0%	<i>n/a</i>	-	60%

EBCE 2022 Bright Choice Emission Factor: 496

TCR Emission Factor: 271.8

PCC2 Emission Factor:224.2



What is the Power Content Label (PCL)?

PCL

- Published annually, based on prior calendar year generation from owned or contracted-for resources
- Detailed breakdown on sources of energy used to provide electricity
- Resembles a nutrition label for electricity
- The PCL submission is reviewed and approved by the CEC

2022 POWER CONTENT LABEL								
East Bay Community Energy								
https://ebce.org/key-documents/								
Greenhouse Gas Emissions Intensity (lbs CO ₂ e/MWh)				Energy Resources	Renewable 100	Brilliant 100	Bright Choice	2022 CA Power Mix
Renewable 100	Brilliant 100	Bright Choice	2022 CA Utility Average	Eligible Renewable ¹	100.0%	35.8%	49.4%	35.8%
0	0	496	422	Biomass & Biowaste	0.0%	0.0%	1.5%	2.1%
				Geothermal	0.0%	0.0%	0.8%	4.7%
				Eligible Hydroelectric	0.0%	0.0%	1.4%	1.1%
				Solar	50.0%	17.9%	18.1%	17.0%
				Wind	50.0%	17.9%	27.6%	10.8%
				Coal	0.0%	0.0%	0.0%	2.1%
				Large Hydroelectric	0.0%	64.2%	21.9%	9.2%
				Natural Gas	0.0%	0.0%	0.0%	36.4%
				Nuclear	0.0%	0.0%	0.2%	9.2%
				Other	0.0%	0.0%	0.0%	0.1%
				Unspecified Power ²	0.0%	0.0%	28.4%	7.1%
				TOTAL	100.0%	100.0%	100.0%	100.0%
Percentage of Retail Sales Covered by Retired Unbundled RECs ³ :					0%	0%	1%	
<p>¹The eligible renewable percentage above does not reflect RPS compliance, which is determined using a different methodology.</p> <p>²Unspecified power is electricity that has been purchased through open market transactions and is not traceable to a specific generation source.</p> <p>³Renewable energy credits (RECs) are tracking instruments issued for renewable generation. Unbundled renewable energy credits (RECs) represent renewable generation that was not delivered to serve retail sales. Unbundled RECs are not reflected in the power mix or GHG emissions intensities above.</p>								
For specific information about this electricity portfolio, contact:					East Bay Community Energy 1-833-699-EBCE (3223)			
For general information about the Power Content Label, visit:					https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program			



Emissions: Overview of *possible* changes

SB 1158

- Passed in 2022
- Requires hourly reporting of retail electric provider emissions by 2028
- California Energy Commission (CEC) required to adopt regulations to implement by July, 2024
- Current status: CEC issued revised Pre-Rulemaking Amendments on Power Source Disclosure Program in February, 2024; no progress since that time.
 - Ava expects a *significant* delay to establishing the required rules. Summer 2025 possible.



Emissions: Potential Impacts

- Ability to Track and Report
- Ability to Forecast
- Ability to Change Resource Bids & Dispatch
- Cost Increases
 - Systems
 - Forecast software
 - More sophisticated bid & dispatch algorithms
 - New staff/job functions
 - Strategic trade offs: bid and dispatch based on economics or emissions reduction

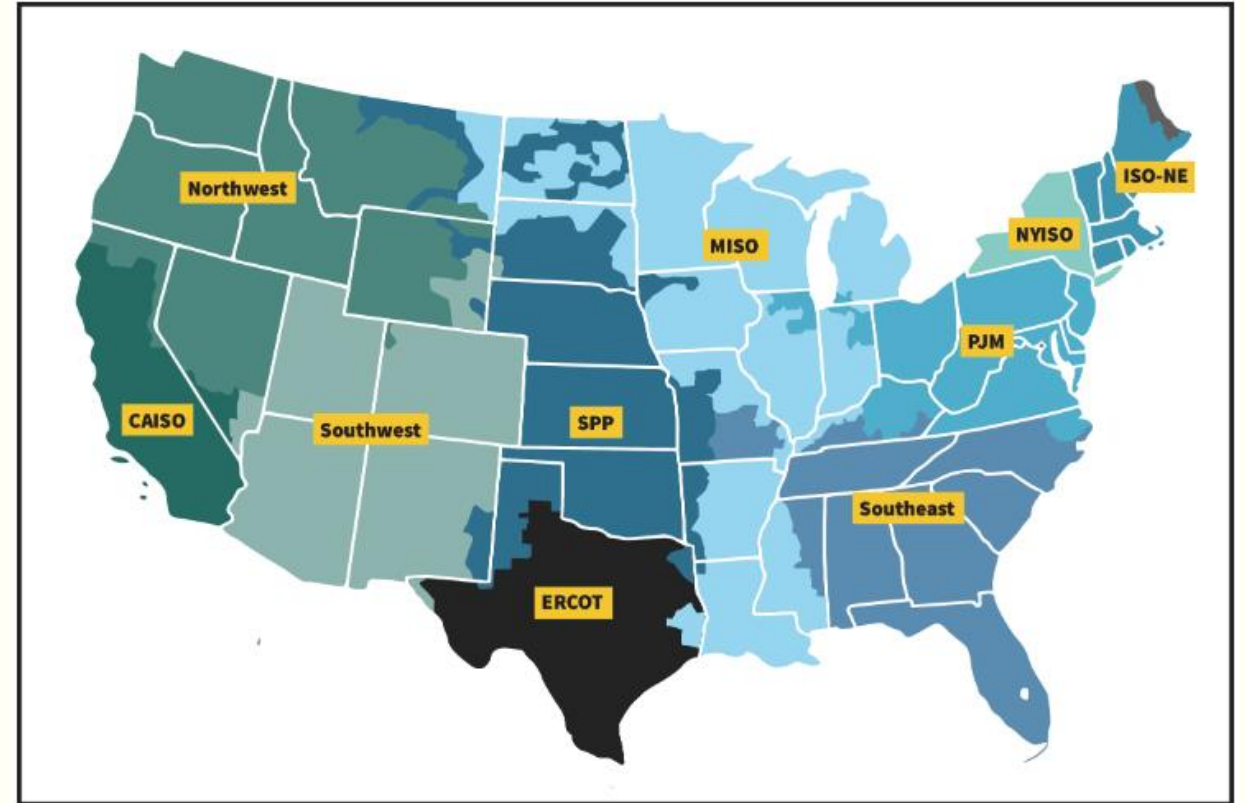


CAISO Market Overview



Wholesale Energy Market Products

- Energy
- Transmission
- Capacity
 - Resource Adequacy
 - Ancillary Services
 - Operating Reserves
 - Regulation Reserves
- Natural Gas
- Congestion Revenue Rights
- Renewable Energy Products



California Balancing Authority Areas

CAISO BAA

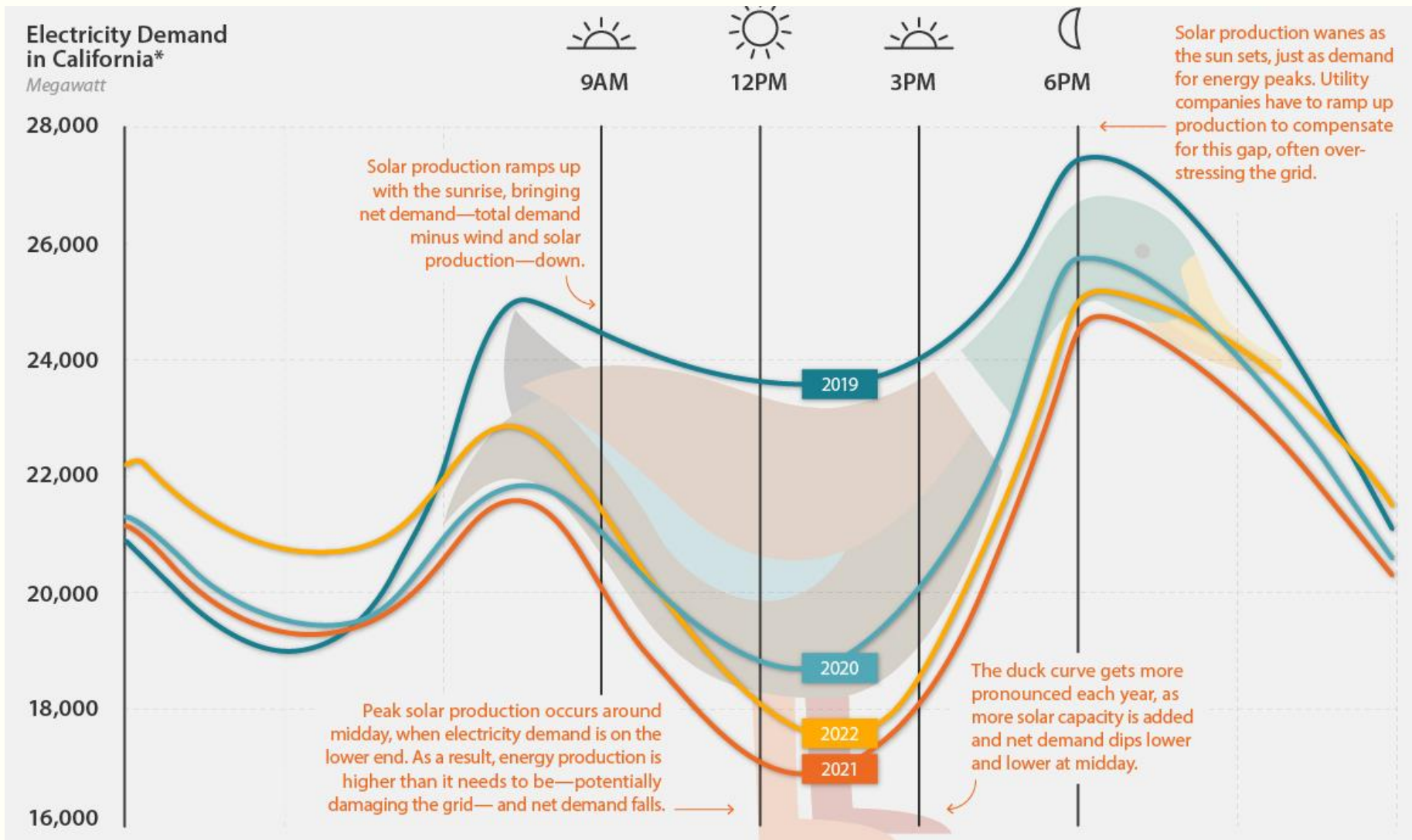
- Avg. Peak Load 45,000 MW
- 26,000 circuit miles of transmission
- 9,700 P-nodes (pricing nodes)

Role of CAISO

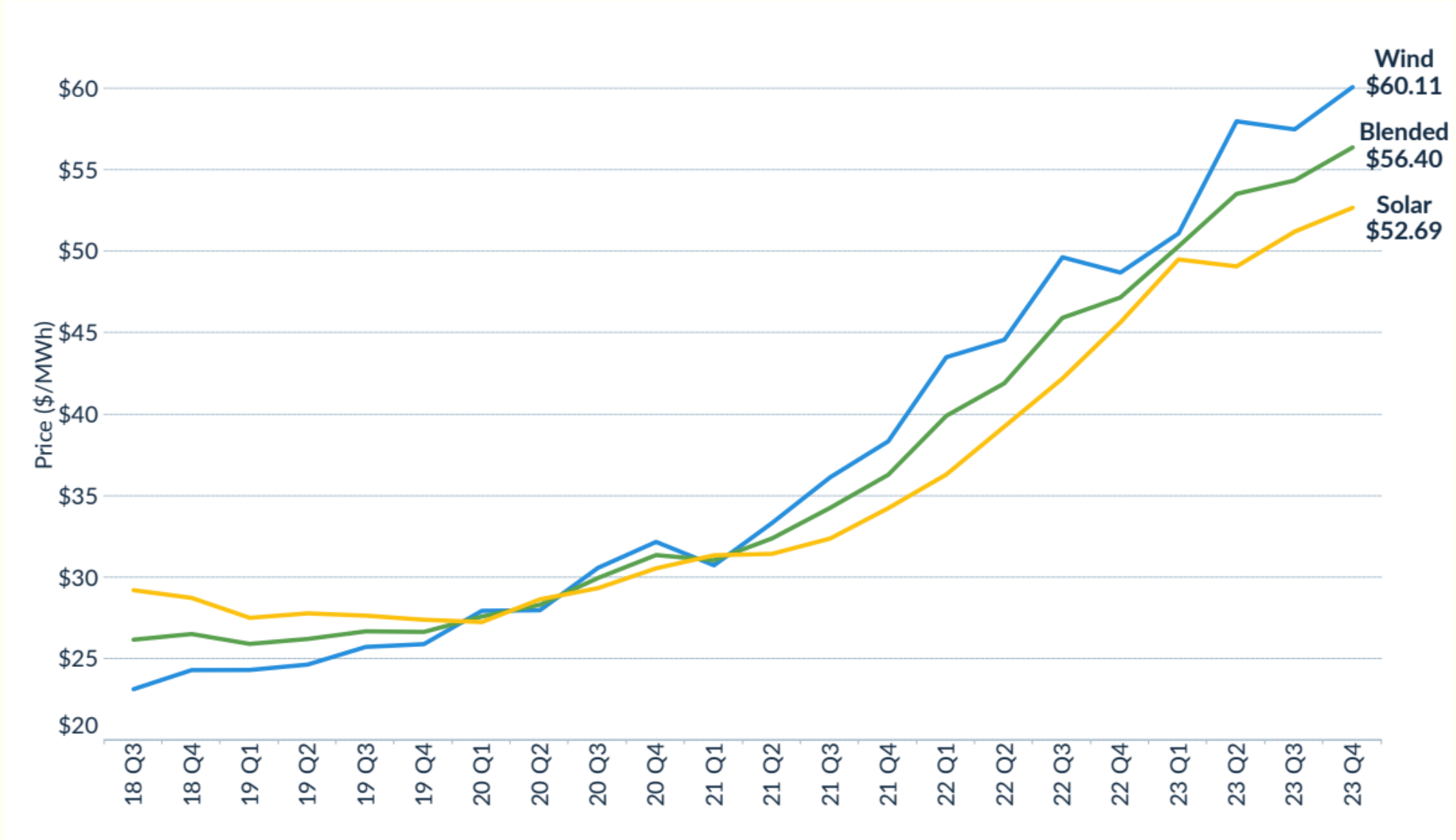
- Competitive Wholesale Power Market
- Reliable Operations
- Grid Planning and Development



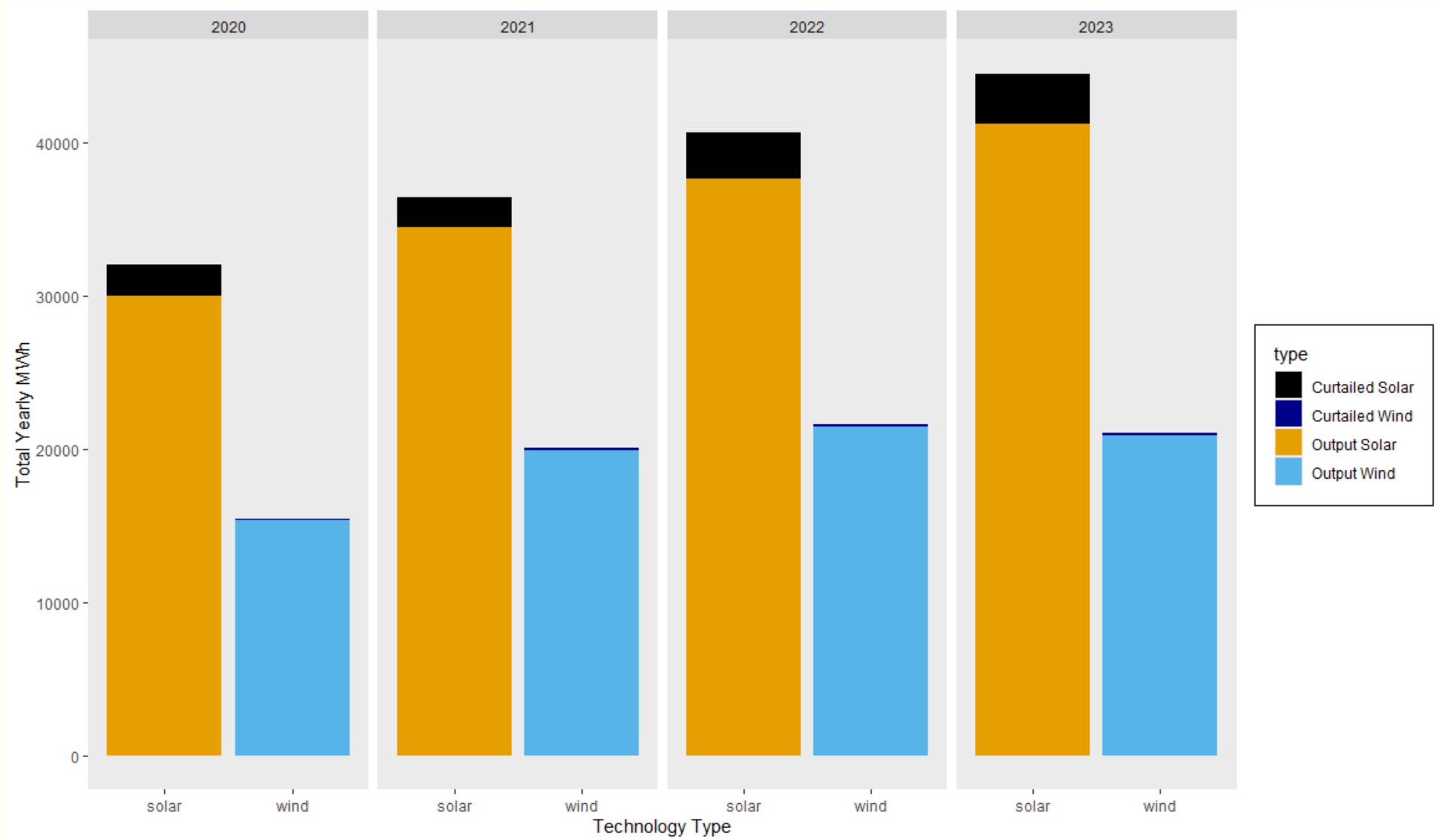
Quack...quack



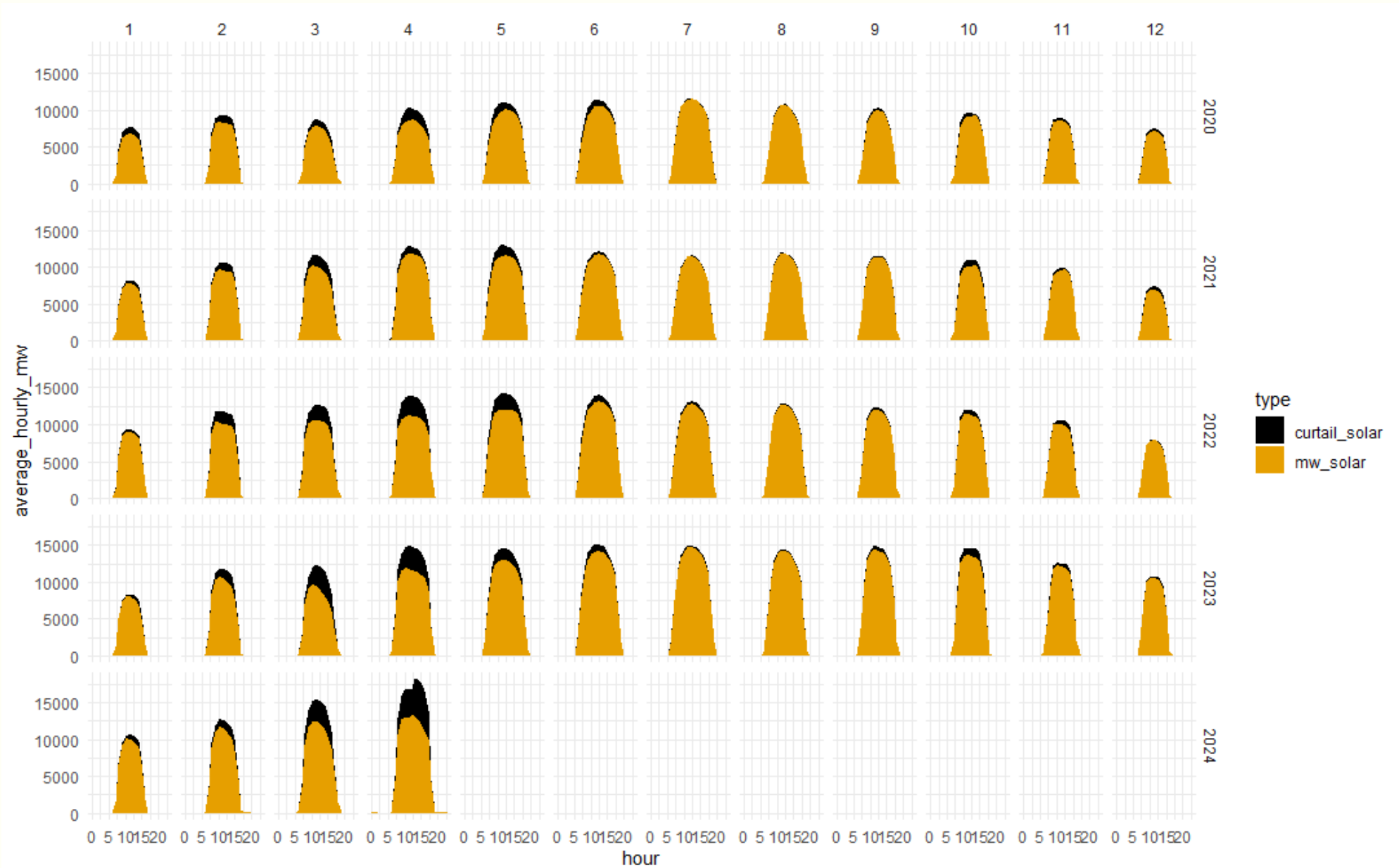
US Wide Solar and Wind PPA Pricing



Curtailments - Wind and Solar



Curtailments - Solar



CAISO Markets

Day-Ahead Market (DAM)

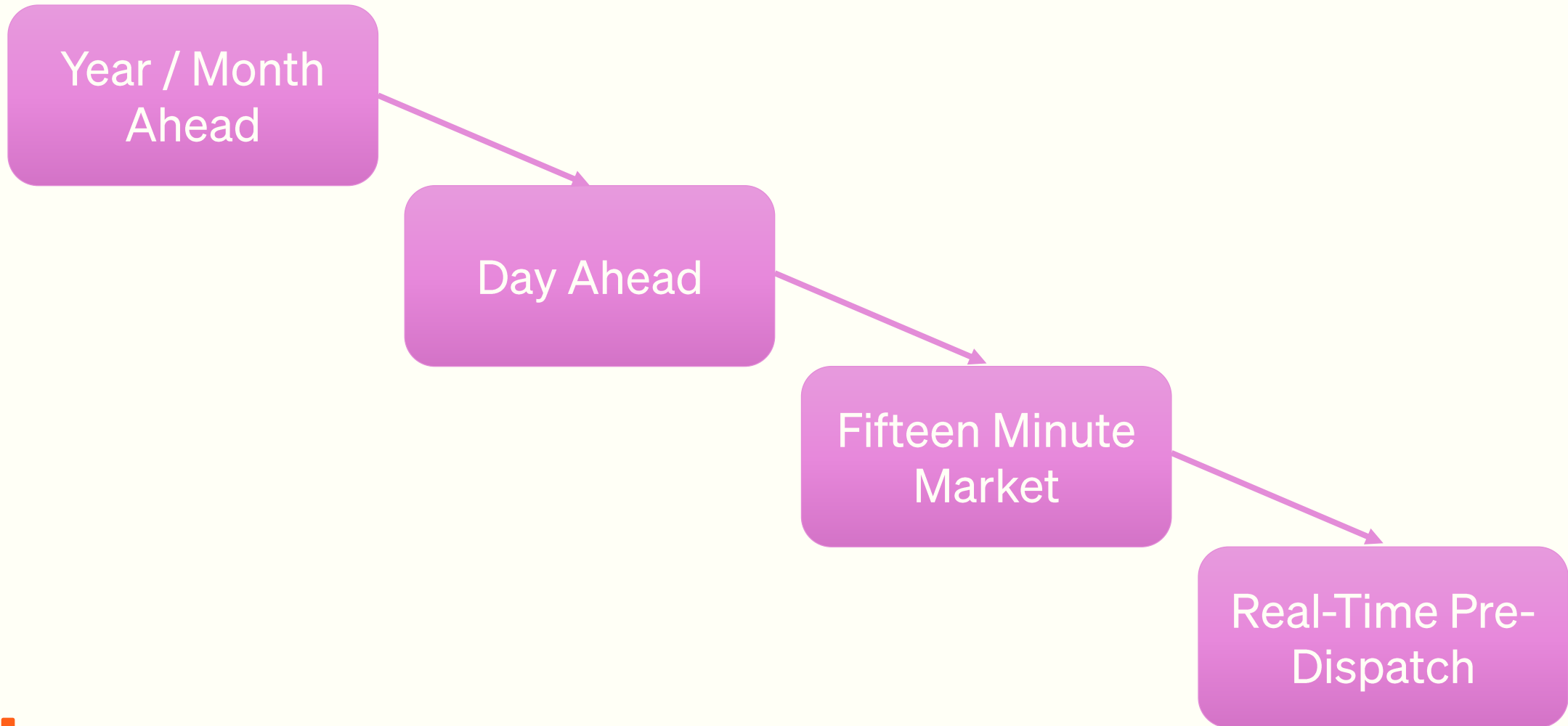
- Matching Forecasted Supply / Demand
- Majority of Transactions
- Market Processes

Real-Time Market

- Matching Realized Supply / Demand
- Incremental Adjustments to DAM
- 15-Min. and 5 Min. settlements
- Market Processes

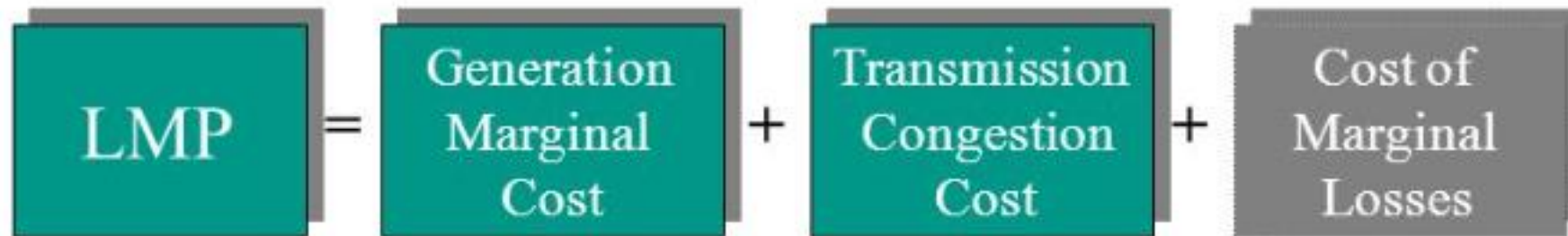


Market Flow



Locational Marginal Prices

The **Locational Marginal Price** at a specific location is the sum of the cost of generating the *next* MW to supply load at a specific location (based on marginal generation cost), the cost of transmission congestion and the cost of electric system losses

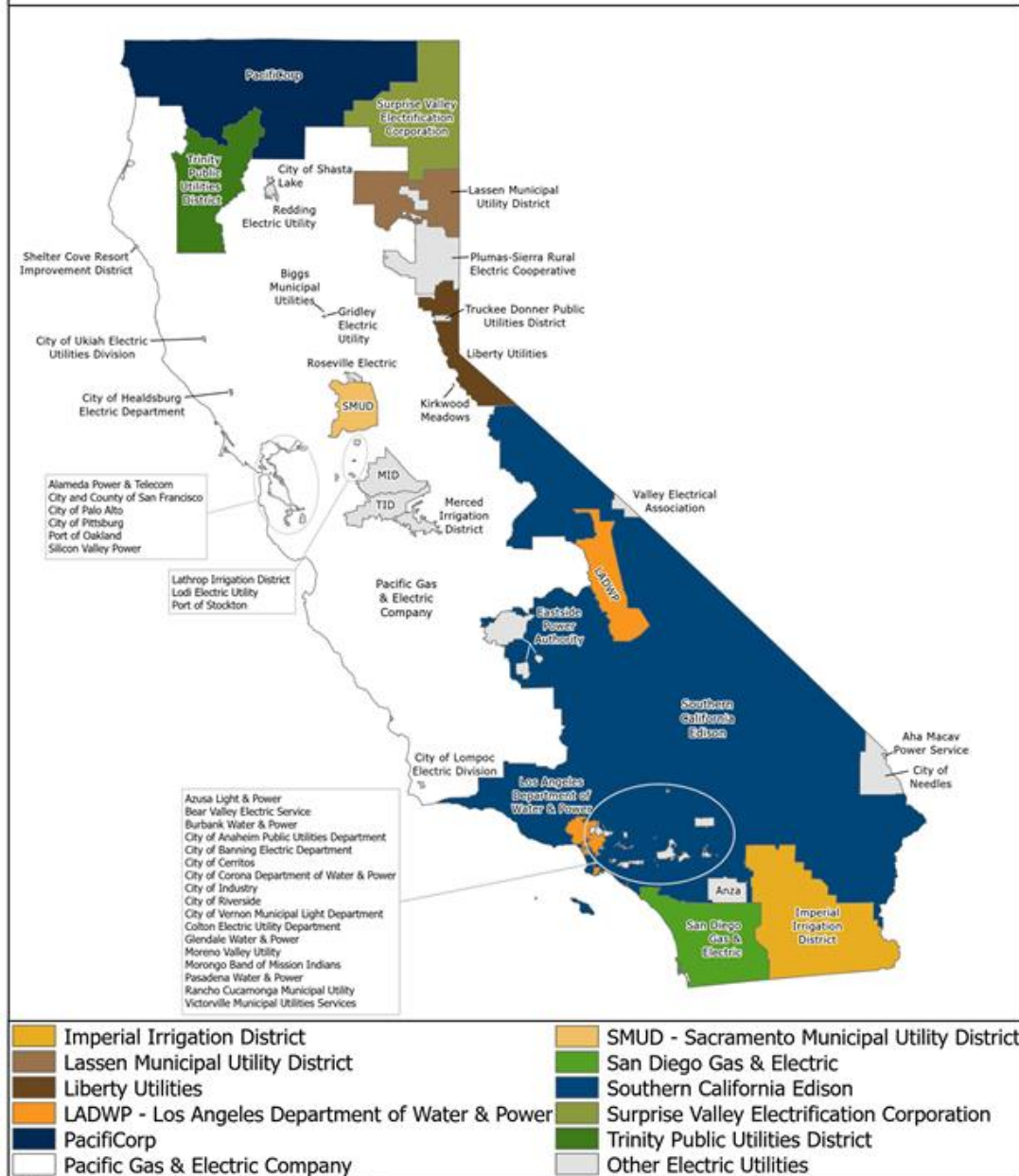


Demand Pricing

CAISO includes 3 Default Load Aggregation Points (D LAPs)

- PG&E DLAP (white on map)
- SCE DLAP (navy on map)
- SDG&E DLAP (bright green in south)
- The LAP is defined for the transmission area at which all bids for Demand shall be submitted and settled

Electric Utility Service Areas California, 2023



Map: <https://gis.data.ca.gov/documents/CAEnergy::electric-utility-service-areas/explore>

Forward Price Review

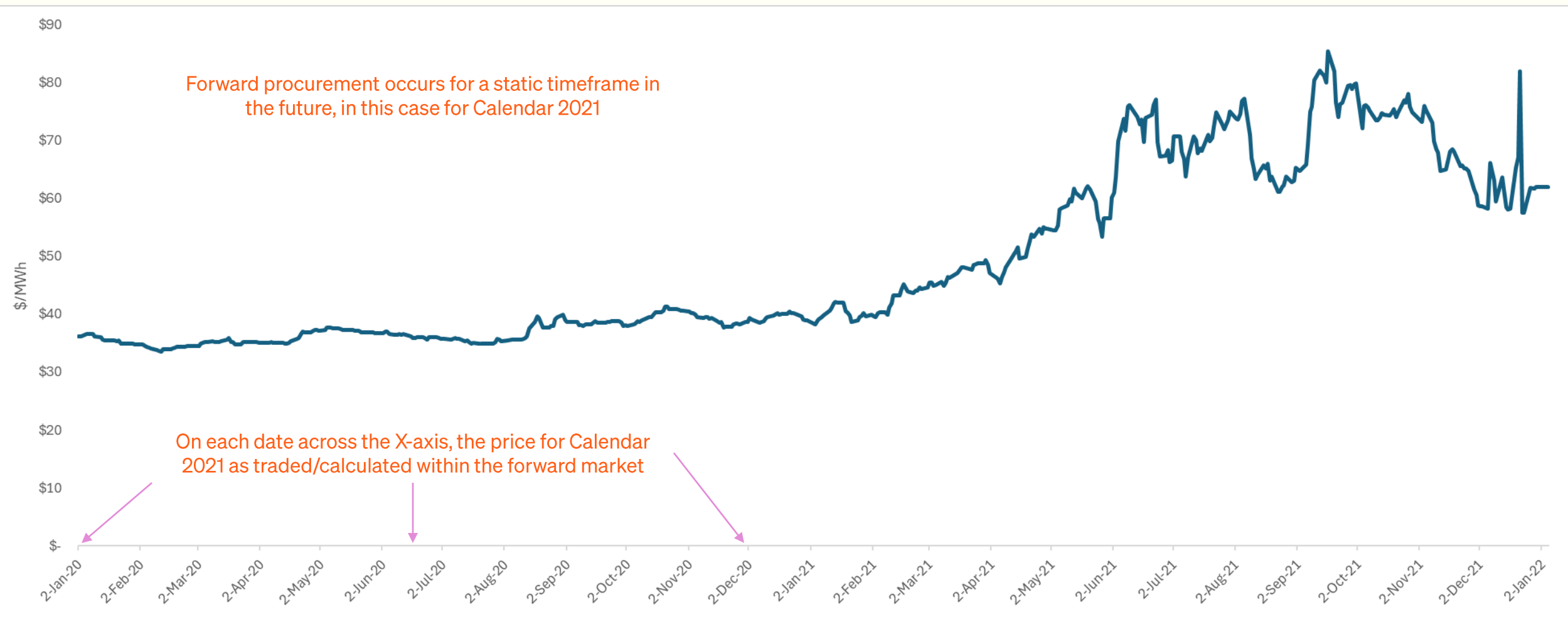


How and Why Forward Procurement Occurs

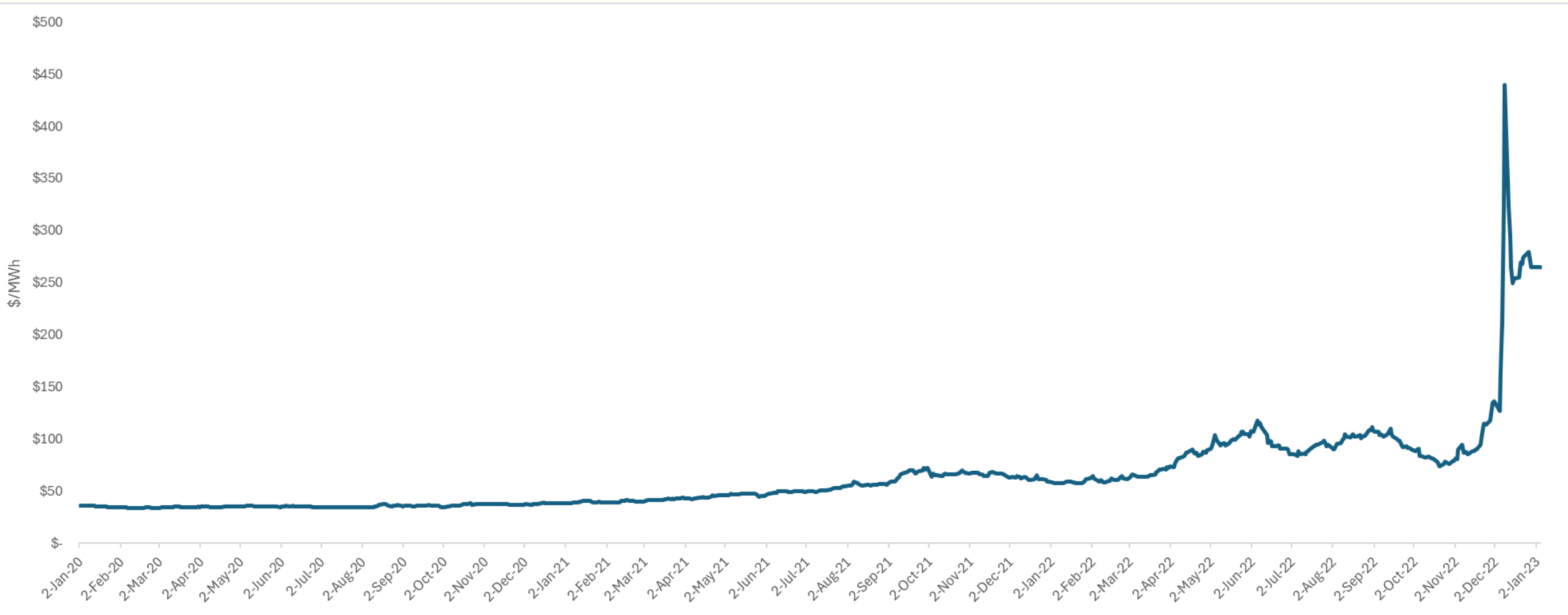
- Serve as a hedge against load
- Serve as a fixed-price fixed-volume transaction
- Serve to lock in budget certainty
- Serve to de-risk supply to cover load obligations
- Serve to spread counterparty risk
- Serve to capitalize on months- or years-ahead prices



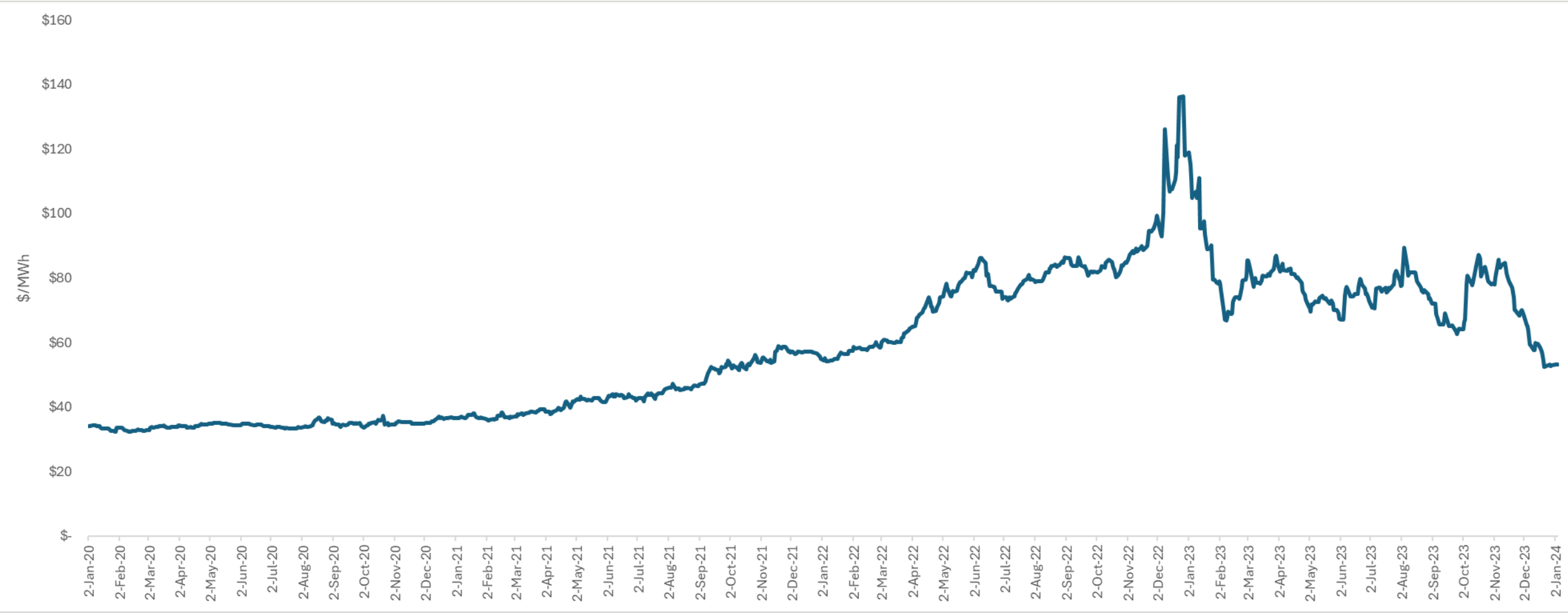
Calendar 2021 Forwards



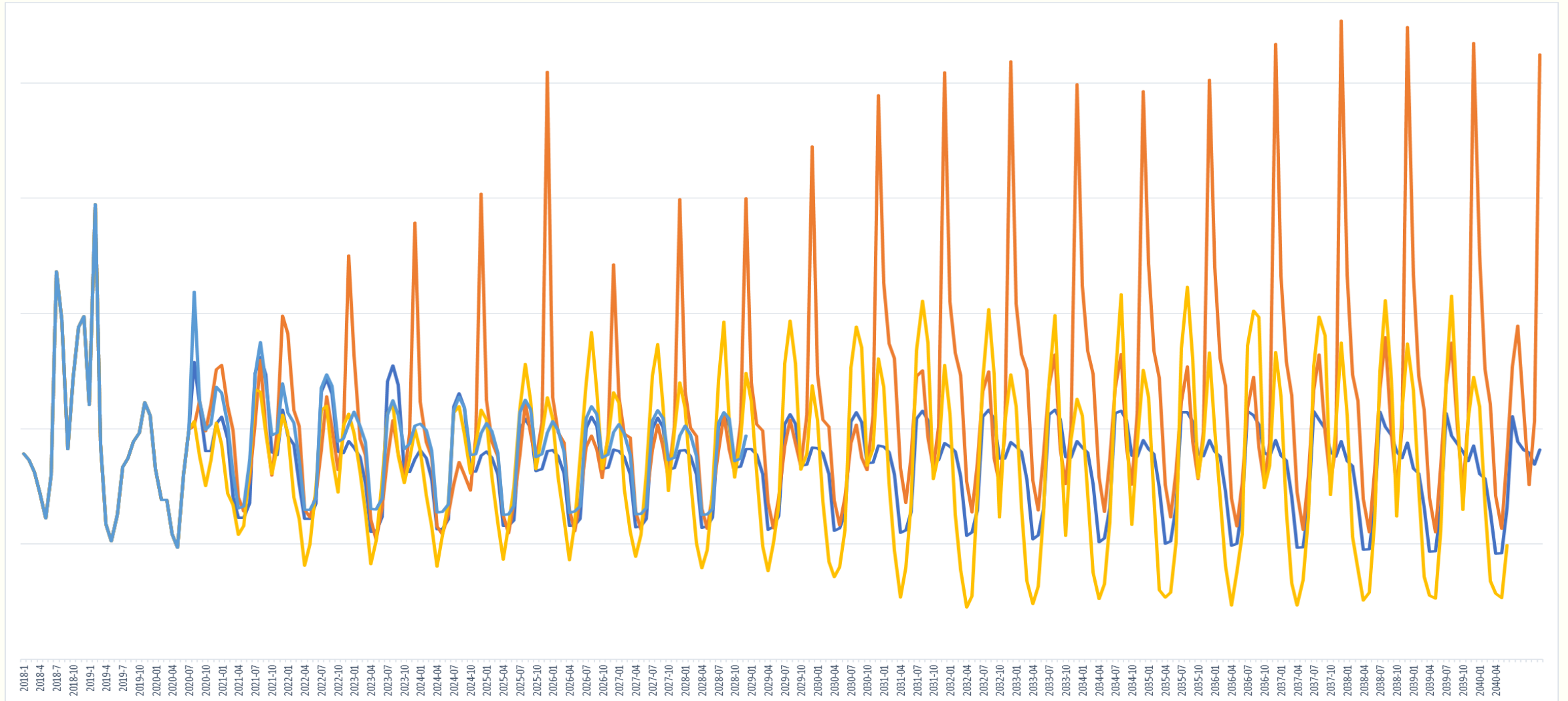
Calendar 2022 Forwards



Calendar 2023 Forwards



Forward Curves From Various Vendors



Day-Ahead Price Review

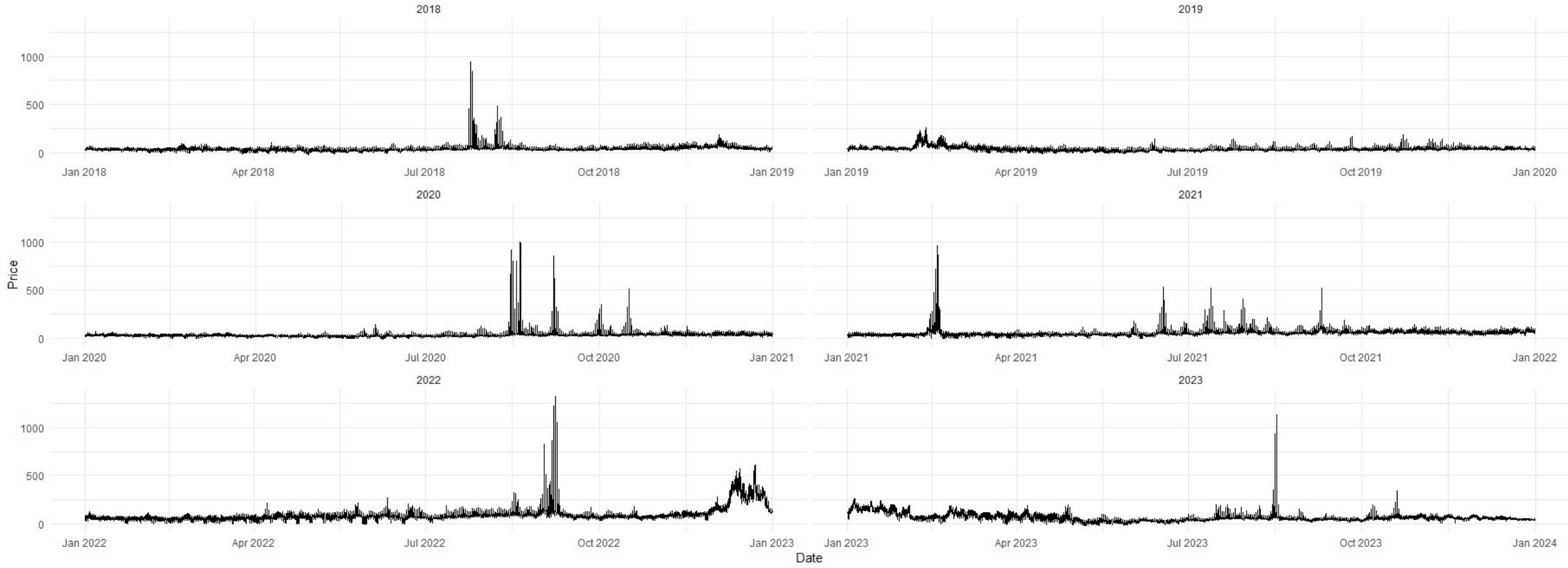


The Day-Ahead Market of CAISO

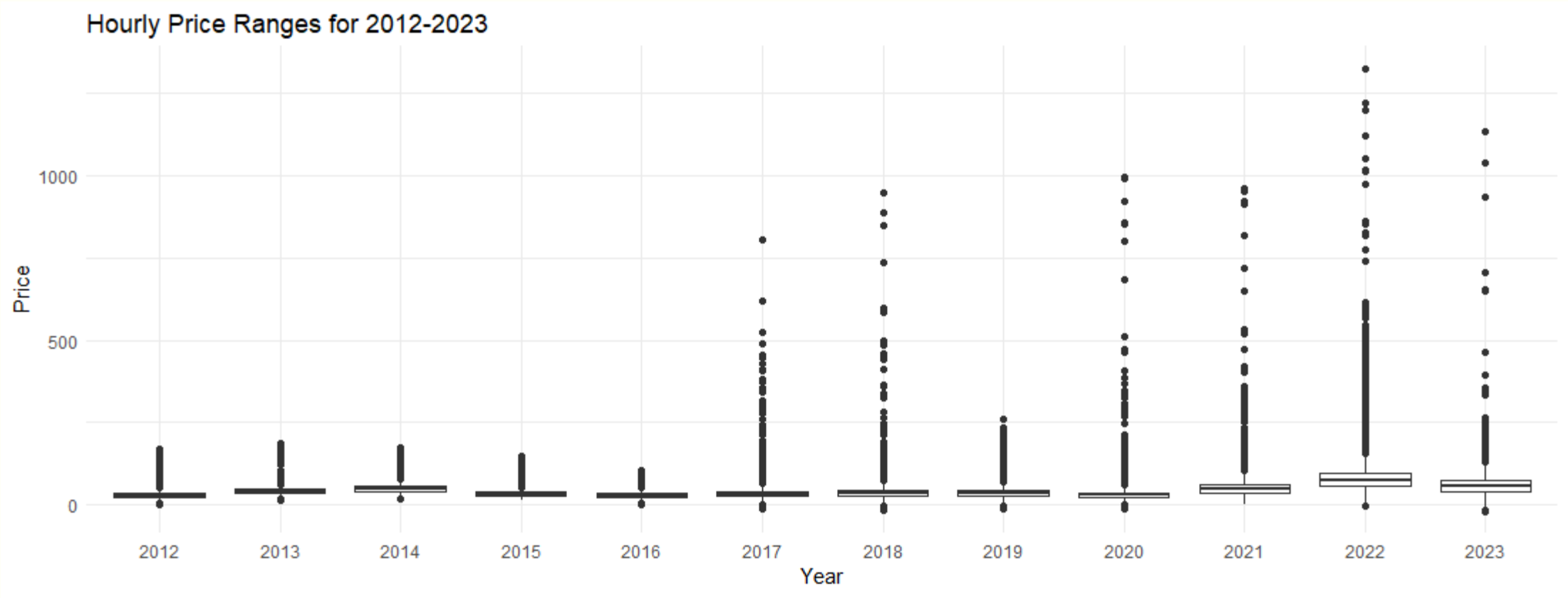
- Serve to match CAISO Forecast of CAISO Demand with submitted supply bids
- Serve to manage and procure contingency products
- Serve to manager and procure ancillary service products
- Serve to mitigate market power
- Serve to ensure compliance
- Serve to provide a less volatile priced market

Calendar Years Day-Ahead DLAP Prices

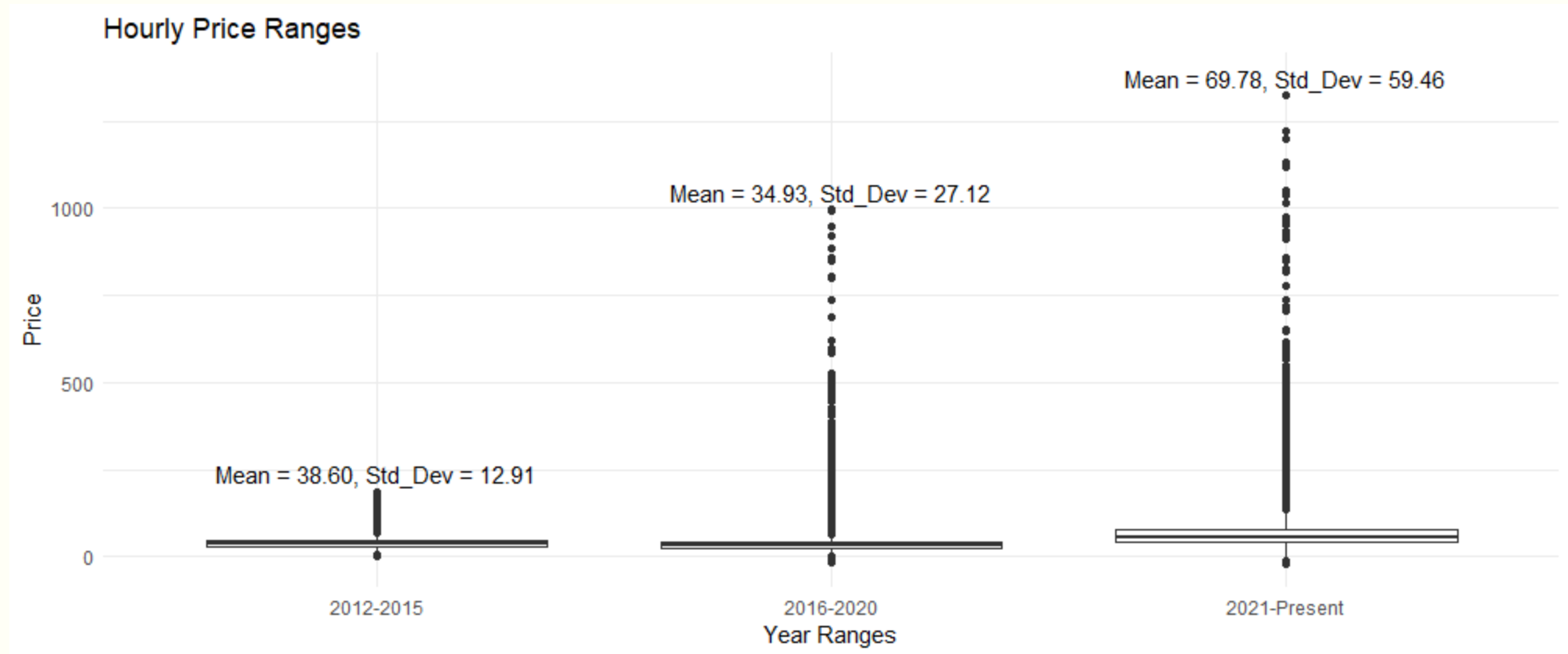
Hourly DAM Prices for 2018 - 2023



Calendar Year Day-Ahead DLAP Price Range



Bucket Years Day-Ahead DLAP Price Range



Real-Time Price Review



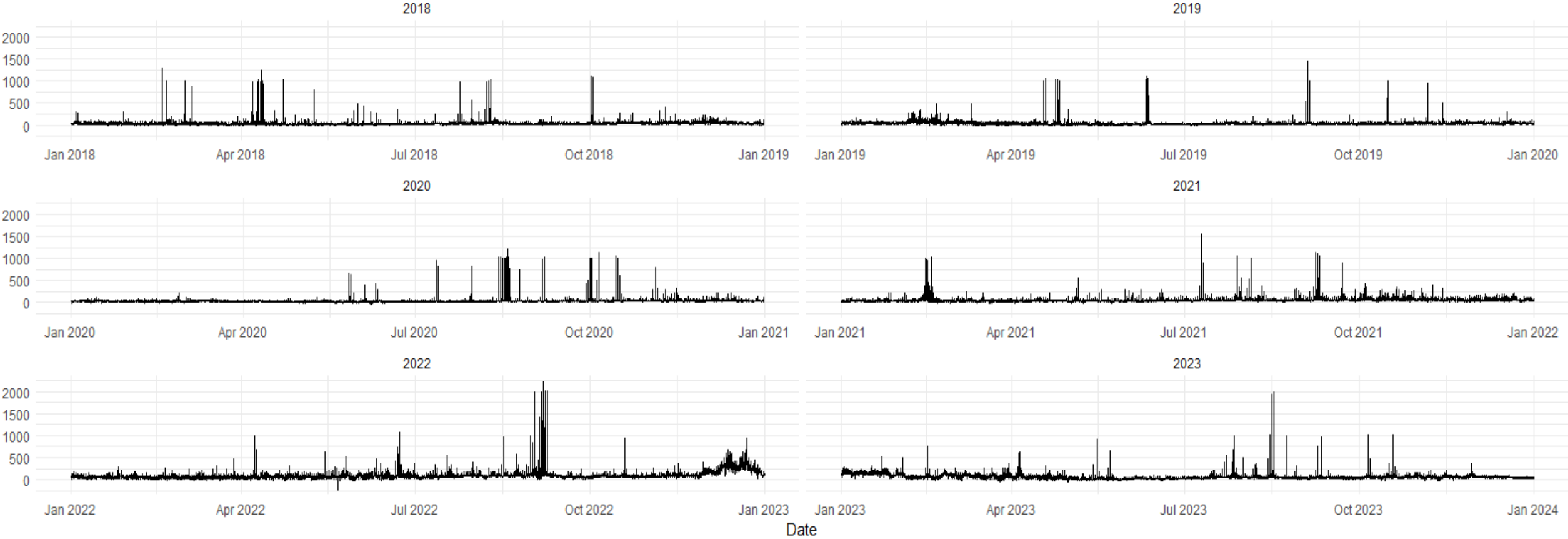
The Real-Time Markets of CAISO

- Serve to match CAISO Forecast of CAISO Demand with submitted supply bids
- Serve to manage generation imbalances
- Serve to provide granular forecasts and prices
- Serve to mitigate market power
- Serve to ensure compliance
- Serve to provide a more volatile priced market
- Generally, RT markets prices are lower than the DA market



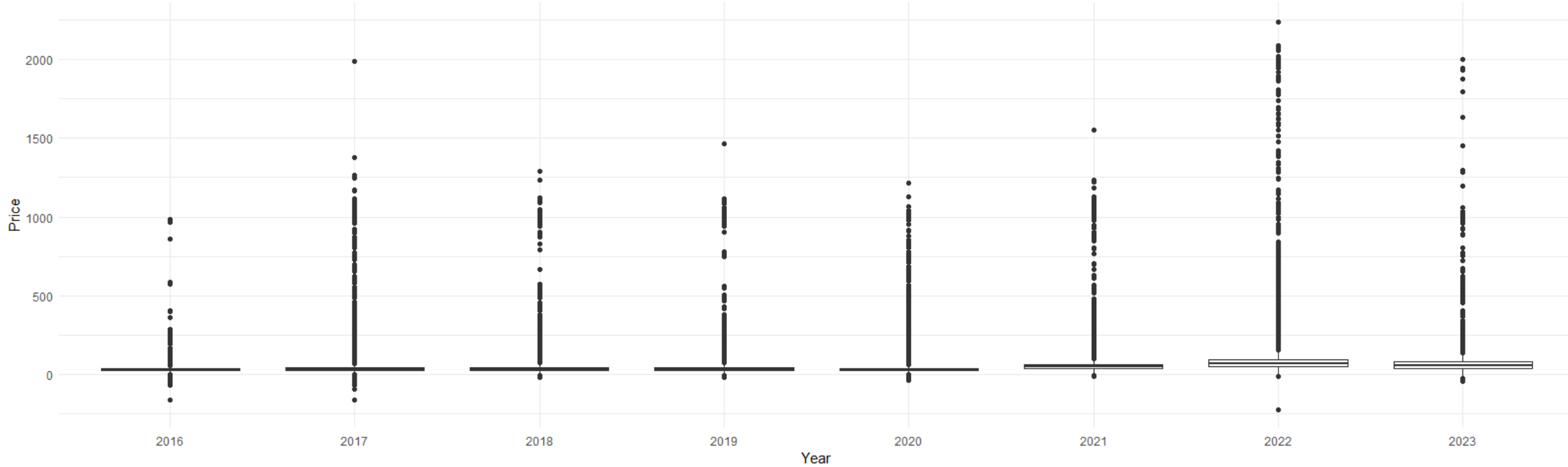
Calendar Years Real-Time DLAP Prices

FMM Prices for 2018 - 2023

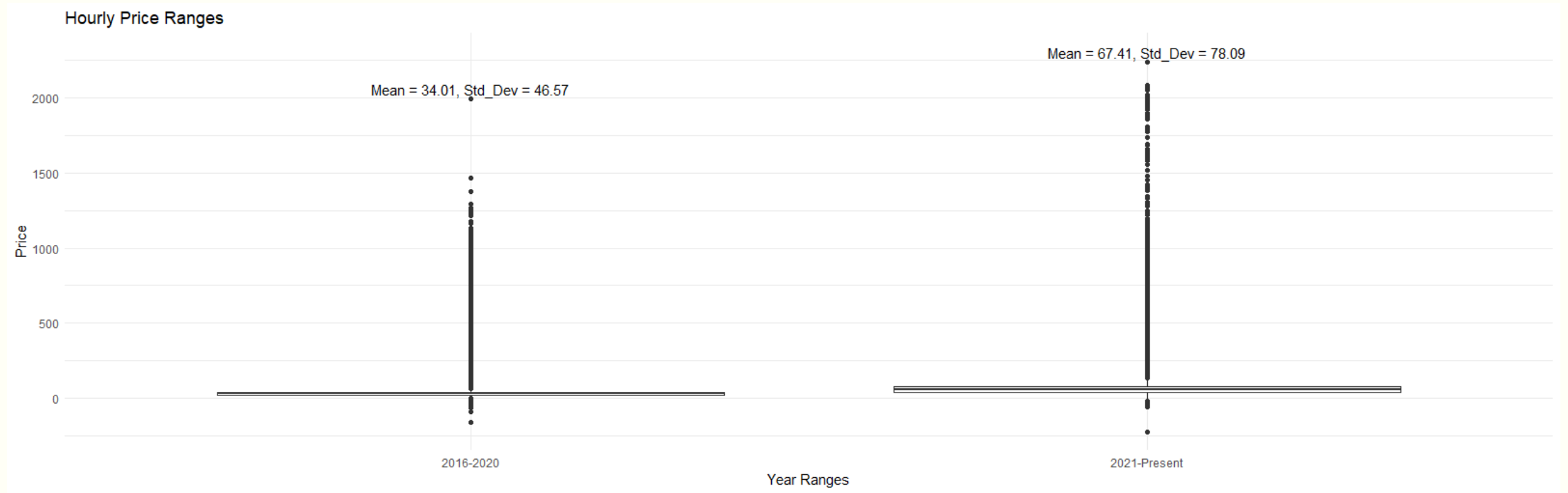


Calendar Year Real-Time DLAP Price Range

FMM Price Ranges for 2016-2023



Bucket Years Real-Time DLAP Price Range



Risk Management



Risk Management in Electric Power Industry

Why Risk Management is important to organizations like Ava

- Mitigate exposure to volatility
- Durable rates
- Enhance financial stability (budget certainty)
- Regulatory compliance
 - FERC requires LSEs have risk mgmt. & compliance programs
 - CAISO has annual risk mgmt. certification process for market participants
- Rating agency & external auditing



Key Risks

Development

Performance

Volume

Profile

Basis

Credit

Balancing

Price

Length of
Contract

Change in
Law

Compliance

Force
Majeure



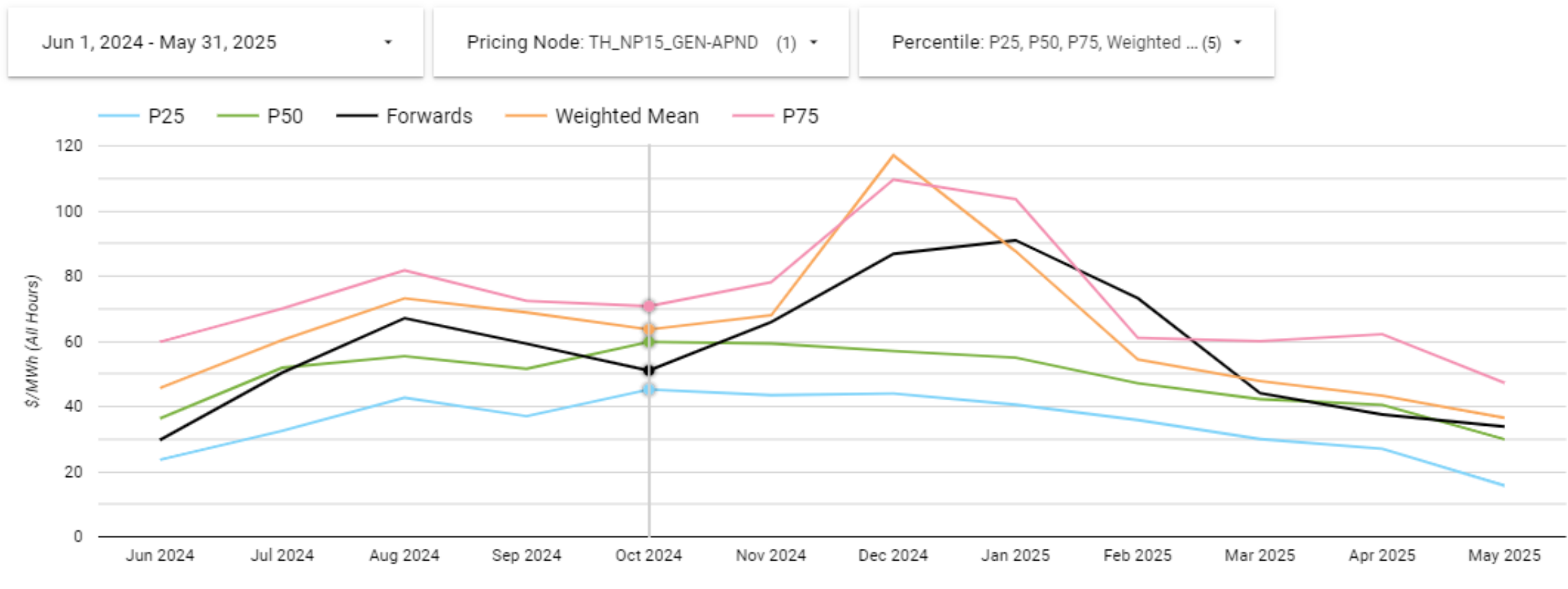
Risk Oversight Committee

- Energy Risk Management Policy approved by the Board
- Energy Risk Management Procedures approved by the Risk Oversight Committee
 - Approved trading counterparties
 - Approved trading products/instruments
 - Approved personnel
 - Approved authorities
 - Compliance training
 - Exception reporting



Risk Management: Forwards vs Historical Price Distribution

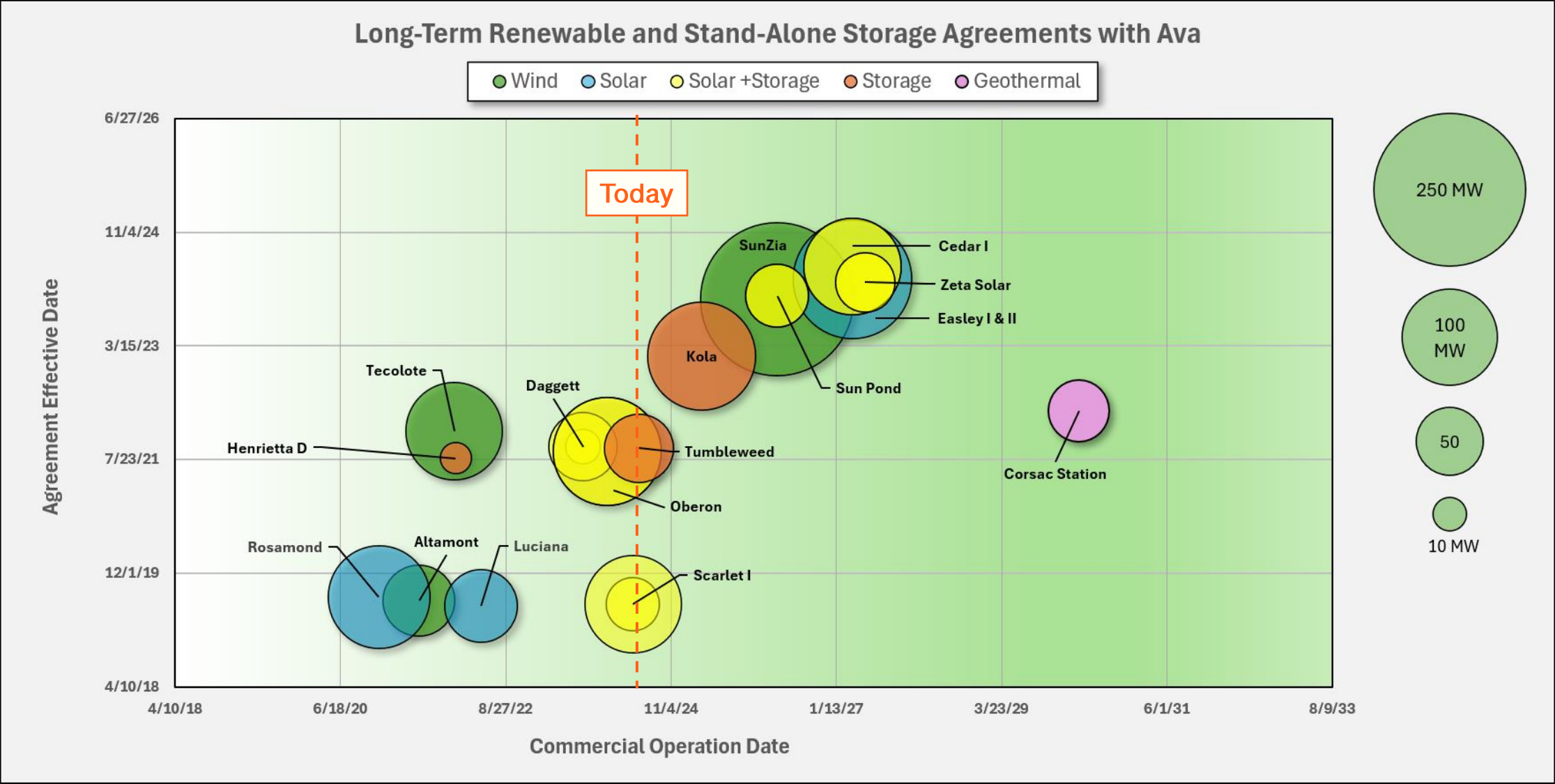
CAISO Settlement Price Distribution Model



Appendix

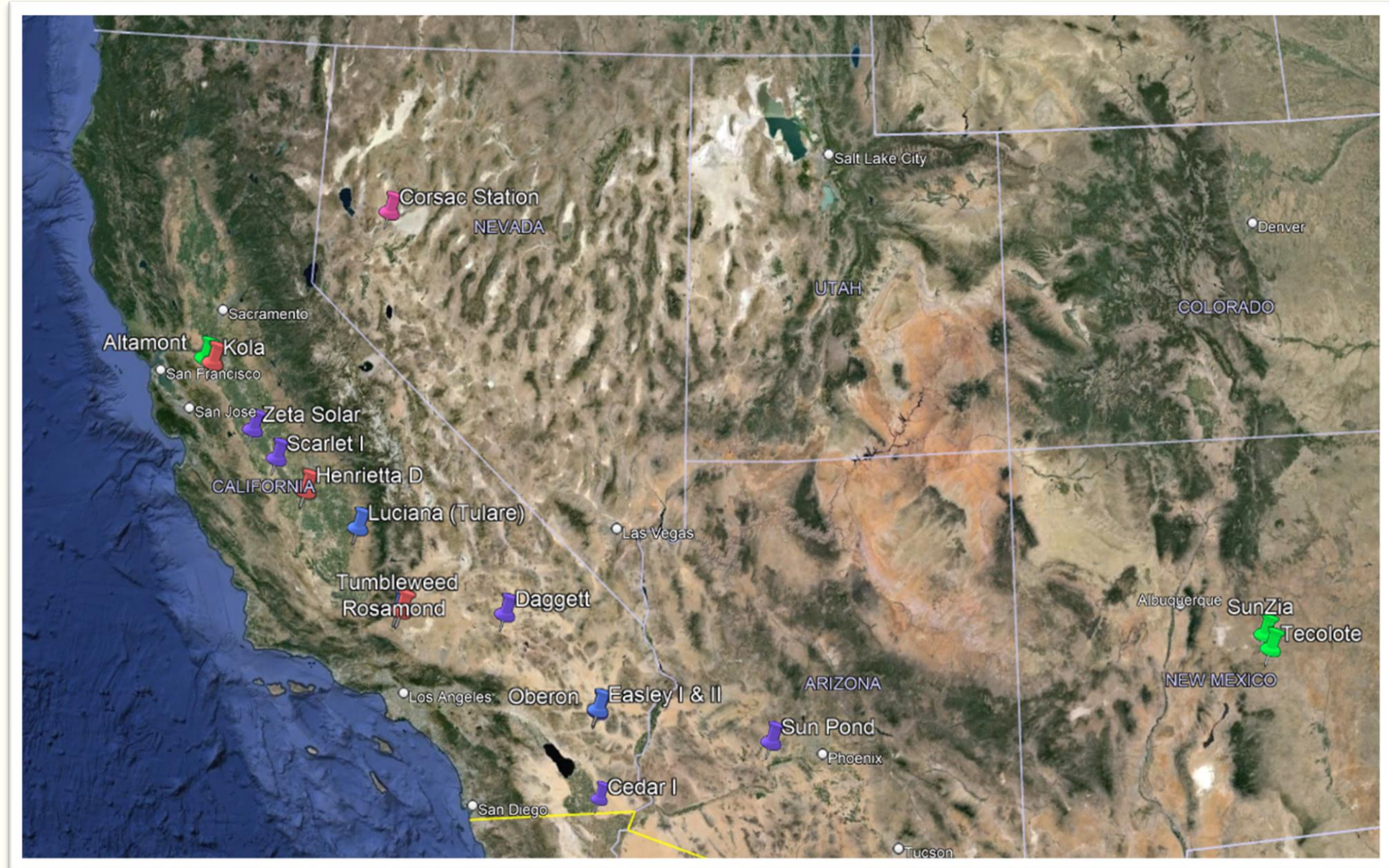


Long Term Renewable Portfolio



Ava's Long-Term Offtake Agreements

- Geothermal
- Storage
- Solar + Storage
- Solar
- Wind



Long-Term Offtake Agreements

Project	Developer	Technology	Expected COD	Generation Capacity (MW)	Storage Capacity (MW)
Rosamond Central	Clearway	Solar	Online	112	-
Altamont	Greenbacker	Wind	Online	54.8	-
Tecolote	Pattern	Wind	Online	100	-
Henrietta D	Convergent	BESS	Online	-	10
Luciana	Idemitsu	Solar	Online	56	-
Daggett	Clearway	Solar + Storage	Online	50	12.5
Oberon	Intersect	Solar + Storage	Online	125	125
Scarlet I	EDP Renewables	Solar + Storage	Online	100	30
Tumbleweed_4hr	REV Renewables	BESS	6/1/2024	-	50
Kola	Next Era	BESS	4/1/2025	-	125
SunZia	Pattern	Wind	3/31/2026	250	-
Sun Pond	Longroad Energy	Solar + Storage	4/1/2026	42.5	42.5
Easley I	Intersect	Solar	3/31/2027	75	0
Easley II	Intersect	Solar	3/31/2027	75	0
Zeta Solar	Longroad Energy	Solar + Storage	6/1/2027	37.5	37.5
Corsac Station	Fervo	Geothermal	4/1/2030	40	-
Cedar 1	Atlantica	Solar + Storage	3/31/2027	100	100



Long-Term Resource Adequacy Contracts

Project	Developer	Technology	Expected COD	Generation Capacity (MW)	Storage Capacity (MW)
Amcor	Nexus	Demand Response	5/15/2024	-	9.499
Scarlet II_BEES	EDP Renewables	BEES	7/31/2024	-	75
Hanford	Middle River Power	BEES	11/22/2024	-	16
Scarlet II_Solar	EDP Renewables	Solar	12/31/2024	200	-
Scarlet III - BEES	EDP Renewables	BEES	12/31/2025	-	160
Alpaugh	Consolidated Edison	BEES	4/1/2026	-	5
Aramis	Intersect	BEES	9/1/2026	-	25
Reclaimed Wind	Ignis	BEES	12/1/2026	0	90.7
Lambie	Clearway	BEES	12/1/2030	0	400
Sequoia	Clearway	BEES	12/1/2032	0	200
Sun Streams 2	Longroad Energy	Solar	Online	150	-
Ocotillo	Vitol	Solar + Storage	Online	50	50



Acronym Key

Acronym Definition

ACS	Asset-Controlling Supply
CAISO	California Independent System Operator
CEC	California Energy Commission
CPUC	California Public Utilities Commission
DR	Demand Response
ERRA	Energy Resource Recovery Account
IOU	Investor-Owned Utility
IRP	Integrated Resource Plan
LSE	Load-Serving Entity
NCPA	Northern California Power Agency
NQC	Net Qualifying Capacity
PCIA	Power Charge Indifference Adjustment
PCL	Power Content Label
PPA	Power Purchase Agreement
PDR	Proxy Demand Response
RA	Resource Adequacy
REC	Renewable Energy Credit
RPS	Renewable Portfolio Standard
SQMD	Settlement Quality Meter Data
ADS	Automated Dispatch Signal
APN	Aggregated Pricing Node
COB	California-Oregon Border
CRR	Congestion Revenue Rights
CS	Community Solar
CUP	Conditional Use Permit
DA	Direct Access
DAC	Disadvantaged Community
DLAP	Default Load Aggregation Point
DLC	Departing Load Charges
DRAM	Demand Response Auction Mechanism
EFC	Effective Flexible Capacity
ELCC	Effective Load Carrying Capacity

Acronym Definition

EPE	Electric Power Entity
FTR	Firm Transmission Rights
GEP	Guaranteed Energy Production
GT	Green Tariff
HLH	High Load Hour
ICE	Intercontinentals Exchange
IEPR	Integrated Energy Policy Report
IST	Inter-SC Trades (Inter-Scheduling Coordinator Trades)
LCOE	Levelized Cost of Electricity
LHL	Low Load Hour
LMP	Locational Marginal Price
LSE	Load Serving Entity
Mid-C	Mid-Columbia (located at Washington-Oregon border)
MRTU	Market Redesign and Technology Upgrade
NERC	North America Electric Reliability Corporation
NOB	Nevada-Oregon Border
NP	CAISO Zone (standing for Northern Path)
OCEI	Oakland Clean Energy Initiative
OTCGH	OTC Global Holdings
Pnode	Pricing node
POU	Public-Owned Utility
PSDR	Power Source Disclosure Report
PTO	Participating Transmission Owner
RTO	Regional Transmission Organizations
SC	Scheduling Coordinator
SP	CAISO Zone (standing for Southern Path)
TO	Transmission Owner
UIE	Uninstructed Imbalance Energy
WAPA	Western Area Power Administration
WECC	Western Electricity Coordinating Council
WREGIS	Western Renewable Energy Generation Information System

