EAST BAY COMMUNITY ENERGY

Board Retreat
Power Procurement Overview

PRESENTED BY:
Marie Fontenot, Senior Director of Power Resources & Tim Belden, Energy GPS

DATE: July 1, 2020

Agenda

- **Section 1:** Energy Markets Overview (Refresher from previous board retreats)
- **Section 2:** Overview of Key Compliance Rules
- **Section 3:** How Do We Build a (RPS) Portfolio?
- **Section 4:** Discussion of Solar Risk
- **Section 5:** Discussion of Other Risks to EBCE

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SECTION 1:

Energy Markets Overview

(Refresher from Previous Retreats)

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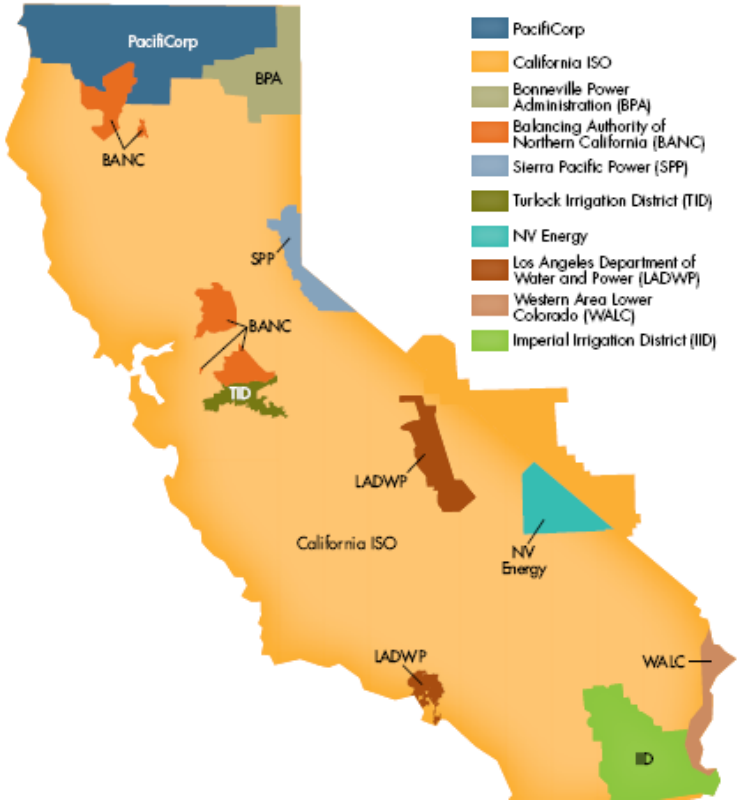
California Balancing Authority Areas

CAISO BAA

- Avg. Peak Load 45,000 MW
- 26,000 circuit miles of transmission

Role of CAISO

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



Source: NCPA, March 2019 Board Retreat Presentation

Wholesale Energy Market Products

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

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Source: NCPA, March 2019 Board Retreat Presentation

Energy Market Price Volatility

Key Drivers of Energy Market Prices:

- Natural Gas
  - Storage
  - Transport
  - Demand
- Weather
  - Local and Regional
- Hydrology
- Policy and Changing Supply Composition
  - RPS
  - GHG Free Objectives

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Source: NCPA, March 2019 Board Retreat Presentation

CAISO Markets

Day-Ahead Market

- Matching Supply / Demand
- Majority of Transitions
- Market Processes
  - MPM, IFM, RUC and ELS

Real-Time Market

- Matching Supply / Demand
- Incremental Adjustments to DAM
- 15-Min. and 5 Min. settlements
- Market Processes
  - MPM, HASP, STUC, RTUC and RTED

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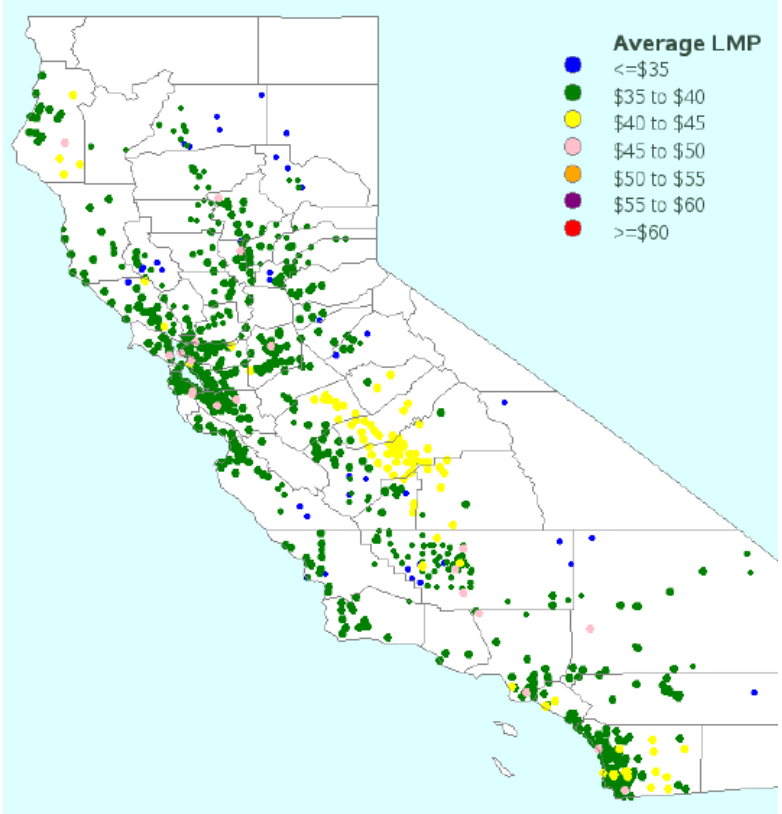
Source: NCPA, March 2019 Board Retreat Presentation

CAISO Nodal Pricing

Locational Market Prices (LMP)

- Full Network Model
  - Injections and Withdrawal
- Prices Calculated at each Node
  - Load
  - Generation
  - Inter-Tie
- Price Granularity
  - Hourly, 15-Min. and 5-Min.
- Based on Cost of Serving 1 MW of Incremental Load



Source: NCPA, March 2019 Board Retreat Presentation

CAISO Nodal Pricing Settlement

Load and Supply Nodal Settlement

- Load Settlement at DLAP
  - Default Load Aggregation Point
  - EBCE in PG&E DLAP
- Generation Settlement
  - Individual PNOD
    - Pricing at location of generation
- Inter-SC Trades
  - Trading Hub Settlement
  - NP15 EZ GEN HUB
    - Weighted average of generation PNODs

Source: NCPA, March 2019 Board Retreat Presentation

Energy Risk Management

Risk Management Objectives

- Mitigate Exposure to Volatility
- Durable Rates
- Financial Stability
- Regulatory Compliance

Key Energy Market Risks

- Volumetric Risk
  - Fluctuations in the volume of supply and demand
- Price Risk
  - Price volatility

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Source: NCPA, March 2019 Board Retreat Presentation

Long-Term to Short-Term Hedge Strategy

Long-Term Hedging

- Load Forecasting
- Coverage Objectives
- Market Conditions
- Resource Composition

Short-Term Hedging

- Refined Load Forecast
- Intra-Month / Intra-Day Shaping
- Market Conditions

Fixed-Price Energy Hedging

- Inter-SC Trades

Example:

Months to Delivery		Price Matrix Percentile						
		>60%	60%	50%	40%	25%	10%	<10%
		Covered Position as a % of Forecasted Load						
0+	3	80%	80%	85%	85%	90%	90%	100%
3+	6	70%	70%	75%	80%	80%	90%	100%
6+	9	70%	70%	75%	80%	80%	80%	90%
9+	12	60%	60%	70%	80%	80%	80%	90%
12+		60%	60%	70%	80%	80%	80%	90%

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Source: NCPA, March 2019 Board Retreat Presentation

MWh Coverage and Value-at-Risk Hedging

Match Demand with Fixed Price Supply

- Reduces exposure to market price volatility
- Forms of Insurance
  - May include premium cost similar to insurance

Establish Coverage within Risk Tolerance

- Maintain open position based on value-at-risk
- Value-at-risk is a measure of ‘risk of loss’

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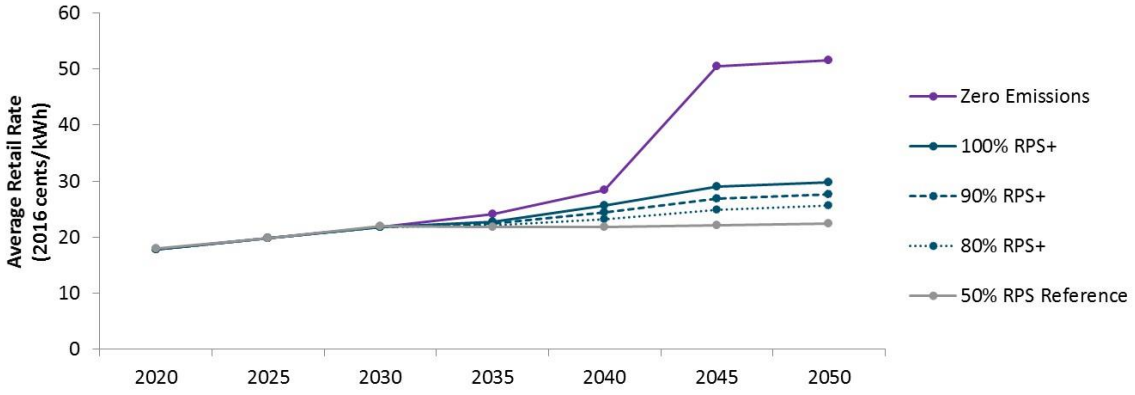
Source: NCPA, March 2019 Board Retreat Presentation

Renewable electricity levels above 80% result in higher electric rates

Electricity costs are significantly higher under the 100% RPS+ Scenario:

- Total electricity costs increase by $26 million, or 32%, in 2045 relative to the 50% RPS Scenario
- Average electricity rates increase by $0.07/kWh
- Most significant changes in electricity rates occur after 2035
- Electricity rates exceed $0.50/kWh in Zero Emissions Scenario due to elimination of all dispatchable generation



Source: E3, June 2019 Board Presentation

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“Pocket Guide” to Integration Solutions

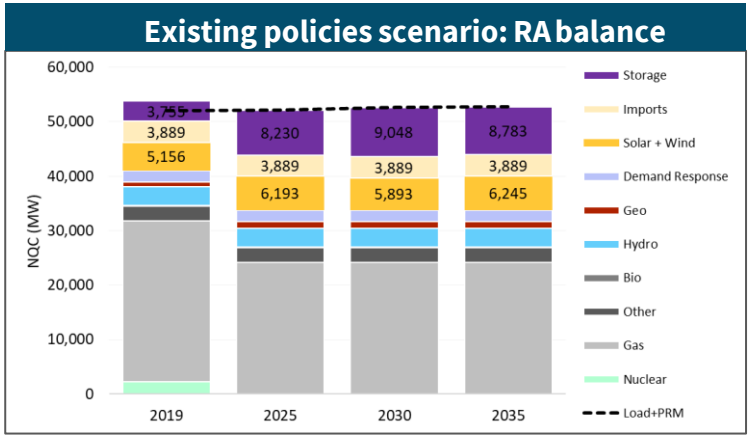
	Integration solution	Findings
Net benefits even w/o renewables	**Regional coordination**	Significant renewable integration value – exporting excess renewables to other markets in the West defers integration challenges
Low cost solutions with potentially large benefits	**Time of use rates**	Provide renewable integration value if TOU periods reflect seasonality and timing of overgeneration periods and if customers are able to regularly increase midday loads, likely via automated responses
	Subhourly renewable dispatch	Significant renewable integration value – enabling subhourly curtailment leads to net reduction in curtailment
	Renewable portfolio diversity	Significant renewable integration value – in-state or out-of-state wind and geothermal resources help to avoid daytime overgeneration
Costs and benefits should be evaluated on specific project or program basis	**Flexible loads Advanced DR**	Provides renewable integration value, but cost effectiveness will depend on specific functionality and cost of resource/program
	Additional storage	Provides renewable integration value, but cost effectiveness will depend on other grid conditions and cost of energy storage
	Gas retrofits	Cost effectiveness of gas retrofits in the model is highly sensitive to assumptions – should be further evaluated for specific sites
	Flexible gas resources	Flexible gas resources were not economic in cases that allowed energy storage build, but should be further evaluated for specific projects
Valuable, though not as much for integration	**Energy efficiency**	Provides cost and GHG savings, though is not expected to significantly impact curtailment
	Conventional demand response	Conventional load curtailment provides cost savings, though does not significantly impact curtailment

Solutions with the highest identified renewable integration value

Source: E3, June 2019 Board Presentation

Nuclear and OTC plant retirements reduce capacity supply significantly by 2025

- **Diablo Canyon retirement results in 2.3 GW capacity shortfall in 2025**
- **OTC plant retirements result in 3.6 GW net capacity shortfall after repowering**
  - Deeper near-term shortfall with shutdown of Alamitos, Redondo, etc.



Note: Storage added to the AURORA capacityexpansion portfolios when a capacity shortfall is observed.

Current CAISO planned additions and retirement by technology (NQC MW)

Technology	2019	2020	2021	2022	2023	2024	2025	Total
Nuclear	0	0	0	0	0	0	-2,280	-2,280
Bio / Geo	30	346	0	0	0	0	0	376
Storage	98	693	120	135	160	0	0	1,205
Natural Gas	-1,557	-2,398	0	400	0	200	0	-3,574

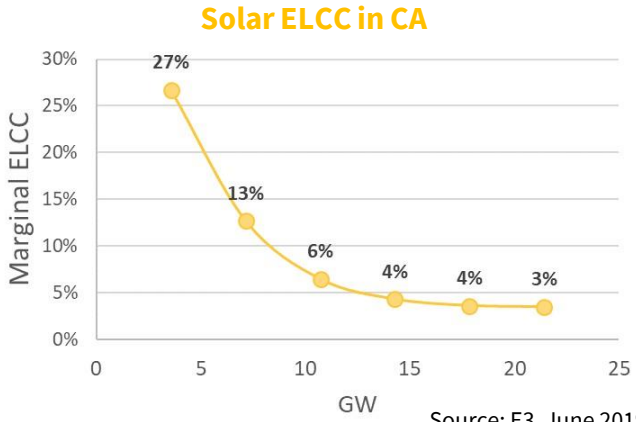
Note: Negative numbers above mean resource retirements

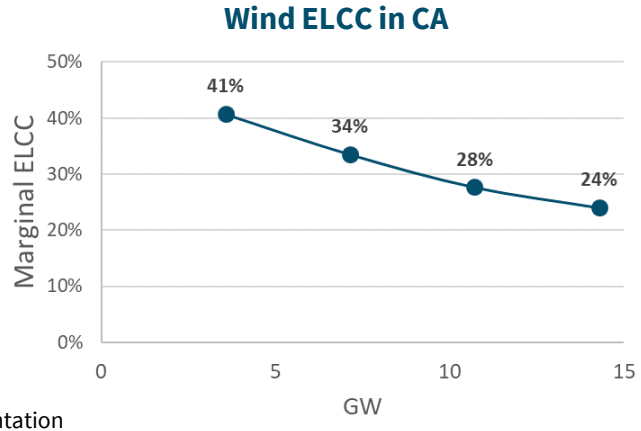
Net loss of nearly 6 GW of firm capacity by 2025, all of which must be replaced with renewables and storage

Source: E3, June 2019 Board Presentation

ELCC (Effective Load Carrying Capacity) from solar and wind additions

- Solar and wind offer diminishing contributions to RA as penetration grows, particularly for solar, which is already facing low marginal ELCC
  - Even 40 GW of new solar will not reduce peak demand significantly from today
- Diversity benefits exist both for technological diversity and geographical diversity (not shown below), meaning a portfolio of solar, wind, and storage may offer a higher ELCC than the sum of its parts





Source: E3, June 2019 Board Presentation

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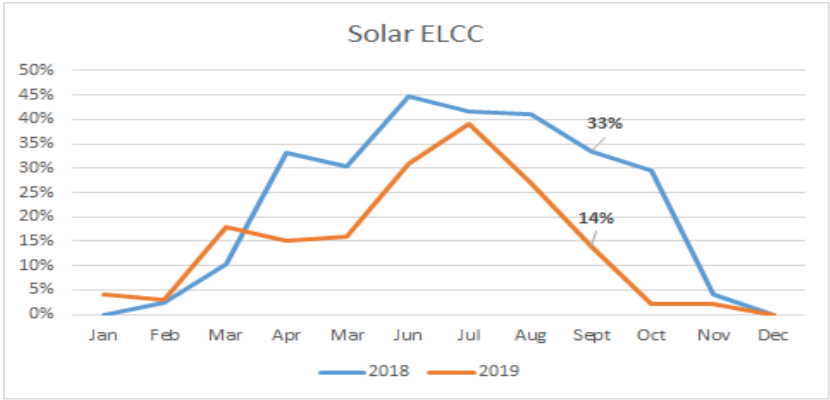
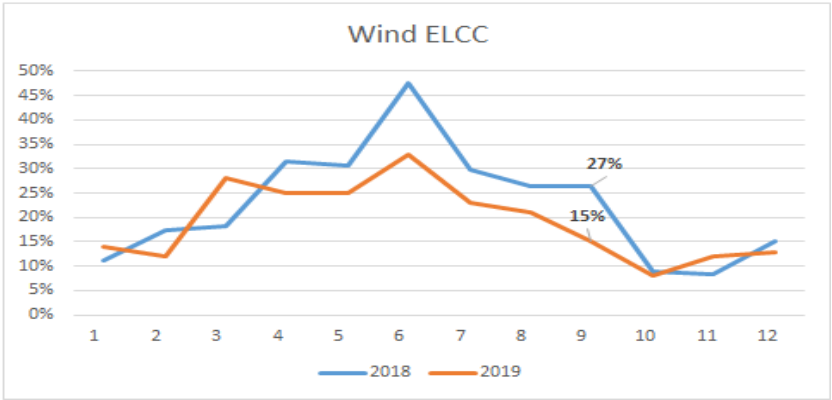
Solar and Wind ELCC

- **Simple avg of Solar ELCC has declined from 23% to 14% from 2018 to 2019 respectively**
- **Simple avg of Wind ELCC has declined from 23% to 19% from 2018 to 2019 respectively**
- **The summer reflects the most constrained RA season with September being the most constrained**



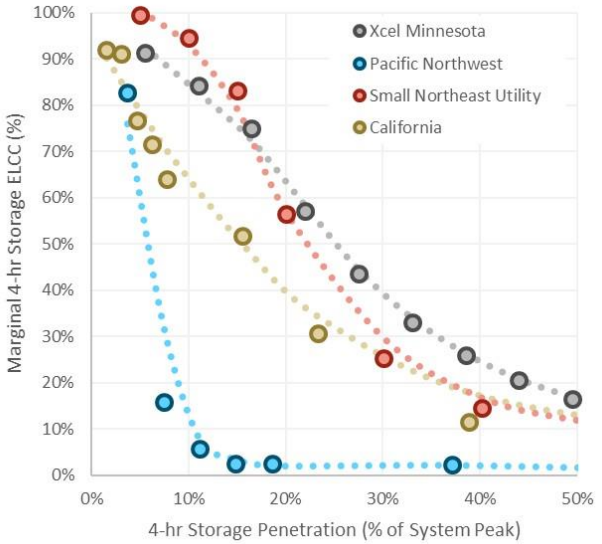


Note: New material

ELCC of battery storage additions

- E3 studied the ELCC of storage in many jurisdictions with varied findings
  - ELCC of storage interacts with net load shape and renewable penetration, synergy with solar
- In the model E3 used step-downs in RA contribution from storage for CA
  - 4-hr storage: 100% ELCC up to 4 GW
  - 6-hr storage: 100% ELCC up to 4GW
  - 8-hr storage: 100% ELCC up to 4GW
  - 12-hr storage: 100% ELCC up to 4 GW
- RA met by storage is increasingly expensive due to long-duration needs
  - New 4-hr storage sets RA price in early 2020s
  - By 2025, 4-hr storage offers declining ELCC and 6-hr storage is required for 100% ELCC (or 4-hr storage is derated by 33%)
  - By 2035, 8- to 12-hr storage is needed for 100% ELCC, or 2-3x as much as 4-hr storage

Marginal ELCC of storage at varying penetrations



Source: E3 Analysis

Source: E3, June 2019 Board Presentation

SECTION 2:

Overview of Key Compliance Rules

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Resource Adequacy

System Resource Adequacy

Resources interconnected in CAISO BA

- Generator Net Qualifying Capacity (NQC)

Imports

- Firm energy imported into the CAISO
  - Must be bundled with Import Capability
- To ensure sufficient BA capacity, imports limited
  - CAISO defines a fixed amount of import capability

Other

- Demand Response

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Source: NCPA, March 2019 Board Retreat Presentation

Local Resource Adequacy

***Update**: Recent CPUC Decision created "Central Procurement Entity" construct for Local RA

Capacity located in a defined sub-pocket

- PG&E System
- SCE System
- SDG&E System

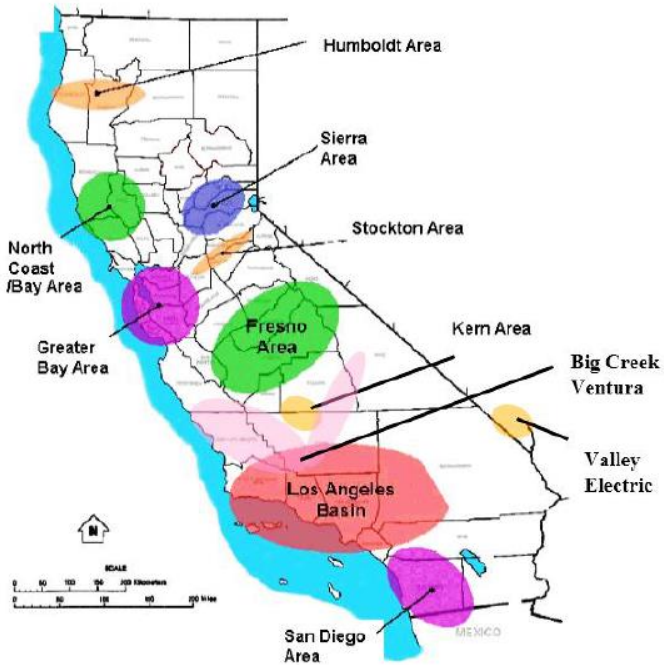
Resources defined by Effectiveness Factors

- Modeling based on contingency analysis
- Designed to maintain load under N-1-1 contingency

Requirements defined annually

- CAISO technical study
- Impacted by resource retirements

Figure 2: LCR Areas within the ISO



Source: NCPA, March 2019 Board Retreat Presentation

Local Resource Adequacy

2020 Year Ahead Local Deficiencies (MW)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bay Area	0	0	0	0	0	12.22	13.18	13.18	0.99	0.03	0	0
Fresno	12.81	12.62	64.59	64.82	64.82	83.58	47.79	0.97	45.79	45.79	0	0
Humboldt	6.98	6.98	6.98	6.98	6.98	6.98	9.97	9.97	16.95	16.95	0	0
Kern	18.97	29.16	28.57	6.27	6.69	4.17	1.86	1.33	3.60	1.33	1.33	8.54
LA Basin	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
NCNB	30.4	30.4	30.4	30.4	30.4	30.4	20.4	20.4	30.4	30.4	30.4	30.4
San Diego-IV	183.21	183.44	181.64	180.98	183.85	288.82	341.94	342.17	342.84	182.88	182.44	182.32
Sierra	77.04	76.89	80.39	78.2	78.38	78.38	120.59	114.89	132.8	145.23	78.13	77.92
Stockton	53.04	53.33	53.87	86.12	72.19	66.41	68.21	69.26	80.02	86.53	61.74	55.36
# of LSEs	**10**	**11**	**11**	**12**	**10**	**11**	**14**	**15**	**15**	**12**	**12**	**12**

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Source: CPUC, The State of the Resource Adequacy Market - Revised

Flexible Resource Adequacy

	Category 1	Category 2	Category 3
Must-offer obligation	17 Hours	5 Hours	5 Hours
	5 AM- 10 PM Daily For the whole year	3 PM to 8 PM for May – September	3 PM to 8 PM for May – September
	5 AM- 10 PM Daily For the whole year	2 PM- 7 PM for January- April and October-December	2 PM- 7 PM for January- April and October-December
	Daily	Daily	Non-holiday weekdays
Energy limitation	At least 6 Hours	At least 3 Hours	At least 3 Hours
Starts	The minimum of two starts per day or the number of starts feasible with minimum up and down time	At least one start per day	Minimum 5 starts a month
Percentage of LSE portfolio of flexible resources	At least 62 % for May – September	Up to 38% for categories 2 and 3 combined	Up to 5%
	At least 46 % for January- April and October-December	Up to 54% for categories 2 and 3 combined	Up to 5%

- Addresses the challenge of variability and uncertainty of variable energy resources
- CPUC established a flexible capacity procurement obligation for LSE's

Generic RA requirement

- Resources may economically bid or self-schedule to fulfill their RA obligation
- Substitution for forced outages
- Replacement for planned outages

Flexible RA requirement

- Resources must economically bid to fulfill their obligation
- No substitution required for forced outages
- No replacement required for planned outages

Source: 2020 CPUC RA Guide and CAISO Pre-Market SIM training

Renewable Portfolio Standard (RPS)

Renewable Portfolio Standard: Definitions

- **Renewable Portfolio Standard** sets goals for Load Serving Entities (LSE) to increase the amount of renewable energy procured until 60% of sales are from eligible renewable energy resources by the end of 2030
  - **SB 100** created additional requirement that 100% of energy be GHG-free by 2045
- **Renewable Energy Credit (REC)**: a certificate of proof associated with the generation of electricity from eligible renewable energy resources
- **Portfolio Content Category (PCC) 1 REC**: the electricity and the REC are from the same eligible renewable resource and delivered into a California Balancing Authority (CBA) at the same time
  - This can be transacted under a fixed price contract or as an indexed transaction
- **PCC 2 REC**: the electricity and the REC are from different sources but matched and delivered into a CBA at the same time
- **PCC 3 REC**: there is no associated electricity, just the unbundled REC

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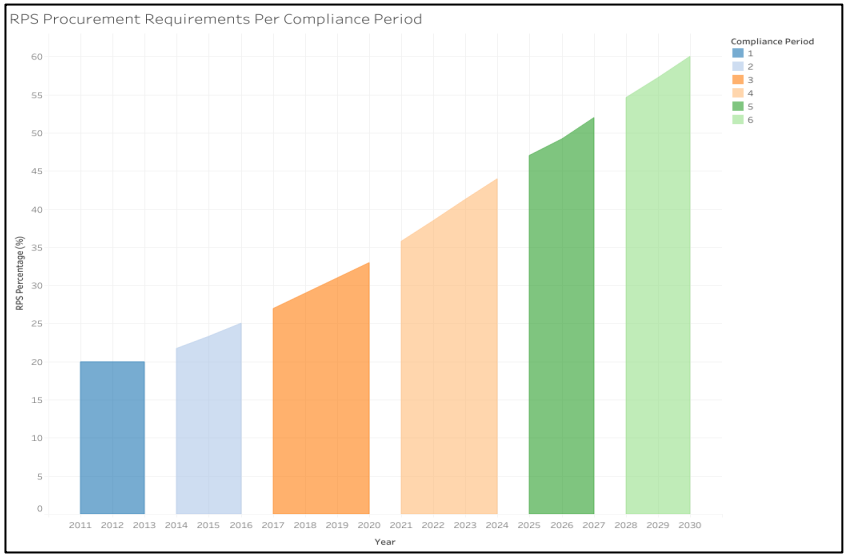
Renewable Portfolio Standard: Rules

- **Over a Compliance Period (CP), LSEs must have a certain percent of their purchases from eligible renewable resources**

- There is no single year requirement; at the end of each CP, LSEs must have purchased the ***average percent*** as eligible renewable content across that CP
- SB 350 requires that 65% of eligible renewable purchases come from contracts ***10 years or longer*** starting in 2021
- Non-compliance with the RPS could result in a $50/MWh fine for any shortage



CP#	CP3		CP4				CP5			CP6		
Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RPS %	31%	33%	36%	39%	41%	44%	47%	49%	52%	55%	57%	60%

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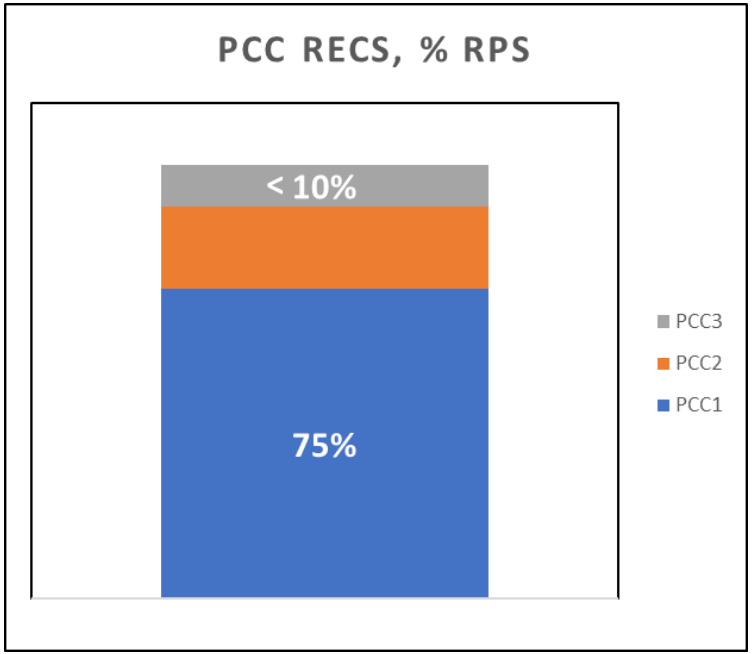
Renewable Portfolio Standard: RPS Products

- State regulations limit the amount that each PCC group can count towards your total RPS requirement:
- **PCC1 RECs**: the minimum amount for the RPS requirement is at least 75% or your purchased RECs must be PCC1 RECs
- **PCC3 RECs**: the maximum amount that can be used for RPS compliance is 10%
- The remaining amount can be **PCC2 RECs**
- EBCE further limits PCC3 procurement to a maximum of 5% of Bright Choice renewables procurement



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Power Content Label
and
Emissions Reporting

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Power Content Label

- CA state reporting requirement
- Discloses the electricity that was delivered to customers as a percent by energy resource for a given calendar year
- Requires EBCE and other electricity retail sellers to declare the electricity by generation source, that was purchased during a calendar year
- Uses a different methodology than the Renewable Portfolio Standard (RPS)

2018 POWER CONTENT LABEL

East Bay Community Energy

https://ebce.org/document-library/

ENERGY RESOURCES	Renewable 100	Brilliant 100	Bright Choice	2018 CA Power Mix**
Eligible Renewable	**100%**	**45%**	**41%**	**31%**
Biomass & Biowaste	0%	0%	0%	2%
Geothermal	0%	0%	1%	5%
Eligible Hydroelectric	0%	0%	0%	2%
Solar	50%	20%	15%	11%
Wind	50%	25%	25%	11%
Coal	**0%**	**0%**	**0%**	**3%**
Large Hydroelectric	**0%**	**55%**	**21%**	**11%**
Natural Gas	**0%**	**0%**	**0%**	**35%**
Nuclear	**0%**	**0%**	**0%**	**9%**
Other	**0%**	**0%**	**0%**	**<1%**
Unspecified sources of power*	**0%**	**0%**	**38%**	**11%**
TOTAL	**100%**	**100%**	**100%**	**100%**

* "Unspecified sources of power" means electricity from transactions that are not traceable to specific generation sources.

** Percentages are estimated annually by the California Energy Commission based on the electricity generated in California and net imports as reported to the Quarterly Fuel and Energy Report database and the Power Source Disclosure program.

For specific information about this electricity product, contact:	**East Bay Community Energy** **1-(833)-699-3223**
For general information about the Power Content Label, please visit:	http://www.energy.ca.gov/pcl/
For additional questions, please contact the California Energy Commission at:	Toll-free in California: 844-454-2906 Outside California: 916-653-0237

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Power Content Label: New Rules

- AB1110 applies rule changes to the Power Content Label
- Reporting on electricity purchases from 2019 will conform to **new regulations**:
  - Unbundled RECs (PCC3s) will not count towards percentage totals.
  - For 2020 purchases and beyond, the Power Content Label will also disclose total emissions, which will include the emissions from the bundled electricity of PCC2 RECs. The emissions accounting methodology differs from the Climate Registry, which is the EBCE Board-approved methodology.
  - Asset Controlling Supplier Power (ACS), which is power supplied from interconnected generators in the Pacific Northwest region, will be disclosed by the individual resources. Past years' ACS was disclosed as Unspecified.
- EBCE has purchased ACS power as a low cost, low emissions electricity source for the Bright Choice plan.
- ACS is mostly electricity from large hydroelectric (>85%) and includes a small amount from imports, natural gas, wind (shown as other) and nuclear.

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ACS Reporting Changes

- AB1110's PCL rule changes to Power Content Label regulations were finalized in May 2020
- Approximately 90% of all 2019 ACS purchases were made prior to proposed PCL rule changes applicable to ACS reporting in Oct 2019
- Board voted not to accept PG&E nuclear allocation at April 2020 meeting
- EBCE did not make any new ACS purchases in 2020
- EBCE does hold legacy contracts that will deliver ACS in 2020 and beyond

Emissions Reporting

- Greenhouse gas (GHG) emissions for generated electricity are measured based on the amount of generated electricity (MWh) and the emissions intensity of the source
- EBCE currently reports and discloses emissions from the previous year using The Climate Registry
- The Climate Registry is a national GHG reporting program for measuring, reporting and verifying emissions
- Emissions from 2020 purchases will be disclosed through the Power Content Label

2018 Climate Registry Report

2018 EMISSION RATES

Factor Type	Utility	Emission Factor (lbs CO_2/MWh)
S	East Bay Community Energy (Renewable 100)	0.00
S	East Bay Community Energy (Brilliant 100)	0.00
S	East Bay Community Energy (Bright Choice)	100.75
W	Northern States Power Company	806.89
S	Northern States Power Company	0.00
R	Northern States Power Company	820.12
S	Northern States Power Company - WindSource®	0.00
S	Northern States Power Company - Renewable*Connect®	0.00
SA	Pacific Gas & Electric	206.29
W	Public Service Company of Colorado	1210.34
S	Public Service Company of Colorado	0.00
R	Public Service Company of Colorado	1307.34
W	Sacramento Municipal Utility District	590.84
S	Sacramento Municipal Utility District	0.00
R	Sacramento Municipal Utility District	465.17
S	Sonoma Clean Power (EverGreen)	46.02
R	Sonoma Clean Power (CleanStart)	98.81
W	Southwestern Public Service Company	1170.65
S	Southwestern Public Service Company	0.00
R	Southwestern Public Service Company	1170.65
SA	University of California, Office of the President	138.17
S	Clean Power Alliance (100% Green Power)	0.0
S	Clean Power Alliance (65% Renewable Power)	6.01
S	Clean Power Alliance (Clean Power)	9.81
S	Clean Power Alliance (Lean Power)	10.59

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SECTION 3:

How Do We Build a (RPS) Portfolio?

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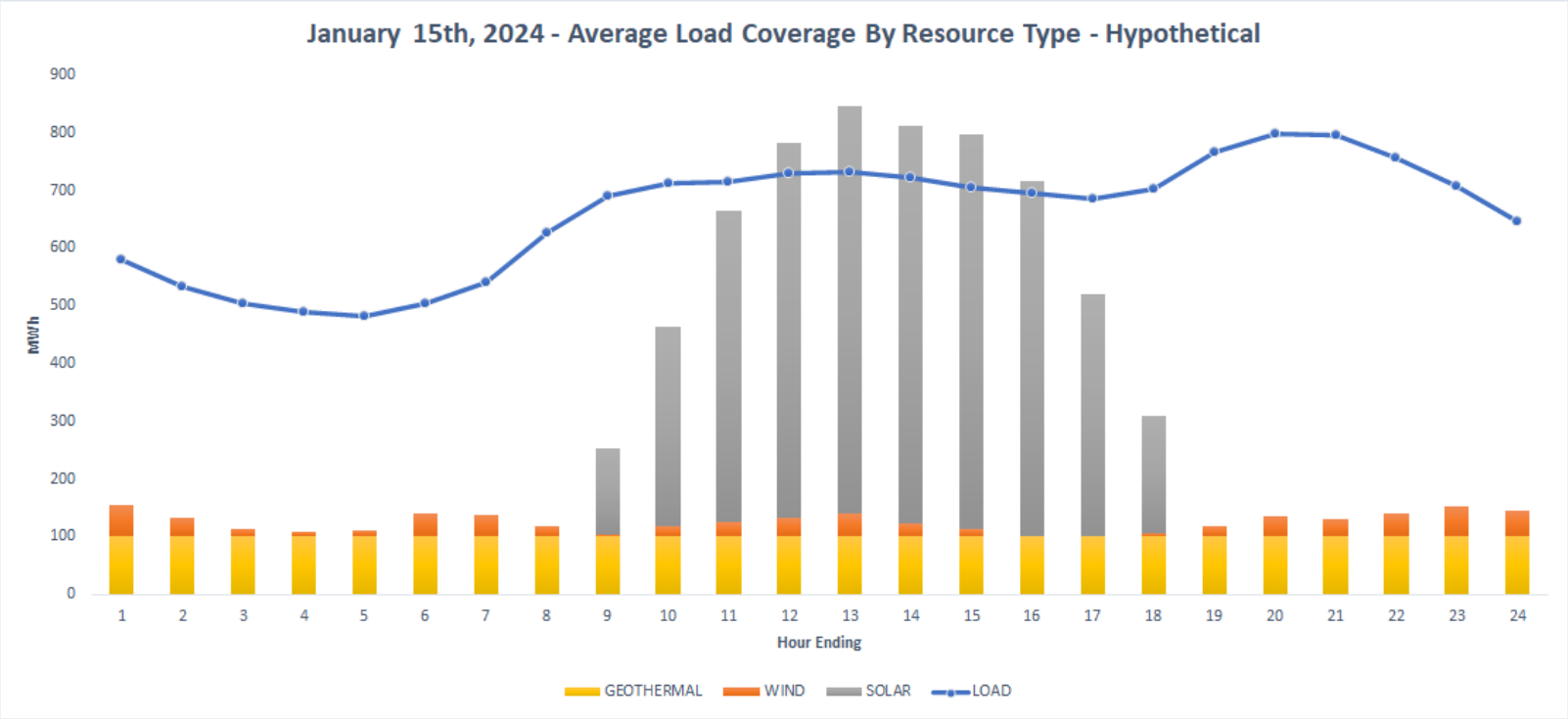
Hypothetical Future January



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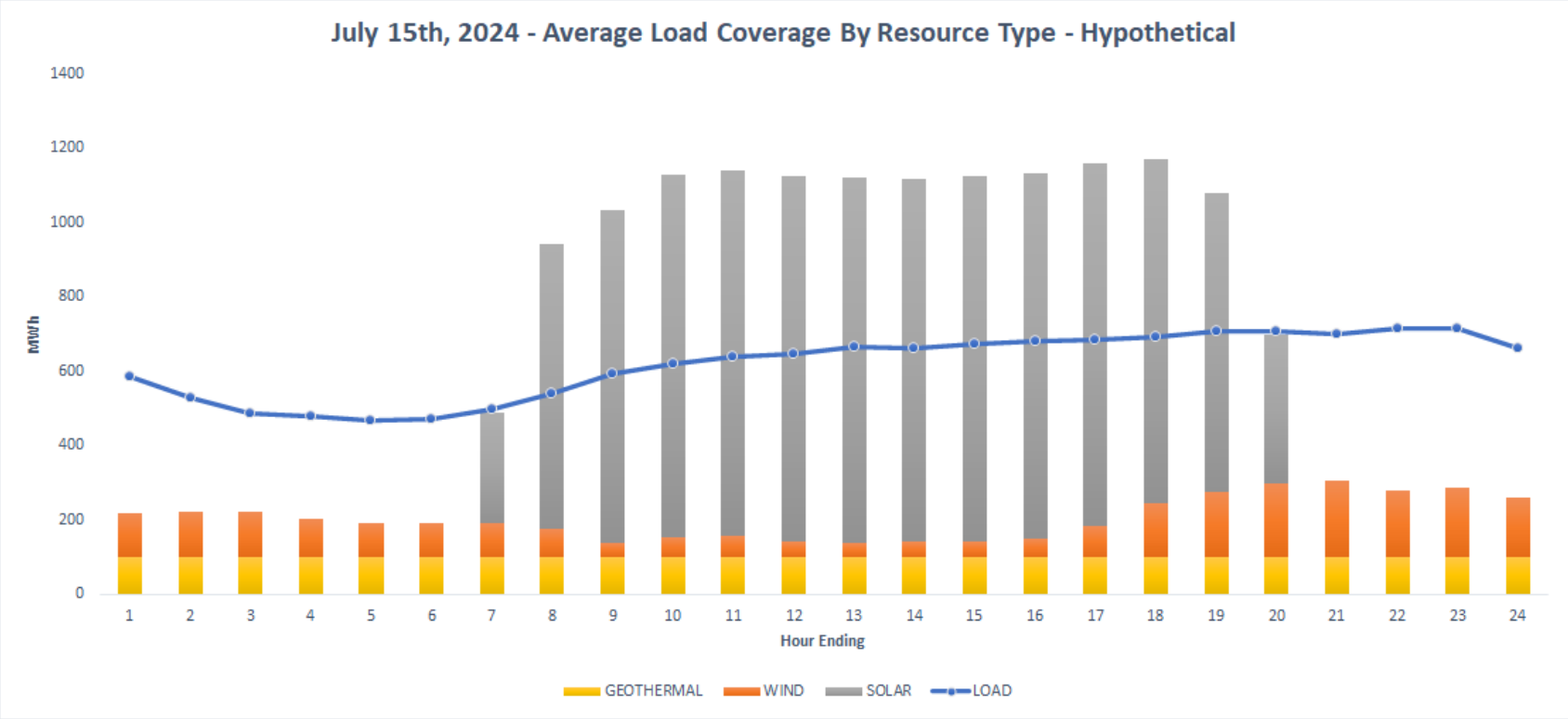
Hypothetical Future July



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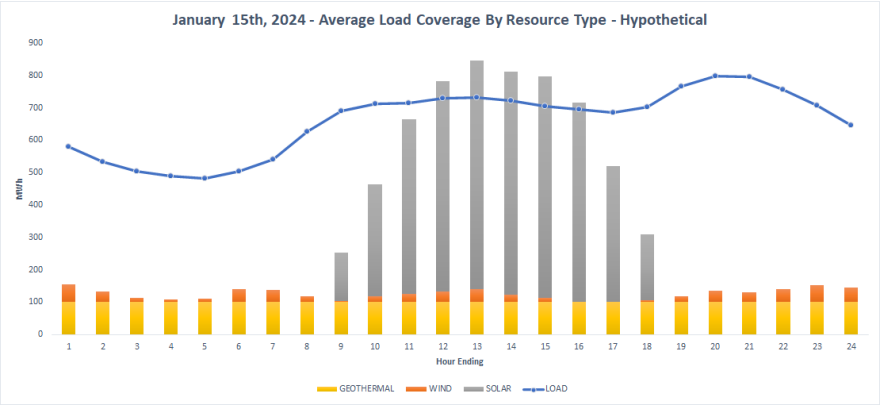
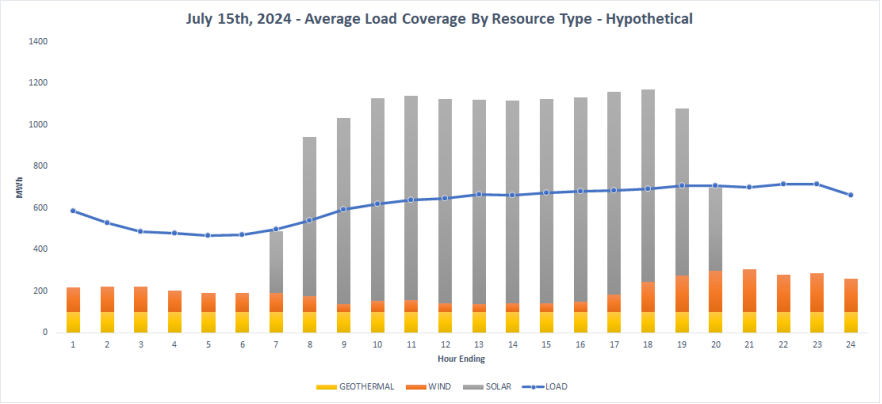
Step 1: Needs Assessment

- Demand forecast
  - Peak vs average monthly loads
- Quantity Compliance Requirements
  - RPS
  - RA
- Other EBCE-goals
- Market Dynamics
  - Open position
  - Market price exposure
- Risk Management
  - Hedge strategies
  - Financeability of transactions





EAST BAY COMMUNITY ENERGY

Step 2: Prioritization & Valuation

Prioritization

- Compliance Requirements
  - RPS
  - RA
- Market Dynamics
  - Open position
  - Market price exposure
- Risk Management
  - Hedge strategies
  - Finance-ability of transactions
- Other EBCE goals

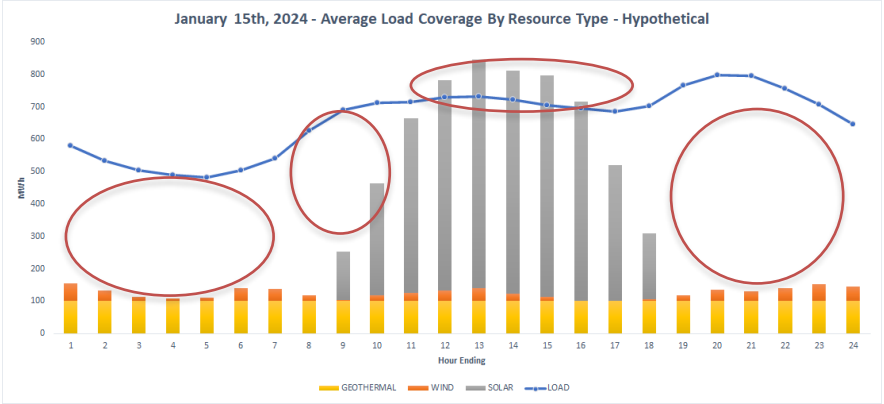
Valuation

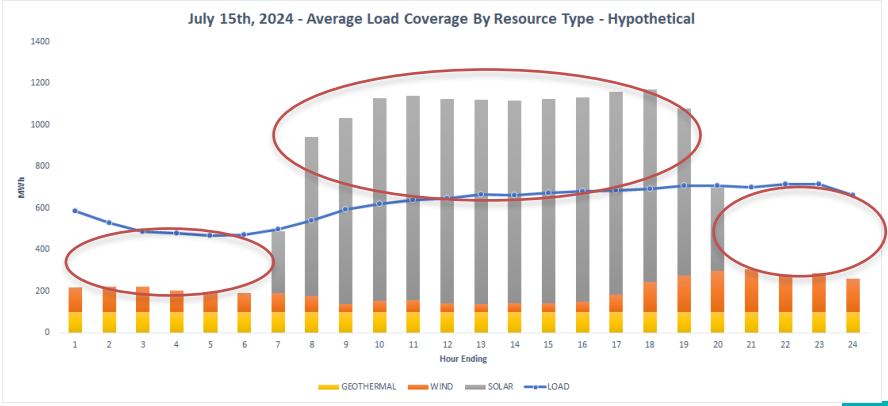
- Quantitative Inputs
  - Forward Curve Development (Energy, RA, RPS)
  - Estimated Value of Location
  - Others
- Qualitative Inputs
  - Open position risk (+ or -)
  - Credit terms & seller creditworthiness
  - Counterparty concentration
  - Project risk/ability to construct in a timely manner
  - Environmental considerations

EAST BAY COMMUNITY ENERGY

Step 3: Define Eligible Products

Product	RPS?	RA?	Hedge Energy Position?
Fixed-price energy hedge	No	No (typically)	Yes
Renewable generation (shaped or dispatchable)	Yes	Maybe	Yes (key: “shaped or dispatchable”)
Call-option	No	Maybe	Yes
RA only (short term or long term)	No	Yes	No
Energy Storage “toll”	No	Yes	Yes





EAST BAY COMMUNITY ENERGY

Step 4: Go-to-Market

- Identify Product
- Develop Timeline
- Market/Seller Outreach
- Evaluate Offers
- Negotiate
- Calculate final, proposed notional values
- Execute Agreements

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SECTION 4:

Discussion of Solar Risk

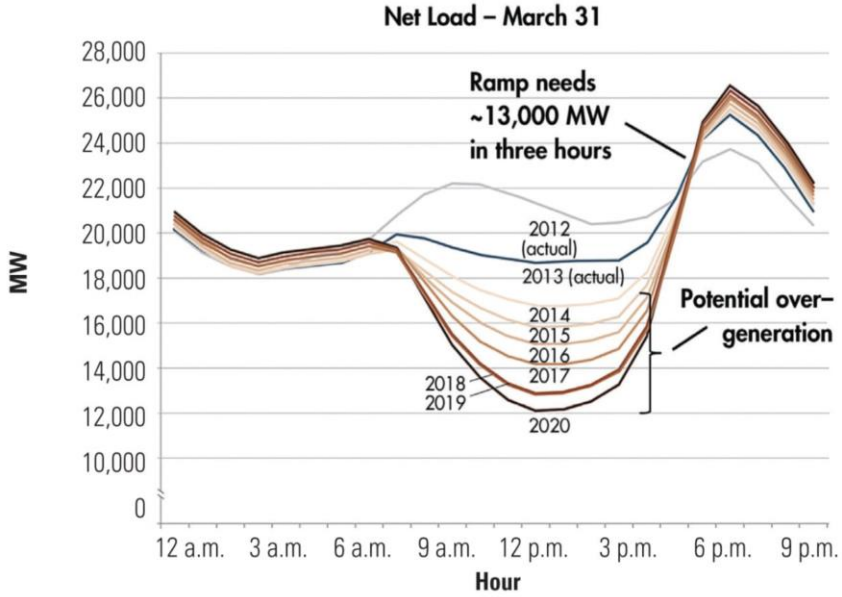
EAST BAY COMMUNITY ENERGY

Solar is the Low-Cost Renewable But Comes with Certain Risks

It's All About:

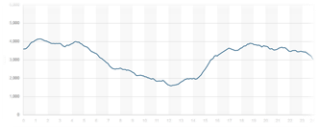
- Solar Penetration Rates
- Shape Ratios
- Price Dispersion

But what are these?



EAST BAY COMMUNITY ENERGY

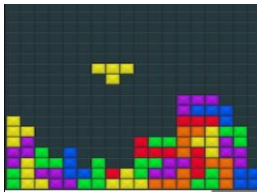
Solar Risk: Stems from a Mismatch Between the Value of What You Own and the Cost/Value to Serve Load



Wind

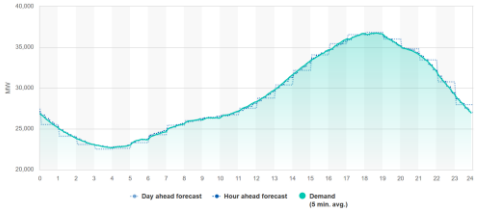
Solar

Market



EBCE Portfolio

EBCE Load



Thesis:

- Mismatch between solar/wind production and load must be resolved with market purchases.
- Net cost of market purchases will depend on relative value of volumes sold (in cases of excess solar) or volumes purchased (in hours when portfolio supply is not sufficient) during different hours of the day.

EAST BAY COMMUNITY ENERGY

ENERGYGPS LLC

Definitions

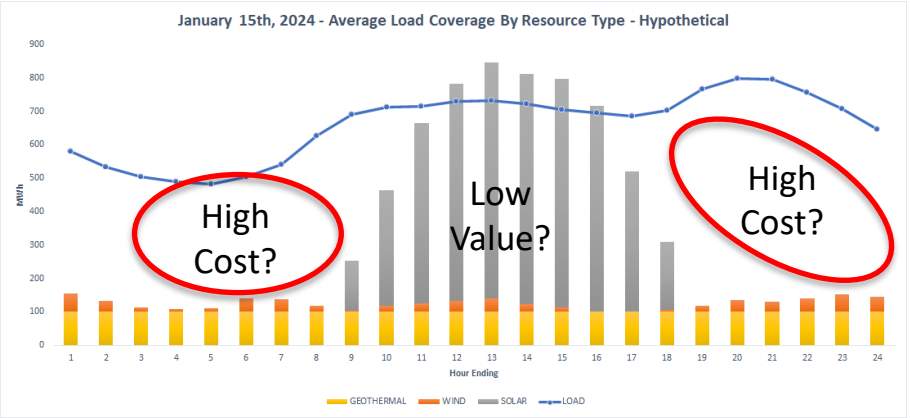
Variable	Definition
Solar Shape Ratio	Solar Weighted Price / Simple Avg Price
Load Shape Ratio	Load Weighted Price / Simple Avg Price
Wind Shape Ratio	Wind Weighted Price / Simple Avg Price
Solar Penetration Rate	Total Solar MWh / Total Demand MWh
Battery Margin	Avg Sales Price Less Average Purchase Price
Battery Price Dispersion Ratio	Battery Margin / Simple Avg Price

EAST BAY COMMUNITY ENERGY

Solar “Shape” Risk

Mismatches:

- **Shape**: Difference between the production profile that you own (solar) and your load obligations.
- Shape Risk: Cost to fulfill short positions is disproportionately high.
- Note: This January example is a combination of “volume” risk and “shape” risk where MWh purchased < MWh of load.

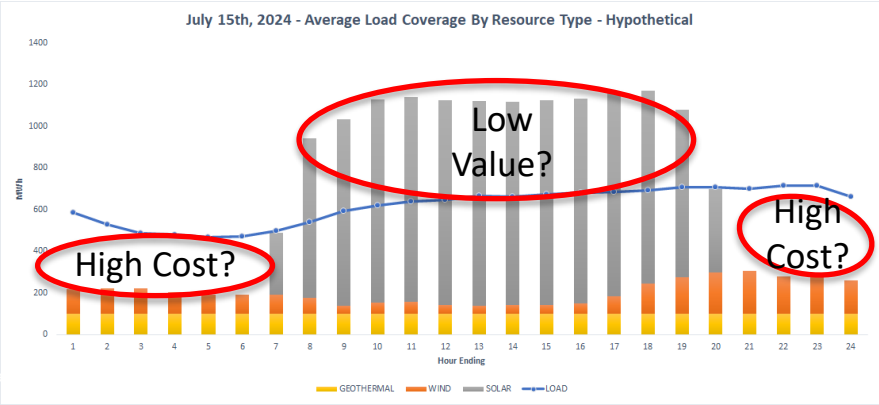


EAST BAY COMMUNITY ENERGY

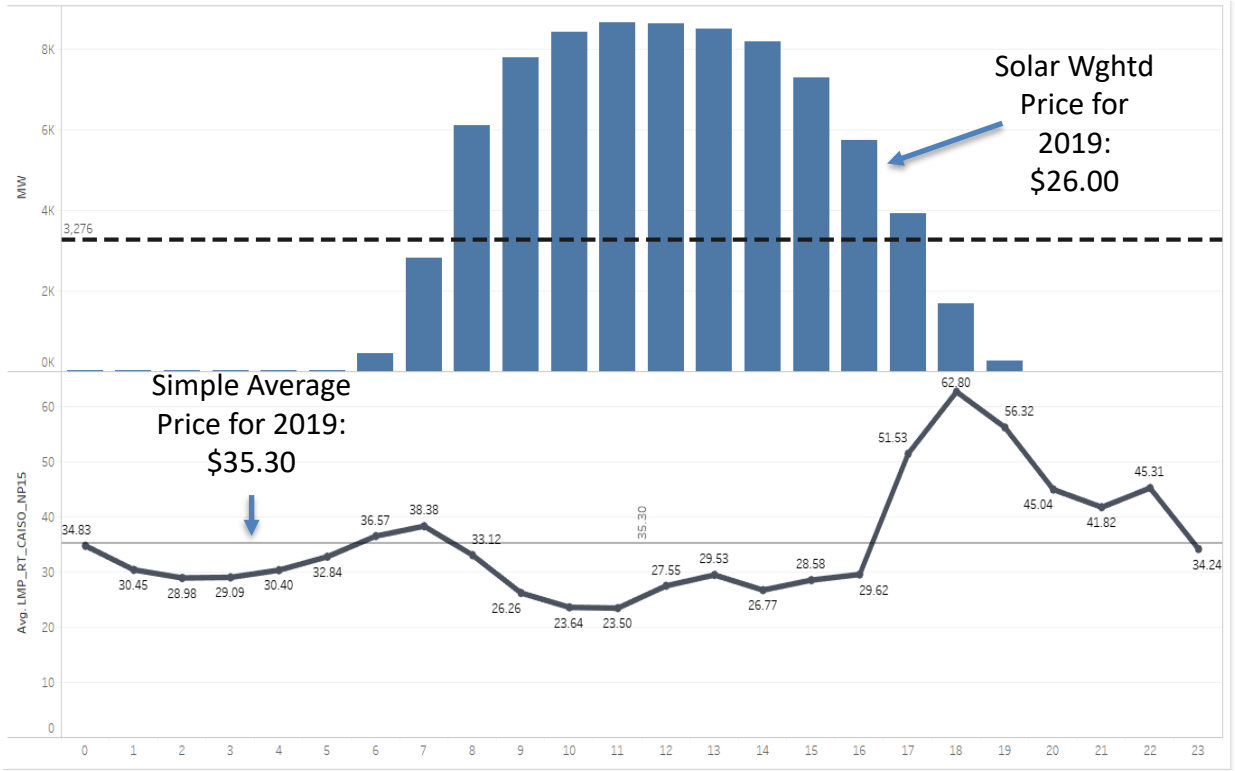
Solar “Shape” Risk

Mismatches:

- **Shape**: Difference between the production profile that you own (solar) and your load obligations.
- Shape Risk: Value of excess energy in mid-day falls relative to the value of energy purchased during off-peak.

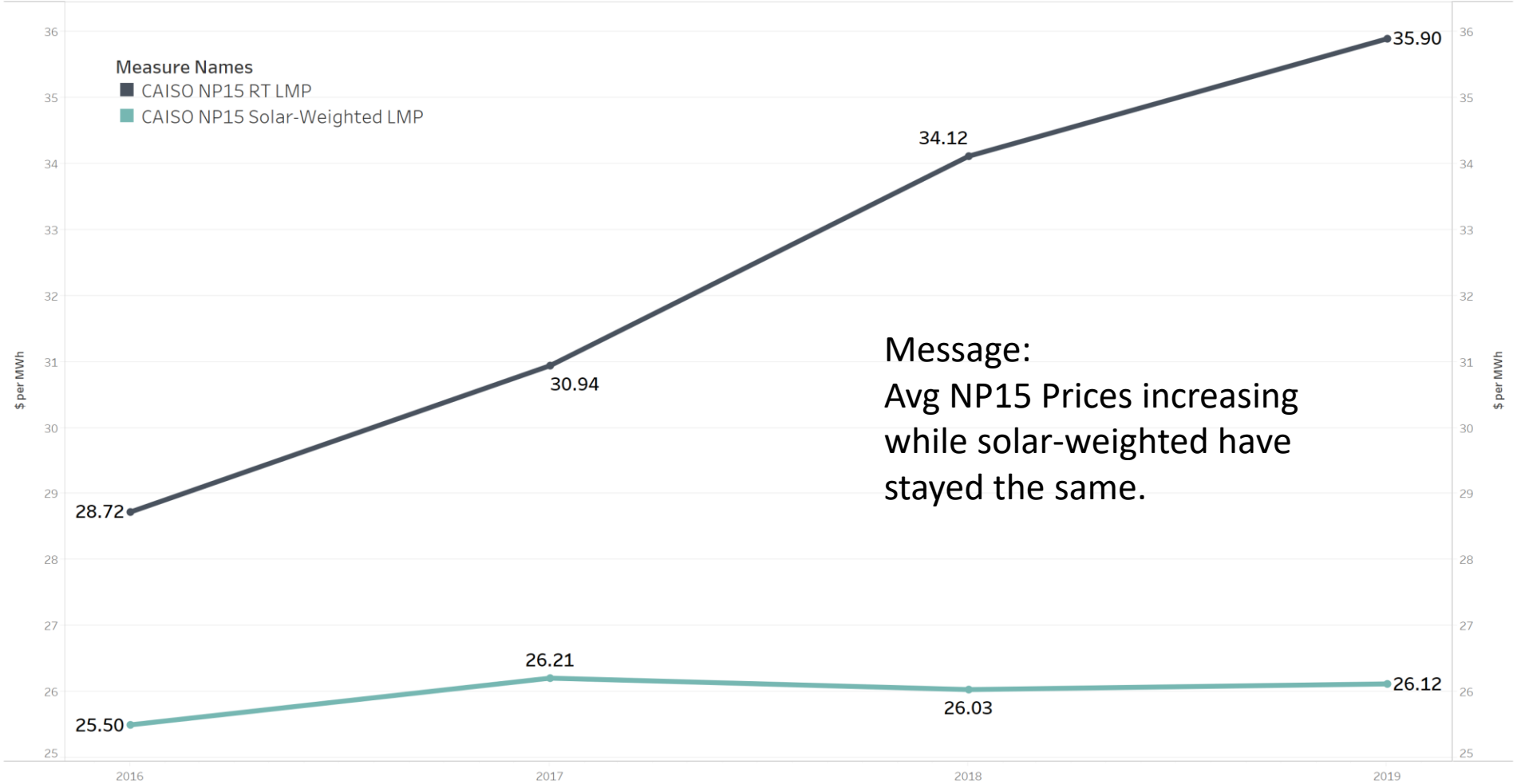


Concept: Weighted Avg Solar versus Simple Average Price for NP15



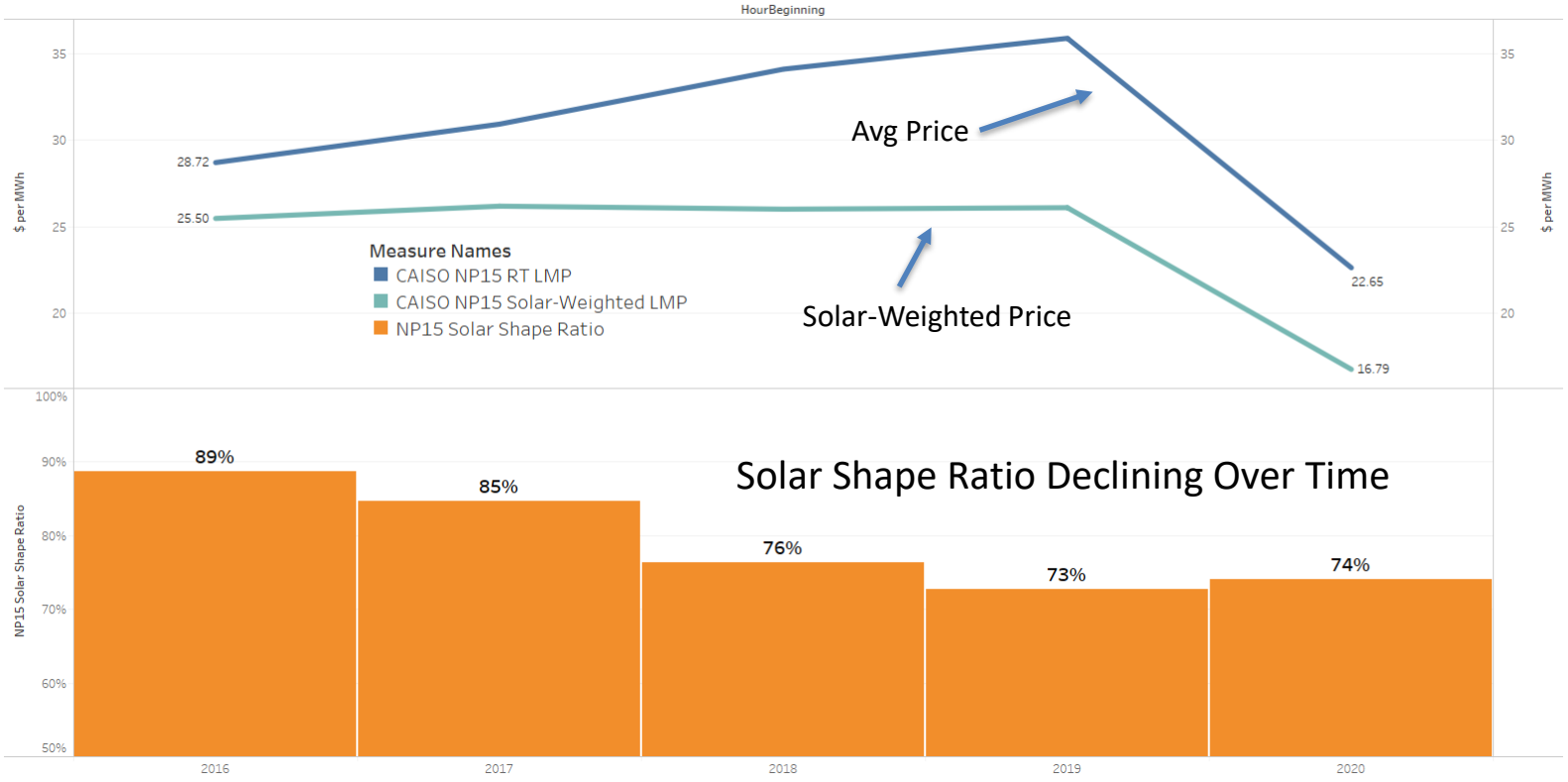
EAST BAY COMMUNITY ENERGY

Comparison of NP15 Average Prices and NP15 Solar-Weighted Prices



Comparison of NP15 Average Prices and NP15 Solar-Weighted Prices (Top)
NP15 Solar Shape Ratio (Bottom)

Solar Shape Ratio =
Solar-Weighted Price / Avg Price



EAST BAY COMMUNITY ENERGY

Definitions

Variable	Definition
Solar Shape Ratio	Solar Weighted Price / Simple Avg Price

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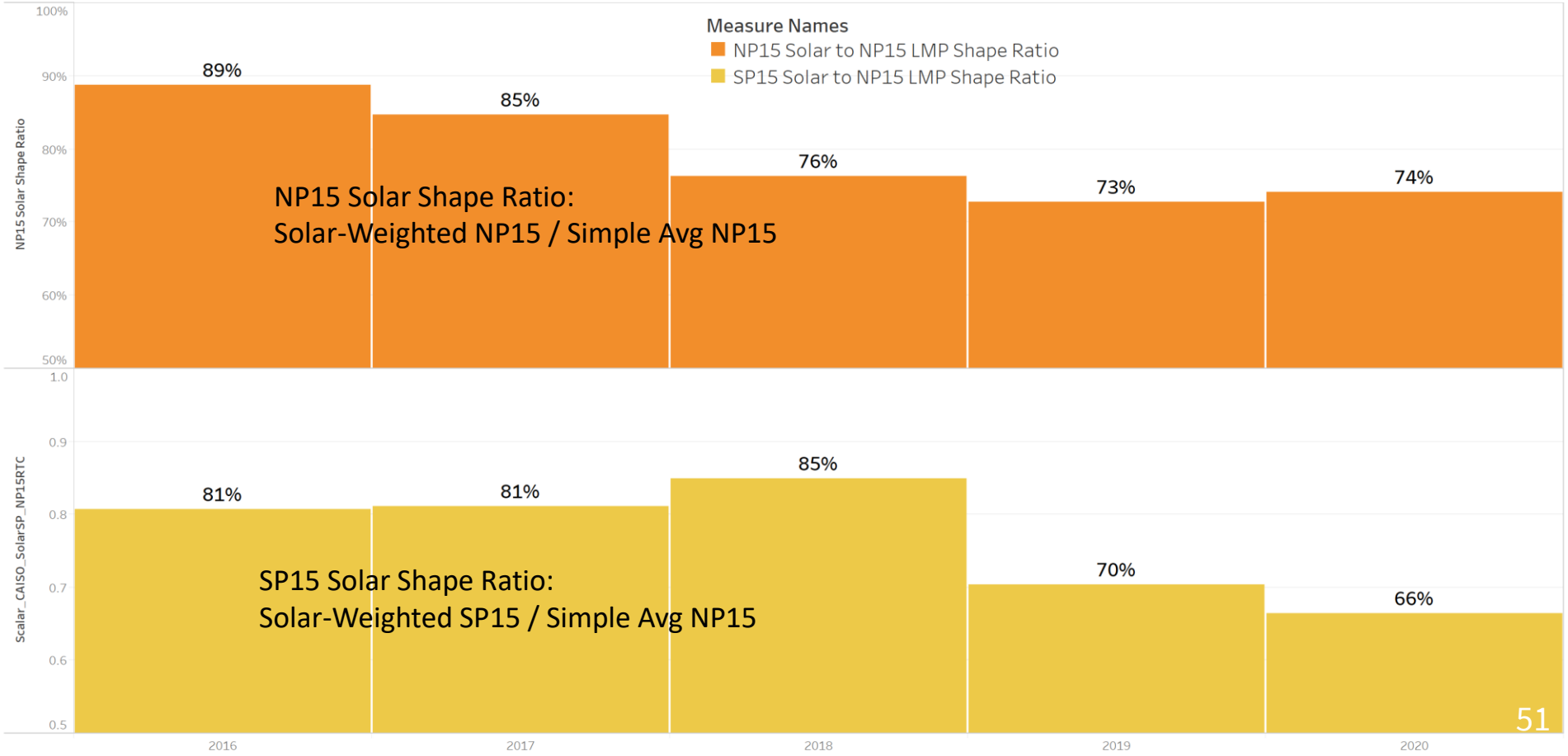
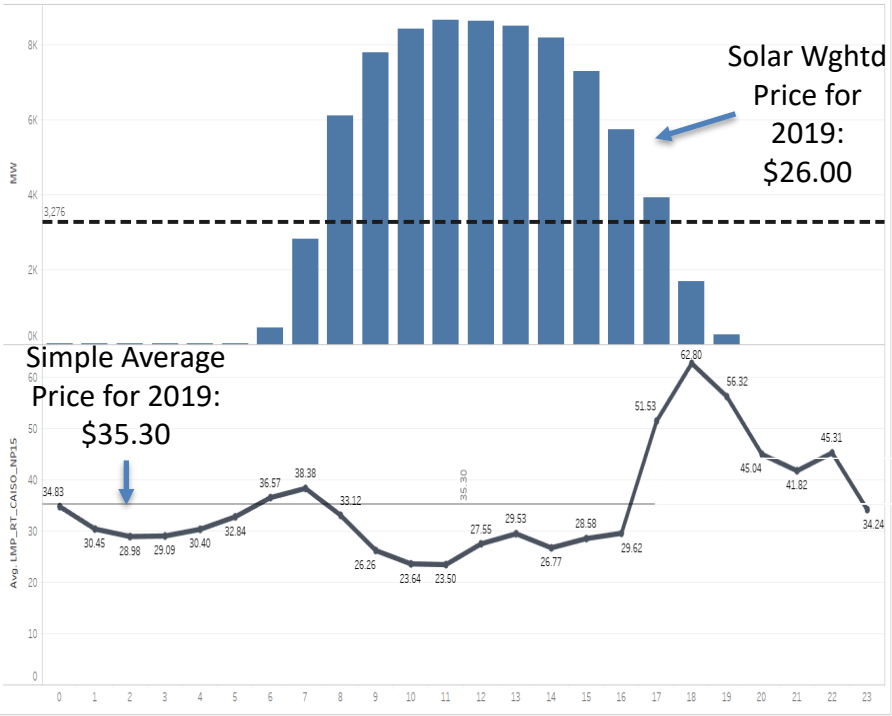
NP15 Solar Shape Ratio: NP15 Solar / NP15 Avg (Top)

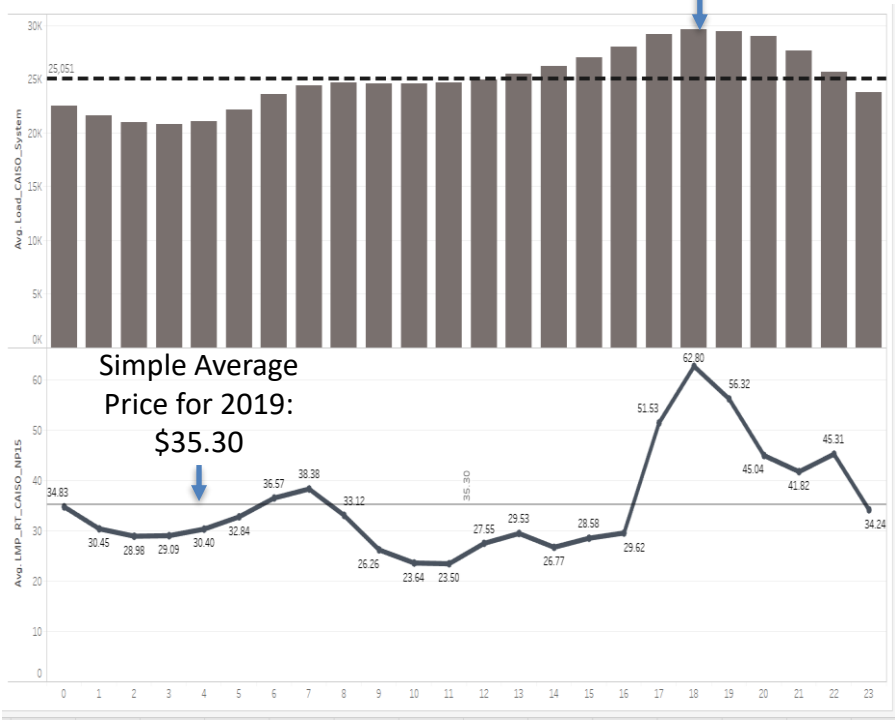
SP15 Solar Shape Ratio: SP15 Solar / NP15 Avg (Bottom)

Message: SP15 Shape Ratio generally lower, except higher in 2018.



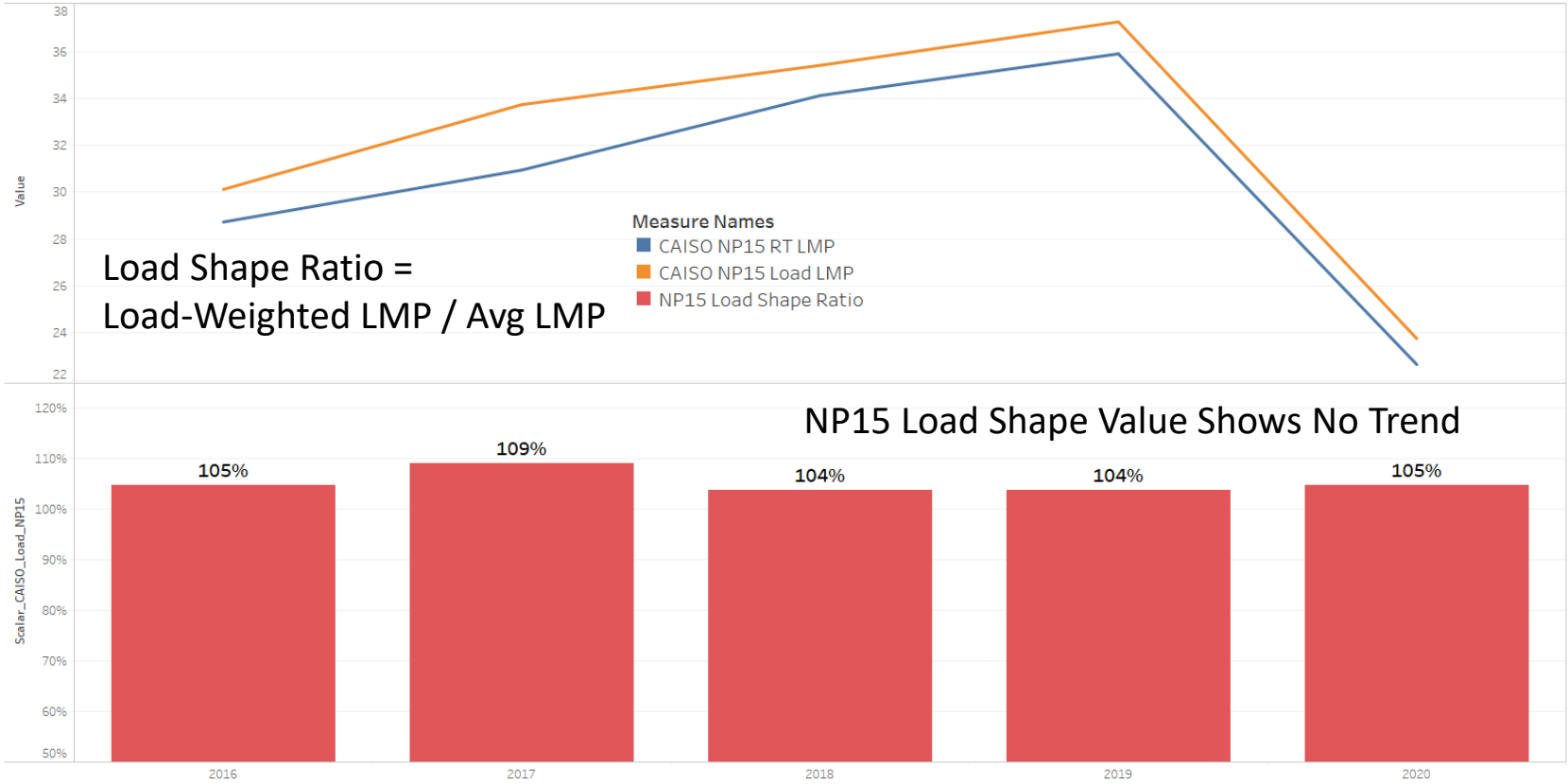
Concept: Weighted Avg Load versus Simple Average Price for NP15





EAST BAY COMMUNITY ENERGY

Comparison of NP15 Average Prices and NP15 Load-Weighted Prices (Top)
NP15 Load Shape Ratio (Bottom)



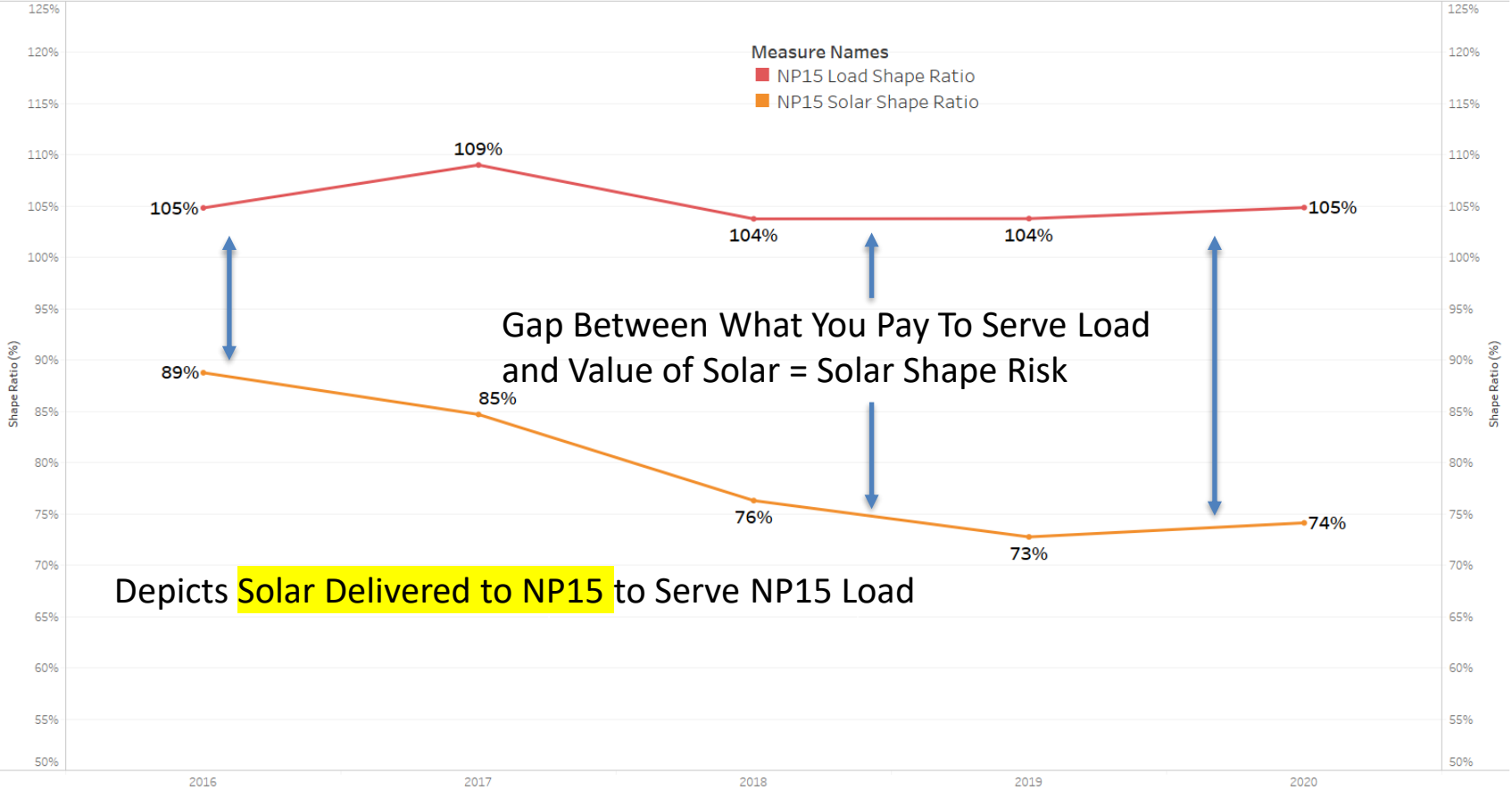
EAST BAY COMMUNITY ENERGY

Definitions

Variable	Definition
Solar Shape Ratio	Solar Weighted Price / Simple Avg Price
Load Shape Ratio	Load Weighted Price / Simple Avg Price

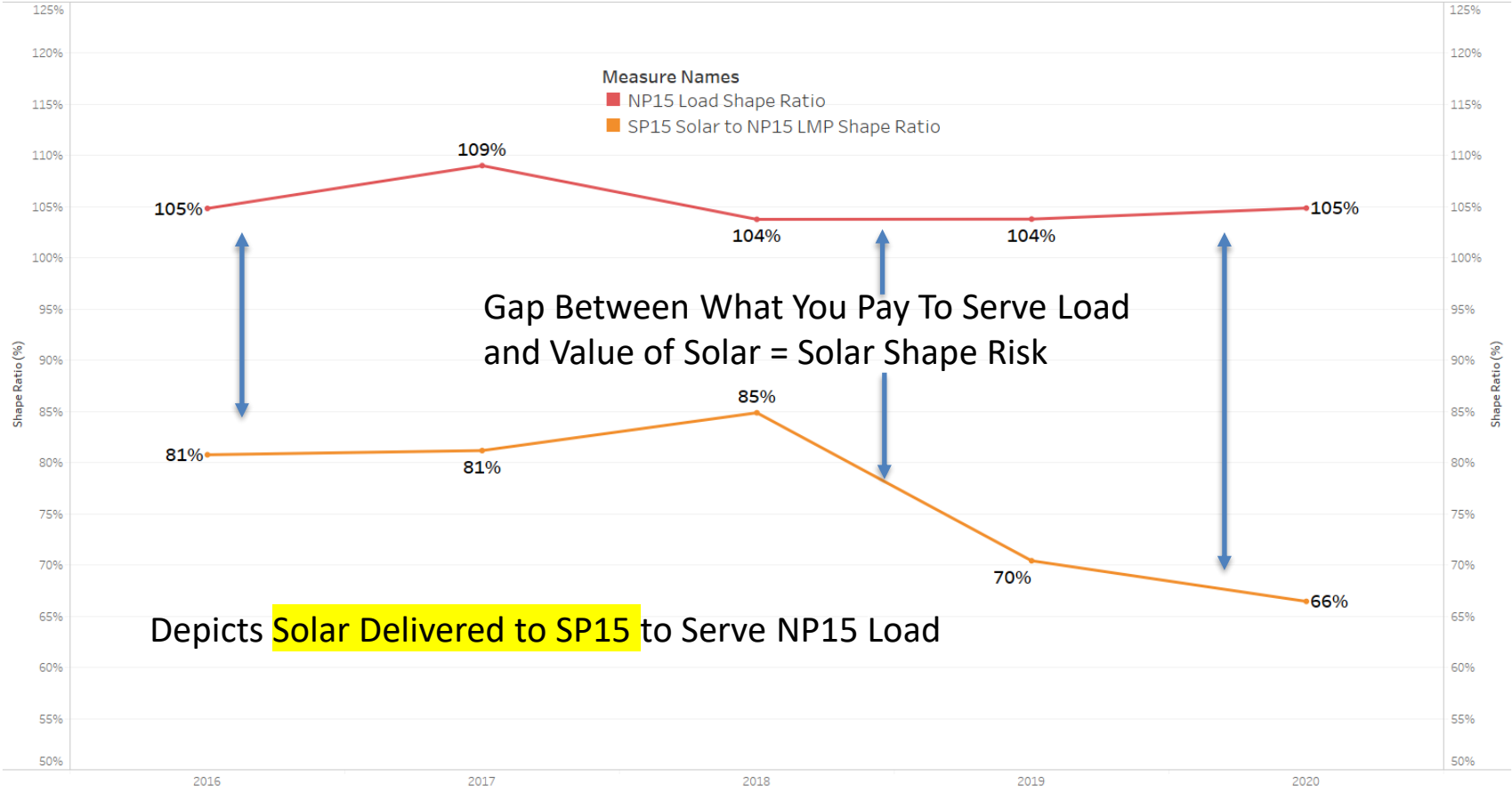
EAST BAY COMMUNITY ENERGY

NP15 Load Shape Ratio Compared to NP15 Solar Shape Ratio



EAST BAY COMMUNITY ENERGY

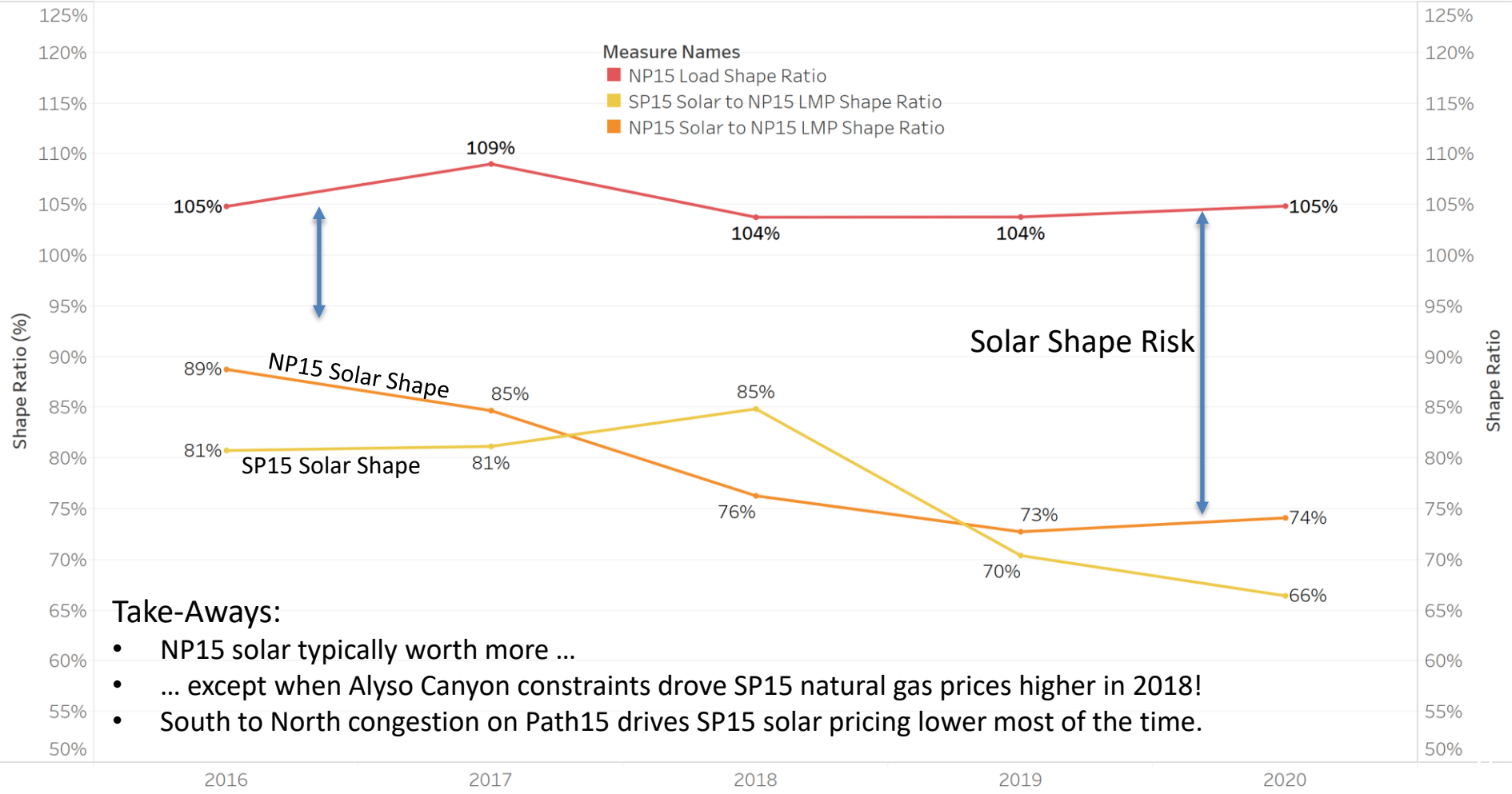
NP15 Load Shape Ratio Compared to SP15 Solar Shape Ratio (SP15 Solar LMP to NP15 LMP)



EAST BAY COMMUNITY ENERGY

NP15 Load Ratio versus SP15 Solar and NP15 Solar Shape Ratio

Combines Previous Two Slides



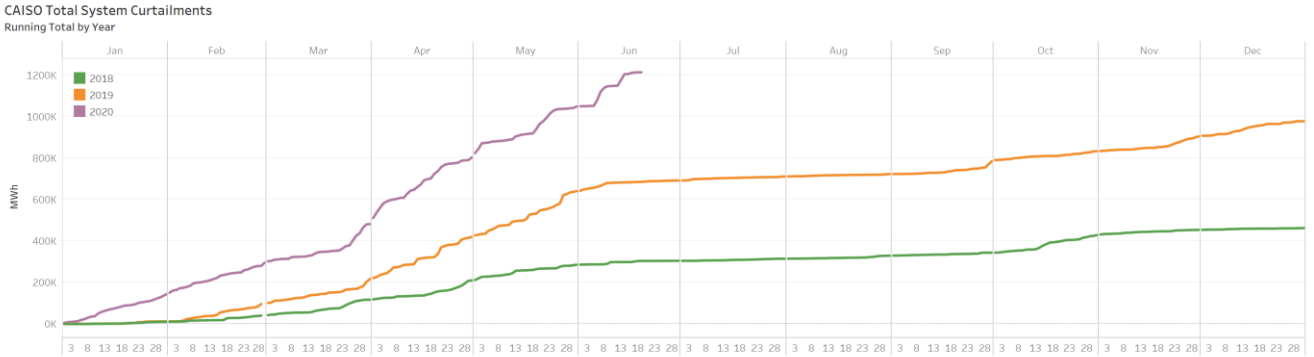
Take-Aways:

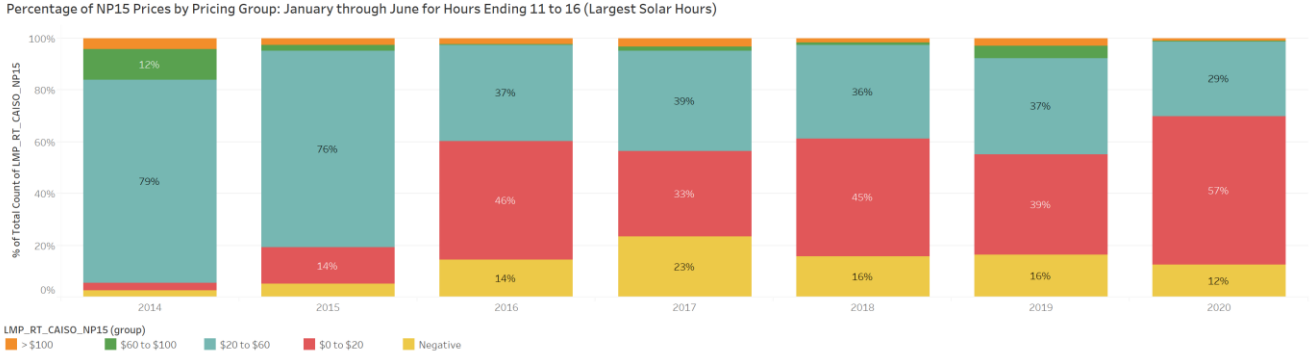
- NP15 solar typically worth more …
- … except when Alyso Canyon constraints drove SP15 natural gas prices higher in 2018!
- South to North congestion on Path15 drives SP15 solar pricing lower most of the time.

Impact of Solar on Curtailment and Pricing

Key Take-Aways:

- Curtailment YTD already exceeds total from 2019.
- Number of low-priced hours has dramatically increased from 2014.
- YTD 2020 looks much worse than 2019.

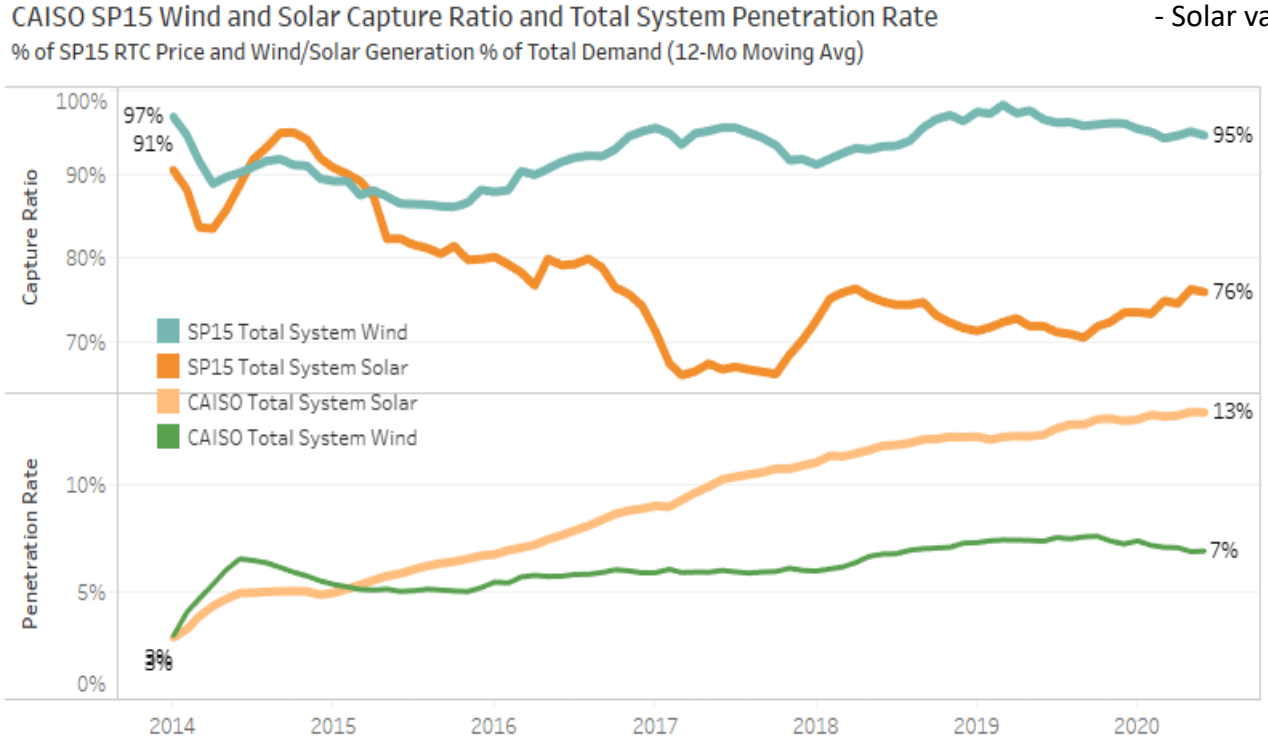




EAST BAY COMMUNITY ENERGY

Shape Ratio (Top Pane) and Renewable Penetration Rates (Bottom Pane)

Key Points:
- Significantly more solar than wind added to grid.
- Wind has retained its value in the mid 90s shape ratio.
- Solar value has steadily declined.



Wind Shape Ratio

Solar Shape Ratio

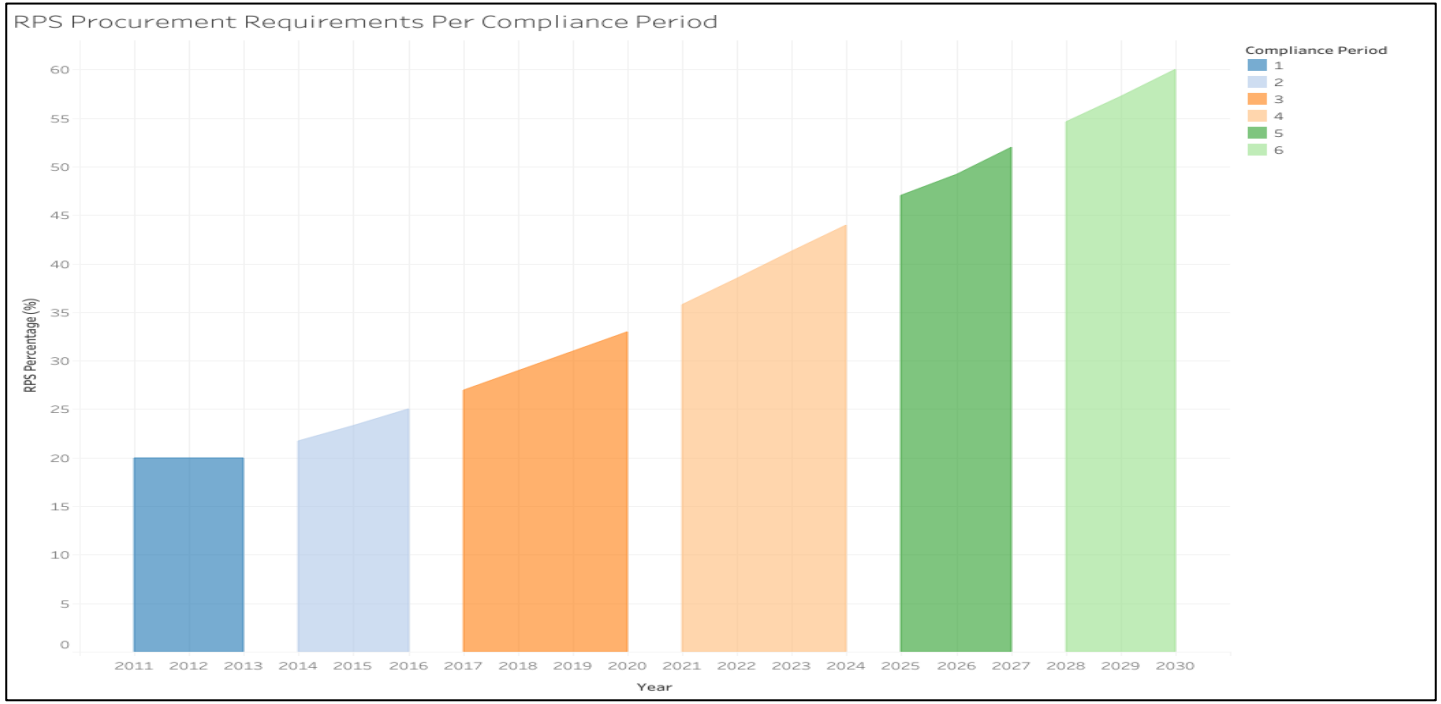
EAST BAY COMMUNITY ENERGY

Definitions

Variable	Definition
Solar Shape Ratio	Solar Weighted Price / Simple Avg Price
Load Shape Ratio	Load Weighted Price / Simple Avg Price
Wind Shape Ratio	Wind Weighted Price / Simple Avg Price
Solar Penetration Rate	Total Solar MWh / Total Demand MWh

EAST BAY COMMUNITY ENERGY

And Renewable Penetration Rates are Going Up!



EAST BAY COMMUNITY ENERGY

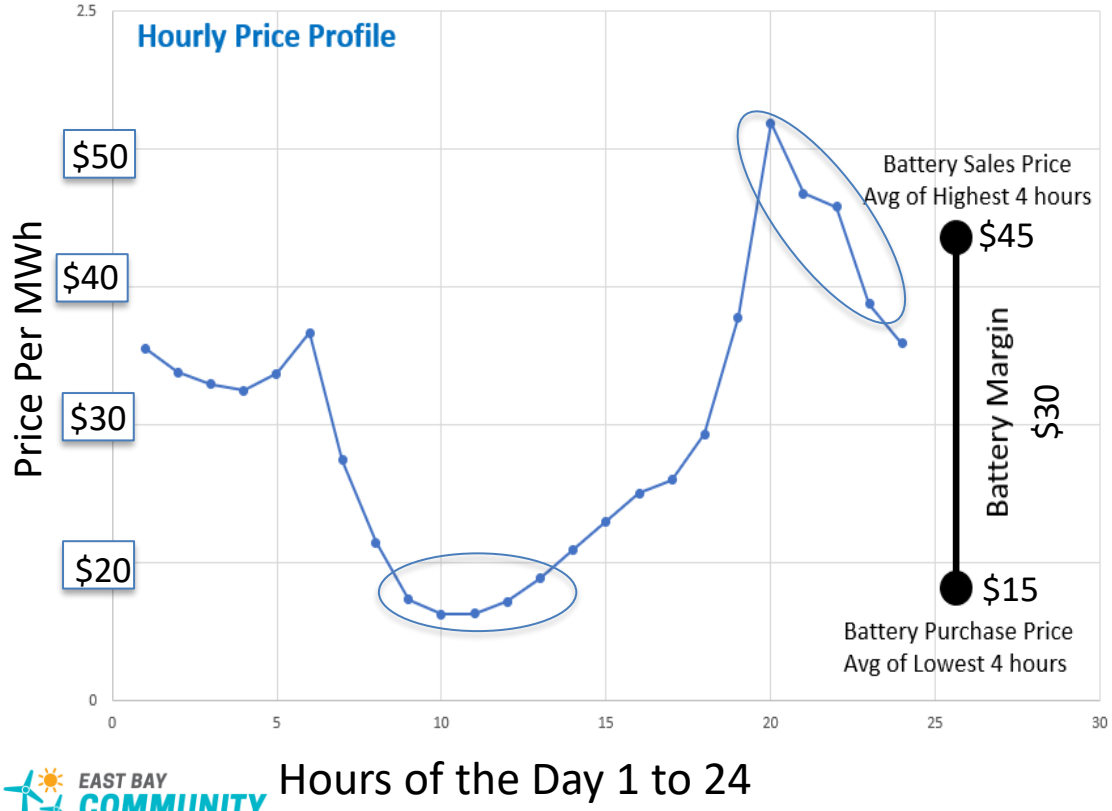
Wholesale Markets View of Forward Solar Shape Value?

	UNITS	2019	2021-2035	2021	2025	2030	2035
NP15 Price All Hours	[$/MWh]	$35.90	$35.95	$37.58	$33.93	$34.85	$40.59
NP15 Load Shape Value	[%]	104%	104%	104%	104%	104%	104%
NP15 Solar Shape Value	[%]	73%	58%	72%	64%	53%	38%
NP15 Load Value	[$/MWh]	$37.26	$37.31	$39.00	$35.22	$36.17	$42.13
NP15 Solar Value	[$/MWh]	$26.12	$20.70	$27.05	$21.77	$18.31	$15.55
NP15 Load less Solar Value	[$/MWh]	$11.14	$16.61	$11.95	$13.44	$17.86	$26.58

- Based on recent EnergyGPS transaction modeling.
- NP15 All Hours Price based on ICE prices extrapolated.
- NP15 load shape ratio is rough estimate based on average CAISO load. May be different for EBCE.
- Tuned model to achieve 58% NP15 solar shape ratio value which is based on current long term quotes for solar buyers in SP15 adjusted for NP15.
- Numbers are not exact but illustrate the market's long term expectations.

EAST BAY COMMUNITY ENERGY

Relationship Between Battery Value and Solar Shape



- When solar production applied to hourly price profile you get solar shape ratio. For example, 70% solar shape ratio.
- Typical CAISO price profile.
- Battery buys the lowest-priced four hours.
- Battery sells highest-priced four hours.
- This is intentionally a simplification of battery dispatch which would include ancillary service and real time price activity.

EAST BAY COMMUNITY ENERGY

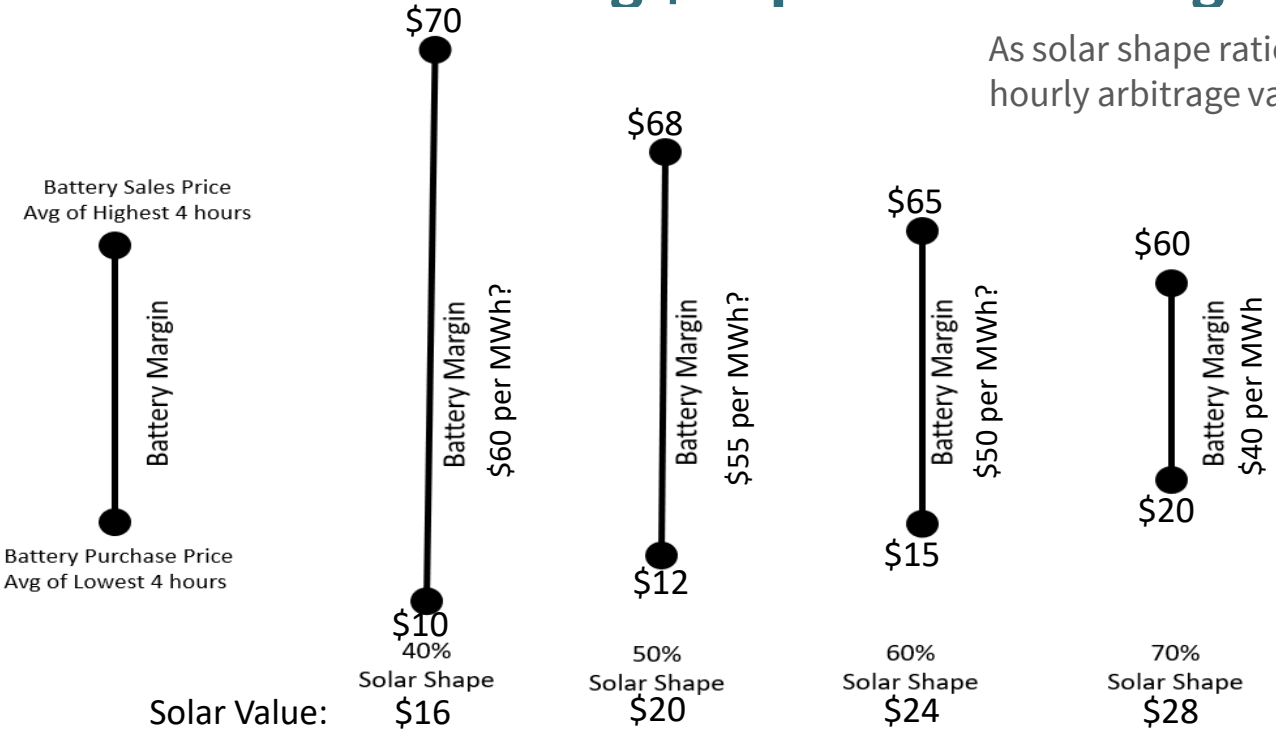
Definitions

Variable	Definition
Solar Shape Ratio	Solar Weighted Price / Simple Avg Price
Load Shape Ratio	Load Weighted Price / Simple Avg Price
Wind Shape Ratio	Wind Weighted Price / Simple Avg Price
Solar Penetration Rate	Total Solar MWh / Total Demand MWh
Battery Margin	Avg Sales Price Less Average Purchase Price

EAST BAY COMMUNITY ENERGY

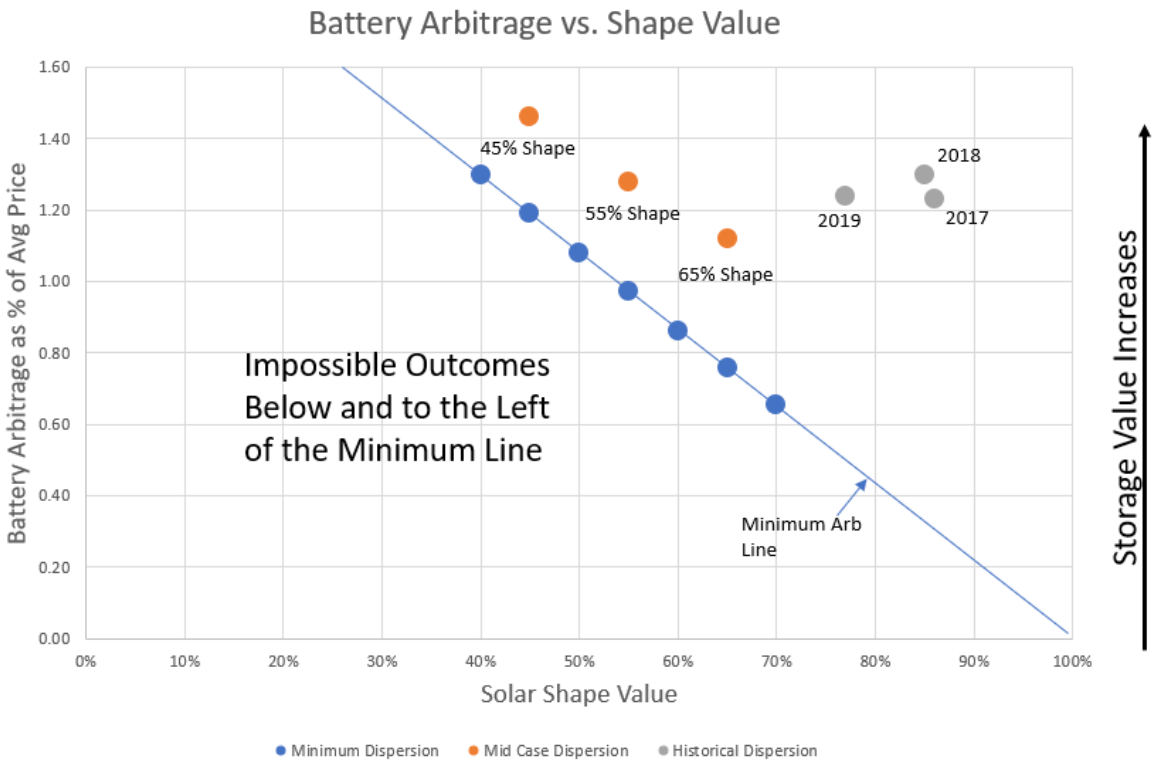
Relationship Between Battery Value and Solar Shape Illustrative Values Assuming $40 per MWh Average Price

As solar shape ratio declines, the hourly arbitrage value increases.



Key Point: Purchasing Long Term Solar and/or Solar Plus Storage Requires an Evaluation of Future Solar Shape Ratio and Expectations of Battery Margins at Different Shape Ratios.

Relationship Between Battery Value and Solar Shape: Advanced Course



Definitions

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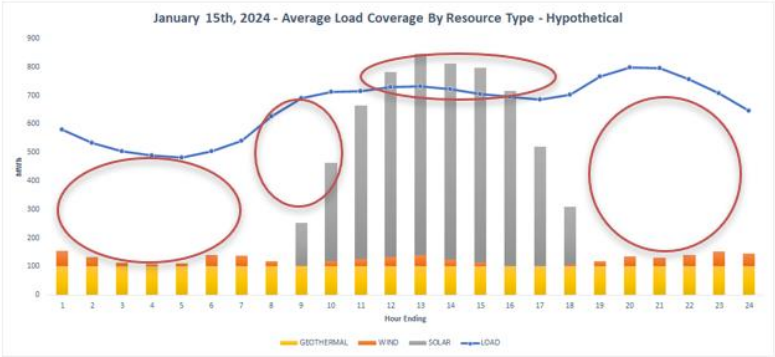
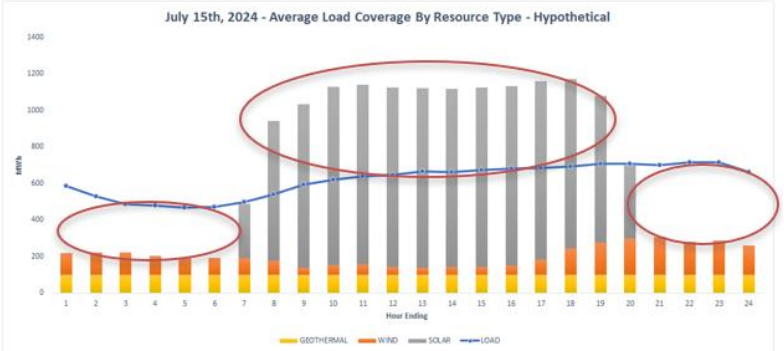
Solar Penetration Rate	Total Solar MWh / Total Demand MWh
Battery Margin	Avg Sales Price Less Average Purchase Price
Battery Price Dispersion Ratio	Battery Margin / Simple Avg Price

EAST BAY COMMUNITY ENERGY

Wrapping Up #1

- EBCE has material shape risk.
- ECBE has to be mindful that the “load shape” value will likely hold steady over time while the “solar shape” value will decline.

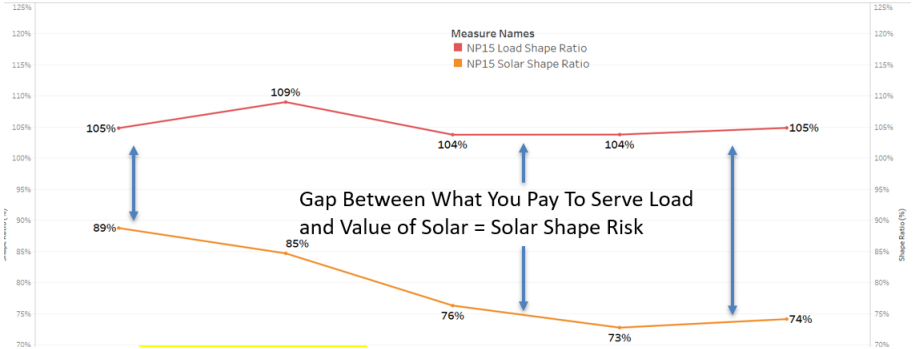




EAST BAY COMMUNITY ENERGY

Wrapping Up #2

- Solar shape value (ratio) will likely continue to fall over time causing expected value of solar to decline as well.
- As solar value declines, the gap between load cost and solar value widens.



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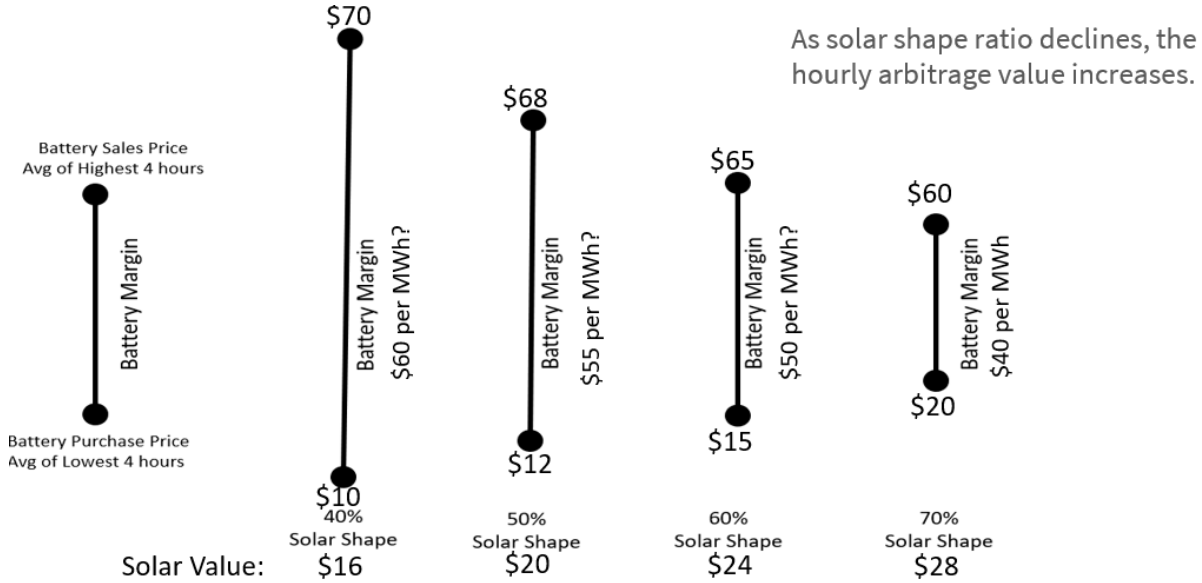
EAST BAY COMMUNITY ENERGY

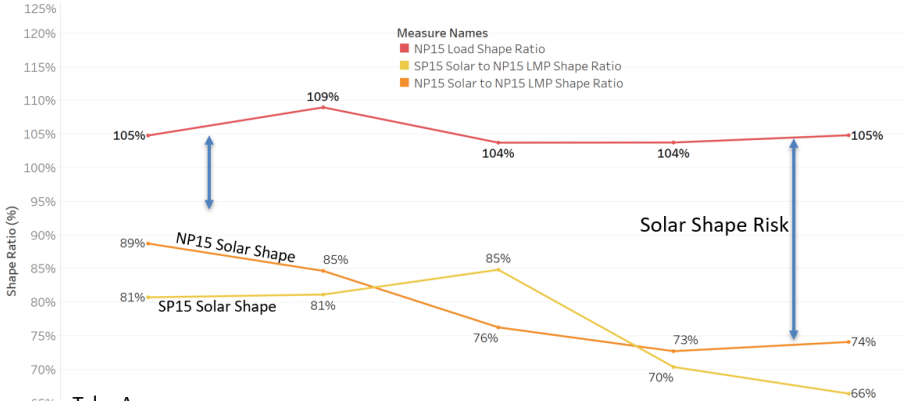
Wrapping Up #3

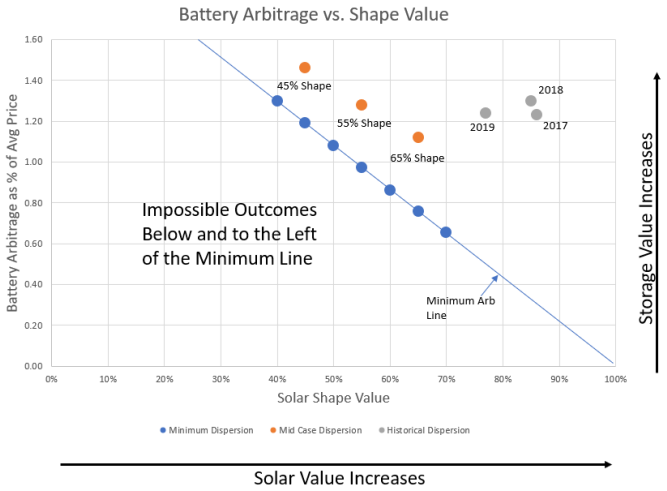
- Battery storage mitigates the risk of declining solar valuation as battery value increases when solar value declines.



Wrapping Up #4

- In future procurements will have to give serious consideration to relative value/cost of NP15 versus SP15 procurement, and
- Perform detailed analysis of risk mitigation of batteries and battery sizing.





SECTION 5:

Discussion of Other Risks to EBCE

EAST BAY COMMUNITY ENERGY

Risk Management

Types of Hedges

- Long-Term
- Short-Term
- Fixed-Price Energy Hedge

Example:

Months to Delivery		Price Matrix Percentile						
		>60%	60%	50%	40%	25%	10%	<10%
		Covered Position as a % of Forecasted Load						
0+	3	80%	80%	85%	85%	90%	90%	100%
3+	6	70%	70%	75%	80%	80%	90%	100%
6+	9	70%	70%	75%	80%	80%	80%	90%
9+	12	60%	60%	70%	80%	80%	80%	90%
12+		60%	60%	70%	80%	80%	80%	90%

Impact of Un-Hedged Position

- Exposure to CAISO market prices
- Risk of compliance failure

EAST BAY COMMUNITY ENERGY

Energy / Fixed Price Transactions

Role of fixed-price hedges in current procurement:

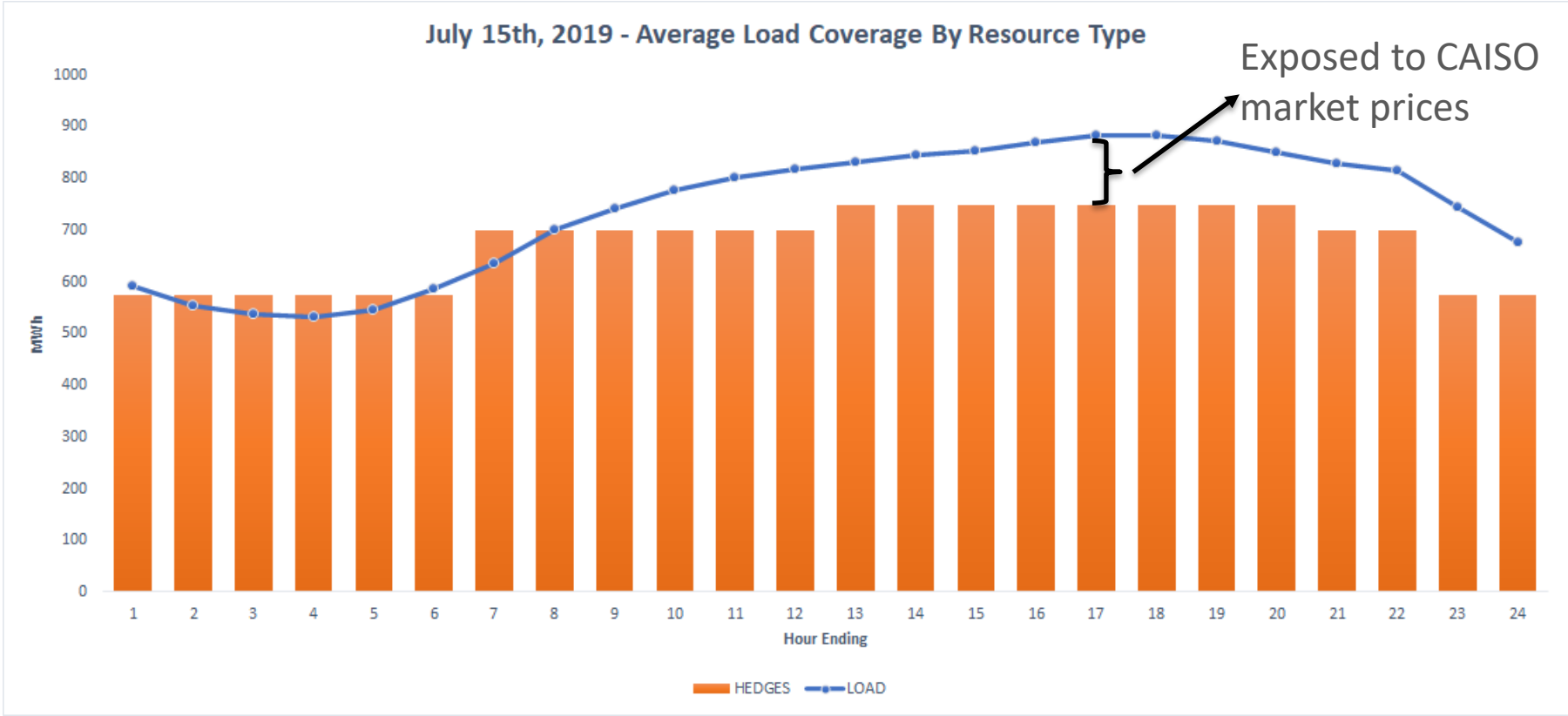
- Short-Term Hedging (~ months to <5 years)
  - Refined Load Forecast
  - Intra-Month / Intra-Day Shaping
  - Market Conditions
  - Typically non-resource specific

Role of fixed-price hedges in future portfolio:

- Long-Term Hedging (~5+ years)
  - Load Forecasting
  - Coverage Objectives
  - Market Conditions
  - Resource Composition
  - Note: in the RPS context, “long-term” is defined as 10 years or more

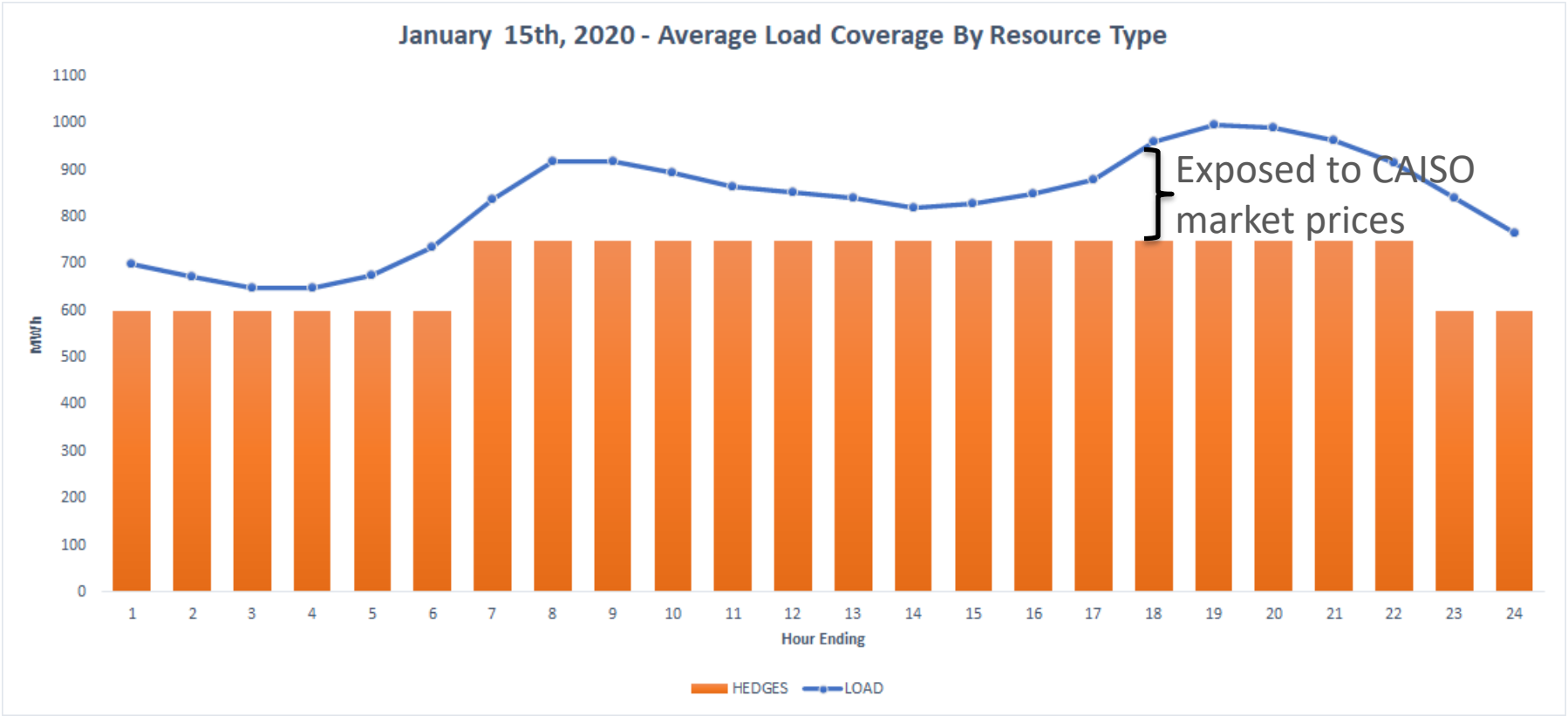
EAST BAY COMMUNITY ENERGY

Example: Energy Hedge, July day



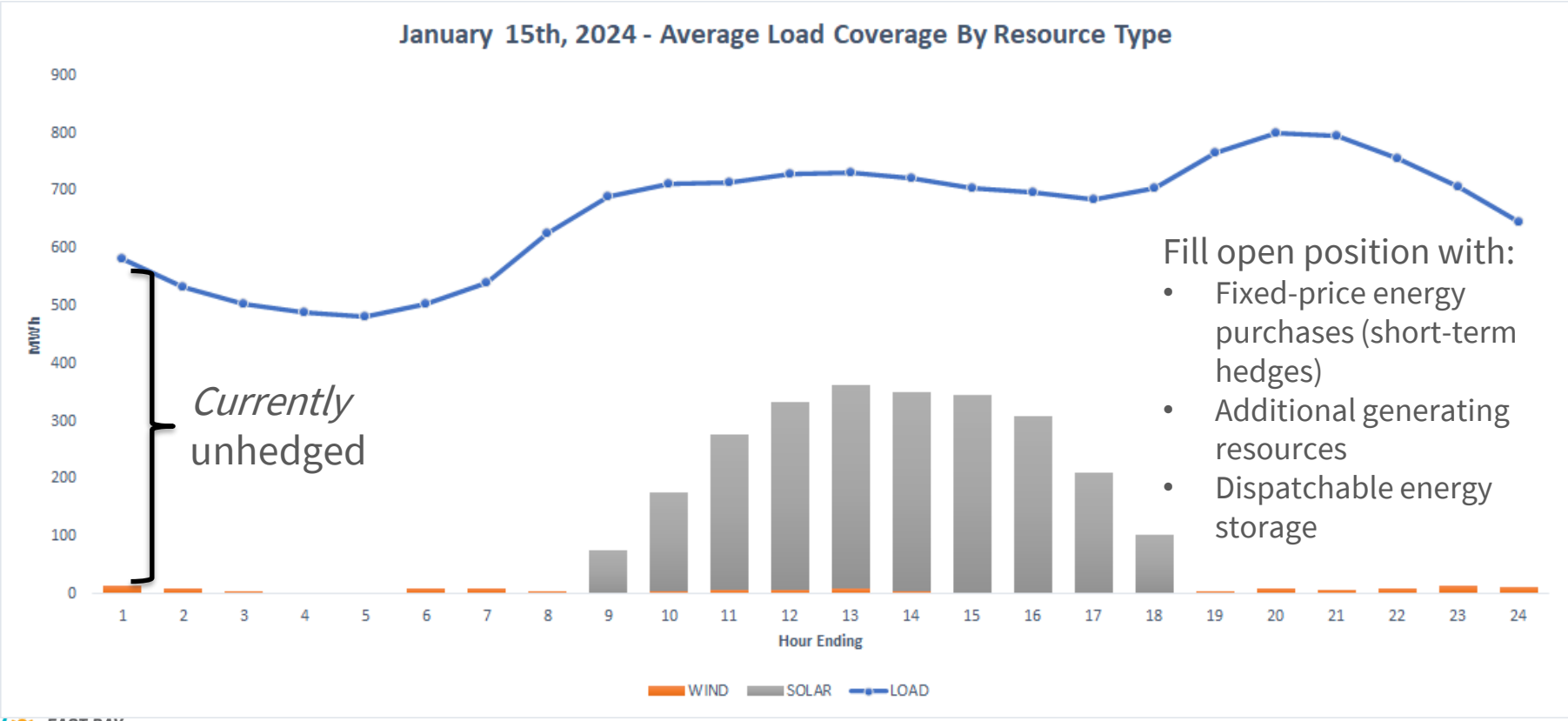
EAST BAY COMMUNITY ENERGY

Example: Energy Hedge, January day



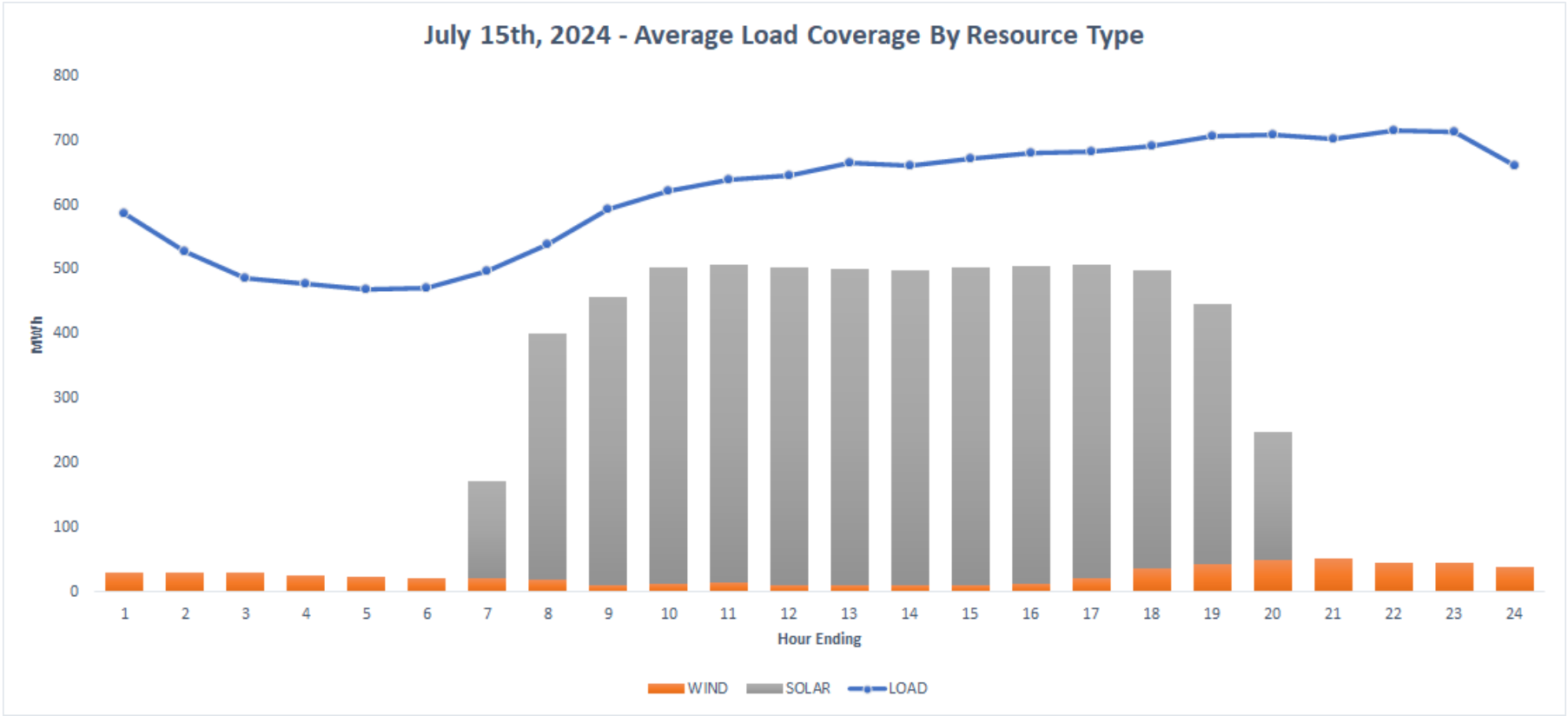
*Note difference in load shape & peak based on seasonality

Example: “un-hedged” January, 2024



Our current portfolio of resources fills January demand…

Example: “un-hedged” future July, 2024



… differently than July demand

Risk Management: Over Procurement

Long-Term Hedges

- Required, in some cases
- Provides certainty of supply
- Creates risks:
  - over-supply
  - above-market contracts

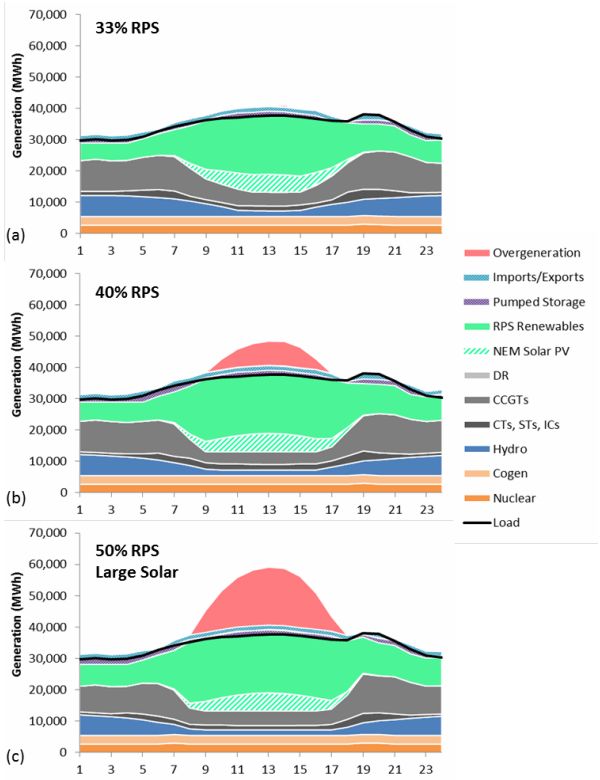
	Compliance Period 4				Compliance Period 5		
*** Numbers are MWh**	2021	2022	2023	2024	2025	2026	2027
Retail Sales forecast	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	6,000,000	6,000,000
RPS target (%)	35.80%	39%	41%	44%	47%	49%	52%
RPS target (MWh)	2,506,000	2,730,000	2,870,000	3,080,000	3,290,000	2,940,000	3,120,000
REC Requirements							
PCC1-75 % of RPS	1,879,500	2,047,500	2,152,500	2,310,000	2,467,500	2,205,000	2,340,000
65% long-term PCC1	1,221,675	1,330,875	1,399,125	1,501,500	1,603,875	1,433,250	1,521,000
PCC2	815,500	673,750	722,750	770,000	822,500	861,000	910,000
PCC3-5 % of RPS	-	-	-	-	-	-	-

EAST BAY COMMUNITY ENERGY

Renewable over-generation / curtailment is a near-term and long-term challenge

- Statewide modeling underestimates today's localized curtailment challenges
- 2030 over-generation is very high on some days under the 50% Large Solar case
  - Fossil generation is reduced to minimum levels needed for reliability
- CA PATHWAYS scenarios implement renewable integration solutions to manage curtailment problem

E3's "Investigating a Higher RPS in CA" (2014)



Source: E3, June 2019 Board Presentation

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Resource Adequacy Challenges

Compliance Requirement

- CPUC rule changes; Imports, CPE, ELCC
- Uncertainty: Solar + Storage

Limited Supply

- Resource Retirements
- Changing grid composition

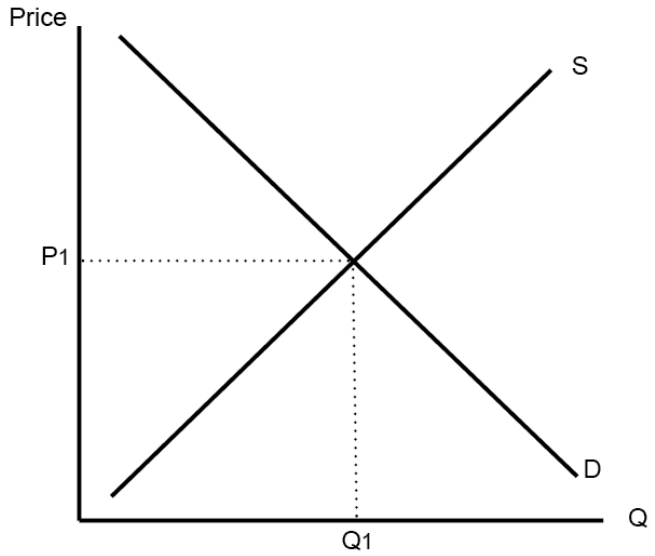
Limited Suppliers

- Key suppliers maintain material share of supply

Lumpiness of Supply

- Resource operating limitations

Cost Increasing Dramatically



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Source: NCPA, March 2019 Board Retreat Presentation

Risk Mitigation

EBCE's objective is not to beat the market consistently

- Risk Management discipline and oversight
- Cost average over time to cover market fluctuations for short-term hedges
- Cost average over time to address technological advancements for long-term project development
  - Storage can serve as a hedge for solar but serves as technology risk
- Diversification of technology, duration, geography, counterparty, etc.
- Policy engagement to manage procurement rules

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