ResponDER Local Flexibility Market Design Document

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Note: The work and analysis covered by this report were funded by SVCE through the Innovation Onramp Program. The report is not representative of SVCE's perspectives and views. SVCE is sharing these findings and documents to help other agencies and organizations learn from the pilot program.

The energy data used in the report's analysis is from Q4 2020.

Contents

1 Terms and Definitions

Acronym	Term	Definition
	Aggregator	Intermediary specializing in coordinating or aggregating demand from individual consumers to meet market requirements
BIP	Base Interruptible Program	PG&E program intended to provide load reduction on PG&E's system on a Day-of basis when the California Independent System Operator (CAISO) issues a curtailment notice.
CAISO	California Independent System Operator	A state chartered, California non-profit public benefit corporation that operates the transmission facilities of all Participating TOs and dispatches certain Generating Units and Loads
CBP	Capacity Bidding Program	Demand Response program for aggregators run by California grid utilities
	Customer	Aggregator who trades in SVCE market
DA Market	Day Ahead Market	CAISO-run market where participants secure energy the day before the operating day
DR	Demand Response	An opportunity for consumers to play a significant role in the operation of the electric grid by reducing electricity usage during peak periods in response to time-based rates or other f financial incentives
DER	Distributed Energy Resources	A small-scale physical or virtual energy resource (e.g EV charger, smart thermostat, behind the meter solar/ storage) that operates locally and is connected within the distribution system
	Natural Hedge	Trading strategy that mitigates market exposure by investing in assets whose performance is naturally negatively correlated
NWS	Non-Wires Solution	Alternative methods to upgrade transmission and distribution infrastructure. NWS use energy storage, demand response and energy efficiency, amongst other tools, to reduce constraints on the grid
	Open Position	Any established trade that is yet to be closed with an opposing trade. An open position represents exposure on the market.
	Participant	SVCE customer who sells DER flexibility in the SVCE market via an aggregator
PG&E	Pacific Gas & Electric Company	PG&E is SVCE's grid utility. It partners with SVCE to deliver electricity through its transmission and distribution system to SVCE's customers. PG&E is responsible for providing safe and reliable electricity to customers connected to its grid.

	Pay-As-Bid	Payment is distributed to sellers based on the price they are willing to pay to sell
PPA	Power Purchase Agreement	A contract used to purchase the energy, capacity and attributes from a renewable resource project
RA	Resource Adequacy	Under its Resource Adequacy (RA) program, the California Public Utilities Commission (CPUC) requires load-serving entities to demonstrate in both monthly and annual filings that they have purchased capacity commitments of no less than 115% of their peak loads.
	Resource	Individual DER or Aggregation of DERs
RT Market	Real Time Market	CAISO-run market where participants procure energy up to 75 minutes before the operating hour
SSDR	Supply Side Demand Response	Programs that integrate demand response assets into CAISO markets. Participating assets are directly dispatched through CAISO to meet system and local requirements.
SVCE	Silicon Valley Clean Energy	Silicon Valley Clean Energy (SVCE) is a Community Choice Aggregator that provides electricity to 270,000 residential and business consumers across 13 Silicon Valley communities

2 Executive Summary

Local marketplaces are becoming increasingly of interest as a method to leverage the flexibility inherent in distributed energy resources to increase grid reliability, achieve decarbonization targets, and reduce customer costs. Silicon Valley Clean Energy, through its Innovation Onramp program,[1] partnered with Electron, a distributed marketplace technology vendor, to design a local marketplace that could provide value to consumers through payment for various energy services to offset the cost of their distributed assets.

Market Value Streams

SVCE and Electron identified three value streams that could be accessed through the creation of a new marketplace: reduction of costs incurred through exposure on the wholesale market, reduced Resource Adequacy costs, and reduction of hourly carbon emissions. Through a detailed assessment of the magnitude of value, the timings of these value streams, and the relation to existing wholesale market products, a day ahead market was created using a single price signal capturing all value stream contributions.

The price signal is formed by the combination of capacity, energy, and carbon reduction that occurs when an asset provides a kW of demand reduction.

Many existing demand response products use a single $/kW or $/kWh value to incentivize customer reduction for a prespecified period. While the consistency of this structure provides certainty for consumers and aggregators, the inflexibility has several drawbacks that the SVCE market aims to overcome. One, it does not capture the time varying value that DERs can provide during different periods of the day: in California, specifically, the 4 – 9 PM summer months may provide an opportunity for the highest amount of savings, but overnight hours, which may not benefit from peak capacity reduction, suffer from higher carbon generation which could be mitigated by further demand reductions or battery dispatch to replace carbon-producing generation sources. Second, requiring a consistent, daily 4-hour period renders these devices unusable for other actions and does not adequately optimize the dispatch profiles of certain types of distributed, flexible resources. The SVCE marketplace aims to overcome these challenges by its definition of value and market construct.

Market Products

The creation of a single price, reflective of product, permits SVCE to offer a higher price than existing market constructs, which currently separate energy, capacity and carbon emission values. Furthermore, this structure takes advantage of the coincidence of demand, carbon, and high prices in the California energy system, allowing a single demand response action to access all three value streams simultaneously.

[1] The work and analysis covered by this report were funded by SVCE through the Innovation Onramp Program. The report is not representative of SVCE's perspectives and views. SVCE is sharing these findings and documents to help other agencies and organizations learn from the pilot program. The energy data used in the report's analysis is from Q4 2020.

Using previous analysis run by SVCE during its Integrated Resource Planning filings and investigation into Virtual Power Plant Options Assessment, each value steam was roughly estimated where possible. The combined value of these products likely ranges between $50 - $200/MWh depending on the time of day and contribution from peak reduction, carbon reduction, and wholesale exposure avoidance.

- **Peak Reduction:** A local market can help SVCE to reduce its future RA costs by incentivizing real-time peak reduction. The financial value of this product requires more detailed analysis of SVCE's RA costs and is predicated on the mechanism that is used to reflect peak reduction in future year capacity obligations based on a measured reduction in peak demand.

- **Carbon:** An SVCE market that incentivizes load reduction when SVCE procures from the CAISO grid mix can help SVCE move towards being net zero on an hourly basis. The CPUC Avoided Cost Calculator (ACC) provides a rough estimate of an hourly value of carbon using an estimated $3 - $25 / MWh[2] based on the SVCE marginal emissions factor, and approximately $30k/yr in total value.

- **Wholesale Exposure:** SVCE wholesale exposure is driven by the absence of 100% renewable generation 24 hours a day. SVCE is required to identify a threshold which will trigger an action on a local marketplace versus a purchase on the wholesale market. Other programs have put this range between $95 - $150/MWh.

Market Structure:

A day ahead and real-time market were designed to coordinate with the existing CAISO day ahead and real-time energy markets, even while the SVCE market is not directly integrated with CAISO.

Electron recommended that the SVCE market operate in two time periods to best align with CAISO:

- A Day Ahead Market, that runs from T-8 days until 8 am on T-1
- A Real Time Market, that runs until T-135 mins on T-0

During these market periods, SVCE will call a market event triggered by any of the following mechanisms:

i) Forecast wholesale exposure: determines the volume of flexibility SVCE requests from the market
ii) Forecast marginal grid emissions
iii) Forecast annual peak period

The flexibility from DERs will be procured on a first-come, first-service basis ahead of CAISO gate closure to enable market participants to coordinate bids and offers in other markets.

[2] The low end of the range occurs when the Cap and Trade Value is used during times of low emissions (e.g. 10:00 AM). The high end of the range occurs if the Cap & Trade Value + GHG Adder is used during high periods of emissions (e.g. 12:00 AM).

Validation of performance will be addressed in the short-term using the 10-in-10 methodology. Stakeholders indicated that existing baselining methodologies lack sophistication and do not address long periods of extreme weather or counterfactual actions in other markets; however, development of a new baseline is out of scope for the initial implementation.

Market Compensation

Compensation for market participation will be managed through a variable pay-for-performance tariff, varying based on the relative contributions of each value stream. Variable pay-for-performance was identified as the most attractive compensation method to ensure assets are fairly compensated and not unnecessarily penalized.

Market Interactions

There is increased interest in designing constructs to enable DERs to value stack different market products. However, existing markets' exclusivity or dual-participation requirements often present a contractual constraint on ability to leverage multiple value streams. Several existing programs are likely to conflict with the SVCE market. For example, under current regulations, resources that are required to bid into CAISO markets during the summer evening peak as a condition of receiving Resource Adequacy capacity payments will not be able to bid into the SVCE market at the same time. Furthermore, potential conflict exists between SVCE market and existing load modifying programs: the devices that will be participating in the SVCE market will be on TOU rates and may be part of other load modifying programs.

Coordination between market programs will continued to be explored to enable multiple DER products to participate in real-time and day-ahead products.

3 Project Background

3.1 Market objectives

SVCE's mission is to reduce dependence on fossil fuels by providing carbon-free, affordable and reliable electricity and innovative programs for its 13 communities in Santa Clara County.
The ResponDER project is part of SVCE's Innovation Onramp program looking at ways to improve energy resilience for its customers. In the project, Electron is designing and prototyping a local SVCE-owned marketplace.

SVCE and Electron defined four objectives for the marketplace to guide how market design should align with SVCE's broader organizational objectives:

1. **Improve Customer Satisfaction:** SVCE should provide the mechanism for customers to achieve low carbon, reliable power at low cost.
2. **Reduce Cost:** SVCE can reduce energy procurement costs resulting from inaccurate forecasting or reduce Resource Adequacy capacity payments.
3. **Minimize Environmental Footprint:** SVCE has ambitious electrification and decarbonization goals. Its strategy is to develop a carbon-free power supply; electrify the built environment and mobility; and to promote energy efficiency and grid integration. The

cost of achieving SVCE's carbon-free goals has increased over time and is expected to continue to rise as competition for large hydro, both in-state and out-of-state, increases.[3]

4. **Ensure Scalability:** SVCE wishes to maximize available services for its consumers. An SVCE marketplace can provide the foundation for an ecosystem of solutions that complement existing and emerging markets or programs.

3.2 Value Stream Identification

Five different value streams can be leveraged to create market value. Value streams are broken into two categories. Direct value streams result in cost savings to SVCE. Indirect value streams leverage SVCE consumer device flexibility, but create channels to access value generated from revenue opportunities in other markets (e.g. CAISO wholesale participation).

3.2.1 Direct Value Streams

Minimize Exposure on CAISO Markets

An imbalance between forecasted demand and real-time supply requires rebalancing on the Day Ahead (DA) and Real Time (RT) markets. To the extent that real-time demand exceeds forecast demand, this may result in higher real-time market prices as CAISO seeks additional resources to meet real-time demand. SVCE can mitigate exposure by leveraging demand flexibility to shed or shift load, reducing the total procurement volume required.

Hourly Emissions Reduction

SVCE currently procures enough zero carbon and renewable energy generation to cover annual demand. However, without an hour-by-hour strategy of matching clean energy to consumption, generation sources such as gas peaker plants may still be dispatched by CAISO during times of peak demand. This is reflected when SVCE procures energy through the CAISO wholesale markets when SVCE is in imbalance. The generation procured through the day ahead or real-time markets reflects the carbon intensity of the California grid[4]. While new accounting strategies are deployed to create hourly renewable certificates,[5] SVCE can begin to reduce hourly carbon consumption by incentivizing demand flexibility to shed or shift load during times of peak demand.

Resource Adequacy (RA) Reduction

SVCE has an obligation to procure RA based on system, local, and flexible requirements. The three-part cost structure for RA, particularly the determination of flexible and system RA requirements, introduces opportunities to leverage flexible demand to reduce a portion of the cost during peak periods. Reduced cost of flexible RA can be achieved by counting approved resources (i.e. a proxy-demand side resource) towards the RA requirement or by reducing system peak demand for future years' capacity obligations.

[3] https://www.svcleanenergy.org/wp-content/uploads/2020/02/SVCE-IRP-Narrative-Report-1.pdf
[4] http://caiso.com/Documents/GreenhouseGasEmissions-TrackingReport-Aug2020.pdf
[5] https://www.energytag.org/wp-content/uploads/2021/05/EnergyTag-and-granular-energy-certificates.pdf

The focus of the minimizing RA reduction for SVCE is through the reduction of SVCE's peak periods, not the creation of a new RA resource.

3.2.2 Indirect Value Streams

Non-Wires Alternatives

One consequence of increased uptake of DERs is demand or generation congestion on the distribution grid, requiring investment by distribution utilities to increase grid capacity and manage two-way power flow. Utilities can defer or avoid these costs by incentivizing DER owners to act reduce or shift their demand at times when the distribution grid is approaching a constraint. Shifting cost away from physical asset investment ("wires") to demand-side flexibility ("non-wires") offers an opportunity to keep consumer bill costs low and to provide supplementary value streams to DER owners.

Facilitate access to wholesale markets

SVCE can bid aggregations of DERs secured through its marketplace into CAISO markets. Providing DERs access to new revenue streams can improve the investment case for these technologies and help to accelerate electrification in the SVCE region. In this scenario, SVCE would effectively be acting as an aggregator of aggregators. This means that the DERs would be paid by the counterparties trading in CAISO.

3.3 Existing SVCE Processes

SVCE currently addresses each value stream through a variety of mechanisms.

Resource Adequacy: SVCE currently procures short-term RA contracts and long-term PPAs for RPS resources and storage to meet its RA requirements:

SVCE plans to incorporate long-term PPAs for additional RPS resources and shed DR resources (e.g. Virtual Power Plants) to meet its future obligations.

Wholesale Exposure: SVCE currently procures energy using long term contracts and PPAs. During periods of wholesale exposure, SVCE procures energy on the Day Ahead and Real-Time CAISO Markets. Natural hedging through long-term resources and pre-market electricity purchases help reduce procurement in the DA and RT markets, keeping exposure low.

Reduction of Hourly Carbon Emissions: SVCE currently uses long-term RPS contracts to achieve 100% annual carbon-free emissions.

3.4 Limitations of current processes

The existing strategies outlined in Section 3.3 allow SVCE to keep its energy costs low and provide reliable, clean energy to customers. However, under current California regulation, many of these options either force wholesale market participation and, thus, higher costs, or limit the opportunities for flexible assets to provide energy services.

3.5 Scope of Innovation OnRamp Project

The Electron Innovation OnRamp project is scoped to address the role of a local SVCE-operated market in providing cost, customer, and environmental value.

The project began with an initial review of the multiple value streams that can be accessed through a local market by distributed energy resources owned by SVCE retail customers. The project identified market constructs and selected the market constructs with the highest likelihood of near-term implementation. The project then sought stakeholder input to validate the market design and ensure its value to SVCE.

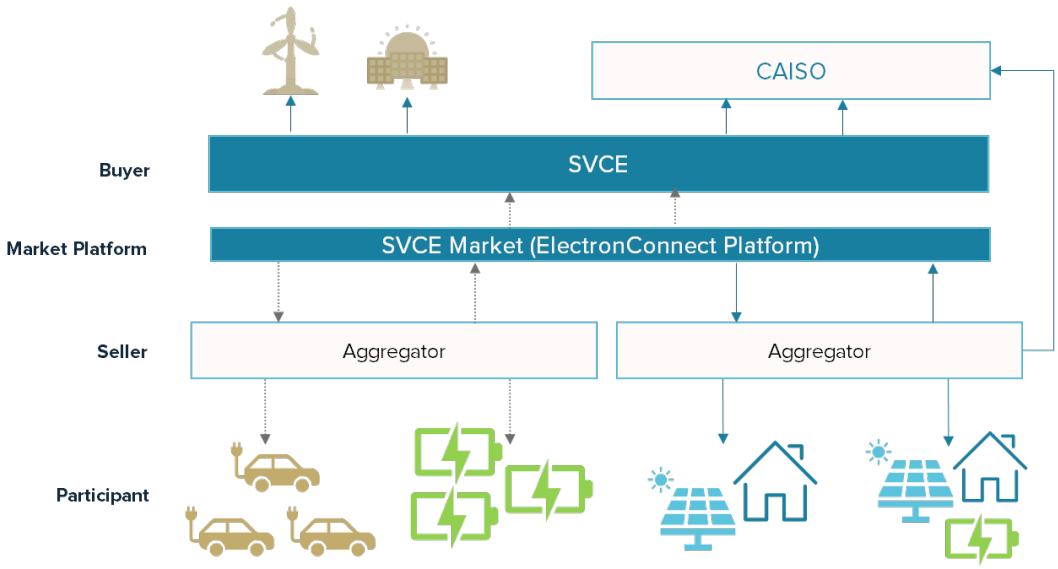


Figure 1. SVCE Market Schematic

The market designs considered align with the existing CAISO market timings and consider the role of emerging market concepts, such as the Distributed System Operator framework. Explicit interaction with the distribution utility (i.e. Pacific Gas & Electric) is not considered in the market design, nor are markets that could exist post the CAISO gate-closure timeframe. Emerging regulations on device participation in wholesale markets (e.g. FERC 2222) or updates to the Resource Adequacy and Demand Response programs introduce complexity, and are considered, but not exhaustively analyzed.

4 Market Proposition

4.1 Market Introduction

SVCE proposes a new local market to enable the provision of multiple flexibility services to address the value streams identified in Section 2.2. The market was designed to enable DER operators ("Aggregators") the ability to access the diverse stream of value DERs can provide by providing a flexibility service to SVCE.

The market was intended to balance reducing barriers to entry and maximizing ease of deployment for a trial. As such, the following parameters decided through stakeholder engagements were integrated into the design:

- Shortening of dispatch requirement: wholesale market 4-hour dispatch windows disadvantage more flexible assets capable of providing shorter and higher power responses
- Assets are price-takers: Assets are considered price-takers to remove the explicit requirement to price the opportunity-cost of bidding residential assets.
- Variable timings: removal of a contracted dispatch windows to allow for easier participation and scheduling in other markets
- Ease of access: Design and development of a UI for the market operator and API for aggregators

4.2 Market Description

The market can be summarized as follows:

- The SVCE market can be accessed by DERs owned or operated by SVCE retail customers;
- Aggregators will participate in markets on behalf of DER owners and SVCE customers, simplifying participation and leveraging the advanced digital tools of Aggregators;
- SVCE can use this market before the Day Ahead and Real-Time CAISO energy markets, with near term focus on implementation of a Day Ahead market;
- The SVCE market will be a continuous market, with bilateral contracts agreed between SVCE and the Aggregators on behalf of the assets they are offering into the market;
- SVCE will define a price signal and volume ("bid") for flexibility based on the relative flexibility contribution to reduction of wholesale exposure costs, reduction of resource adequacy costs, and reduction of hourly emissions.
- Matching will be made on a continuous in a first-come, first-serve order until asset volume meet the required bid volume from SVCE
- Users will be notified via API or email of their selection and schedule for participation
- Settlement will be managed through a temporary Day Matching '10-in-10' baseline approach

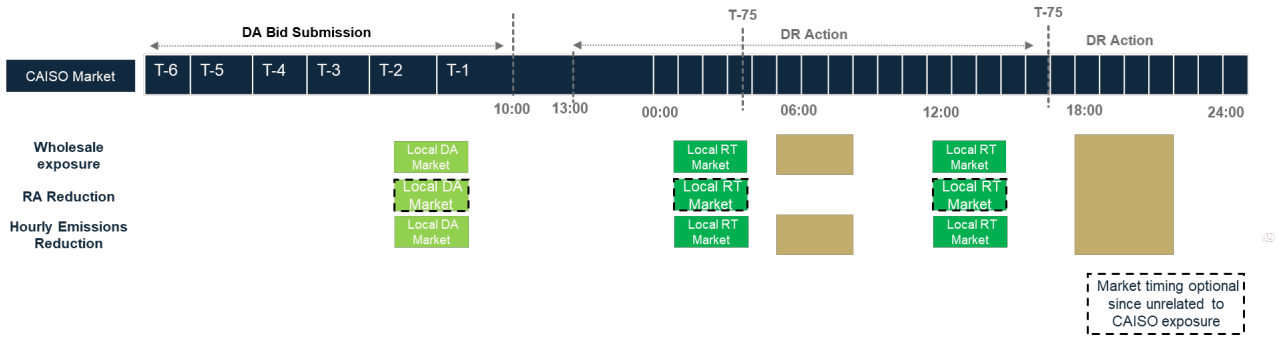


Figure 2. SVCE Value Stream Timings

4.3 Market Activity and Value

The SVCE local market will be a continuous market, using a 'pay-as-bid' mechanism with expected activity during three key periods:

1. **Period 1:** Before SVCE wholesale exposure where SVCE would otherwise be required to procure energy in the Real-Time or Day Ahead energy markets
2. **Period 2:** Days of peak demand which drive the calculation of SVCE's resource adequacy requirements

3. **Periods 3:** Times of high carbon intensity where SVCE production is not covered by existing clean energy procurement

Value for each market event is driven by the volume of flexibility that assets and the opportunities for each of the periods described in Section 5.2 to coincide. Time periods are described in more detail in Section 4.3, 4.4, and 4.5.

Each component of the value stack contributes independently to form a single, variable price signal. Values described below are examples of how aggregate value may be estimated or bounded by existing markets or procurement methods. Information is provided to facilitate understanding of relative contributions rather than predicting expected values.

4.4 Period 1 - Wholesale Exposure

4.4.1 Market Timing

SVCE is exposed on the wholesale market during times when demand is not met by existing supply contracts.

Most pre-market and wholesale market transactions are required between 4 – 9 PM, occurring when demand is high and solar generation output begins to decrease. Additional time periods include overnight hours when solar generation remains low and early morning when demand begins to increase.

Wholesale exposure is also seasonally driven by the output of renewable energy. The spring months see an excess of procured generation given moderate temperatures and high solar output whereas summer and fall months typically have increased exposure. As solar and wind output decrease in winter months, net shortages across all months are more likely.

4.4.2 Market Value

SVCE has estimated the 10-yr NPV achievable using load shedding to avoid wholesale exposure in the Day Ahead and Real-Time markets at $4.5M and $6M, respectively.[6]

Market prices for SVCE procurement of load shedding must be lower than the price paid during periods of wholesale exposure. Illustratively, purchase prices can vary between $30/MWh and $170/MWh over the course of a day in the Day Ahead Market and range from <$20/MWh to >$200/MWh in the Real Time Market.[7]

Figure 3 shows a representative summer day in July where DA prices reached $170/MWh and RT prices reached $210/MWh.

[6] Ascend Analytics Assessment and Valuation of VPP Resources, Slide 12
[7] http://www.energyonline.com/Data/GenericData.aspx?DataId=22&CAISO__Day-Ahead_Price

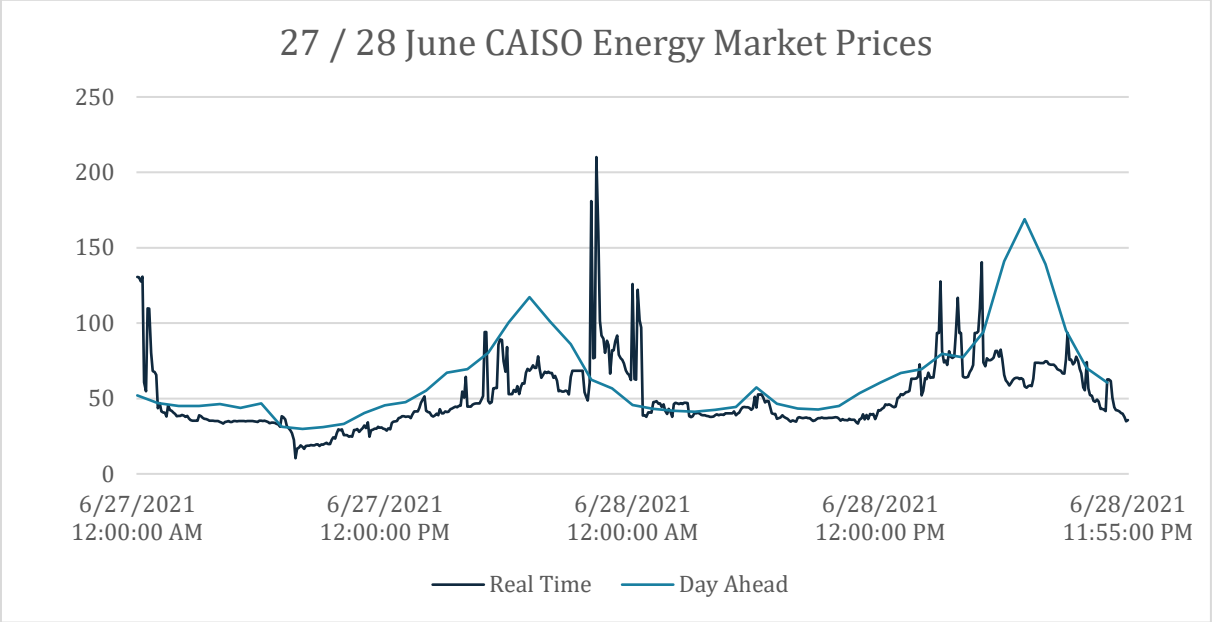


Figure 3. 27 July Energy Prices

4.5 Period 2 - Resource Adequacy Cost Reduction

4.5.1 Resource Adequacy timing

The current CPUC resource adequacy structure is designed to cover peak forecasted load, operating reserves, forced outages, and demand forecast error.[8] RA obligations are based on the California Energy commission (CEC) forecast and hourly peak load data, alongside monthly energy and peak demand forecasts for the coming year submitted by each Load Serving Entity.[9]

SVCE is required to procure approximately 7000 MW/yr of RA, about 2/3 of which is provided through physical resources.[10] This value is expected to stay consistent through 2030 given a project flat yearly demand forecast. Prior SVCE analysis has found that peak reduction for 2 -3 hrs of the first 20 – 30 MW can reduce their overall resource adequacy costs[11].

Notably, current regulation requires qualified RA resources to dispatch for a 4-hour minimum event, over 3 consecutive days, for a minimum of 24 hours / month. The SVCE market will overcome this restriction by using actions which will impact future year capacity obligations. Given the seasonal nature of required generation capacity, Resource Adequacy will be treated as a seasonal and hourly requirement. In particular, prior 8760 analyses indicate likely timing will follow the increased generation capacity requirements during August and September between the hours of 18:00 – 24:00, peaking in September.[12]

[8] http://www.caiso.com/InitiativeDocuments/SecondRevisedStrawProposal-ResourceAdequacyEnhancements.pdf
[9] https://www.caiso.com/Documents/CommunityChoiceAggregation_ReferenceGuide.pdf
[10] https://www.svcleanenergy.org/wp-content/uploads/2020/02/SVCE-IRP-Narrative-Report-1.pdf
[11] Ascend Analytics, Assessment and Valuation of VPP Resources; Slide 13
[12] 2020 ACC Documentation v1cFinal

4.5.2 Resource Adequacy Value

Prior SVCE analysis has found that peak reduction for 2 -3 hours of the first 20 – 30 MW can result in a 10 yr NPV of $6.5M. Analysis of SVCE forecast load data suggests that for the months of August in 2025, a market incentivizing a 30 MW reduction in peak demand would operate for 92 hours and would need to pay for 1596 MWh of reduction.

4.5.3 Resource Adequacy Uncertainty

Resource adequacy cost reduction has the highest level of variability and uncertainty due to the methodology used to calculate the LSE RA requirement. SVCE expects value to be gained by a net reduction of peak load, resulting in a future reduction of its RA obligation. Specific values are predicated on the computation of future obligations by CPUC.

4.6 Period 3: Hourly Reduction of Emissions

4.6.1 Hourly Emissions Timing

SVCE currently meets its RPS requirements and 100% renewable goals using Asset Controlling Supplier (ACS) purchase of renewable energy credit. With a desire to ensure carbon-free energy during each hour of the day, SVCE must reduce reliance on system power which subjects them to higher levels of emissions.

Prior analysis has identified that SVCE has a forecasted clean net short position of >1,500 GWh/yr, based on estimates of hourly production procured through long term contracts through 2030.[13] The hours of high emissions track with periods of SVCE wholesale exposure as SVCEs existing long-term contracts are exclusively with zero- and low-carbon resources. Thus, any energy procured through the CAISO market results in carbon emissions.

Figure 4 shows the overlay between carbon emissions and CAISO prices. A clear correlation is seen between high carbon emissions and peak price hours in the Day Ahead and Real-time markets.

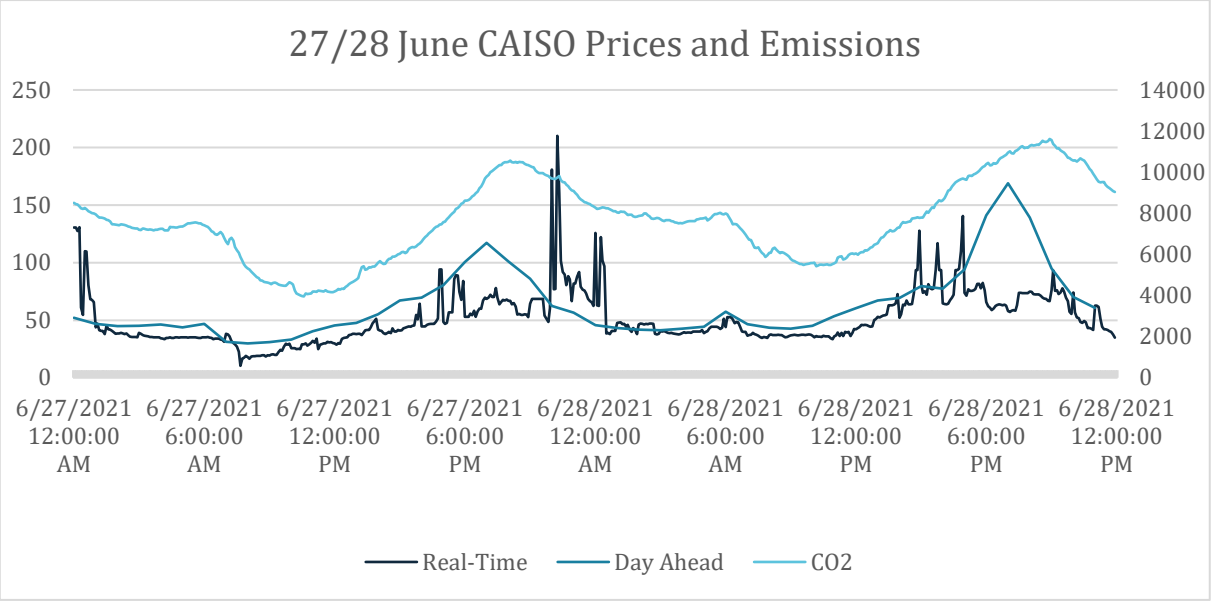


Figure 4. CAISO prices and emissions from 27th and 28th June

[13] https://www.svcleanenergy.org/wp-content/uploads/2020/02/SVCE-IRP-Narrative-Report-1.pdf; Pg 200

Periods of trading activity which expose SVCE to carbon emissions at peak periods will vary based on current supply and demand curves and SVCE's internal forecasting accuracy.

4.6.2 Hourly Emissions Value

The value of hourly emissions reductions is still nascent as products are continuing to emerge to meet the increasing desire for a 24x7 carbon-free product. Value will be driven by a combination of the following inputs:

- Difficulty and expense of decarbonizing marginal non-solar and wind producing hours
- Market pull for 24x7 energy sources
- Policies incentivizing 24x7 carbon-free energy
- Relative cost of existing renewable energy and GHG credits

The CPUC Avoided Cost Calculator (ACC) provides a rough estimate of an hourly value of carbon using an estimated $/MWh based on the marginal grid emissions factors.[14] The ACC sets the cap-and-trade value of carbon to $22.45/tonne and uses $103.82/tonne when a GHG adder is included. This results in a value ranging $3 - $25 / MWh[15] based on the SVCE marginal emissions factor, and approximately $30k/yr in total value.

4.7 Combined Value

The relative contributions of each component of the value stack form a single price signal that varies hourly, daily, and seasonally based on SVCE's supply, demand, and emissions profiles. The price signal for each hour is the total $/MWh from contributions of the day-ahead energy market price, the real-time energy price and GHG emissions.

Without resource adequacy estimation, energy and carbon values might be relatively equal in value, with arbitrage opportunities in the evening peak between the DA and RT prices.

The inclusion of generation capacity values, used as a proxy for estimating RA value, result in a significant increase in value in the 4 – 9 PM period. Average yearly values for RA are between $25-$300/MWh depending on the hour, but as generation capacity is only required a few days a year, the contribution on a daily profile is significant.

[14] https://www.ethree.com/public_proceedings/energy-efficiency-calculator/

[15] The low end of the range occurs when the Cap and Trade Value is used during times of low emissions (e.g. 10:00 AM). The high end of the range occurs if the Cap & Trade Value + GHG Adder is used during high periods of emissions (e.g. 12:00 AM).

5 Market Interactions

5.1 Market conflicts and exclusivity requirements

Multiple markets and programs exist for DER flexibility services, particularly demand and energy reduction. Below we highlight the most common DER flexibility services and detail their ramifications for participation in an SVCE market. This section covers the contractual obligations imposed by existing programs operated by LSEs. Section 8.2 discusses the regulations in place to prevent devices being compensated twice for the same action.

Programs are broken down into two categories:

1) **Supply Side Demand Response (SSDR) programs** integrate demand response assets into CAISO markets. Participating assets are directly dispatched through CAISO to meet system and local requirements. Resources registered in SSDR programs are treated as supply resources in CAISO markets[16], where they can also qualify for Resource Adequacy.

2) **Load Modifying Demand Response (LMDR) programs** are used to reduce peak demand, but resources are not integrated into CAISO markets. Flexibility from Load Modifying Resources (LMRs) instead reshapes or reduces the net load curve of an LSE and is ultimately embedded in the CEC's demand forecast. LSE's can use LMDR to reduce their Resource Adequacy requirements.

5.1.1 Supply Side Demand Response Programs

Demand Response events called through SSDR programs will compete with SVCE market events to secure flexibility. SVCE may be able to outcompete existing SSDR programs by providing a higher bid price or by tailoring its request to suit DER capabilities[17]. The following SSDR programs may compete with the SVCE market:

Demand Response Auction Mechanism: IOUs must provide at least 100 kW of aggregated demand reduction that must bid into the CAISO day-ahead energy and real time markets as a supply-side resource (PDR). Two revenue streams exist for resources participating in DRAM:

- As a Proxy Demand Resource, assets receive compensation from winning bids in the CAISO energy market
- IOUs can acquire Resource Adequacy from demand response products located in the IOU service territory. RA payments are a higher revenue source than CAISO energy market payments.

CAISO rules oblige PDRs to submit bids on the CAISO DA and RT markets throughout the summer evening peak, when the SVCE market is likely to be operating[18]. There is a high likelihood that that

[16] https://drpwg.org/wp-content/uploads/2018/06/DFWG-Meeting-3-Load-Modifying-DR-Final.pdf
[17] For example, RA-qualified Proxy Demand Resources (PDRs) are required to dispatch continuously for four hours. Feedback from stakeholders suggests that this time length is not suited to DERs such as batteries.
[18] CAISO BPM for Reliability Requirements; Section 7: https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Reliability+Requirements

only non-RA qualified resources could stack value between the CAISO DA/RT markets and SVCE markets.[19]

IOU Capacity Bidding Program: CCA-registered resources are permitted to enroll in Capacity Bidding Programs operated by IOUs[20]. Qualified resources are required to participate in a certain number of events, according to the option they choose, but are not otherwise restricted from participating in programs such as the SVCE market.

IOU Base Interruptible Program: Provides load reduction on a Day-of basis when CAISO requires curtailment. Events cannot exceed 1 per day, 10 per month or 180 hours a year. The time that events can occur is not proscribed but are likely to occur at the same time as SVCE market events, when the California system experiences peak demand and reduced renewables generation availability.

Emergency Load Reduction Program: Procures load reduction during times of peak usage when there is limited generation available. ELRP supplements Resource Adequacy planning and is separate from the CAISO market. Events can be called from May – October, seven days a week, between 4pm and 9pm. Event duration is 1 hour minimum and 5 hours maximum. The program is open to non-residential customers not currently enrolled in CAISO Demand Response programs (e.g PDR), including DERs that can generate energy and VPPs. CAISO market-integrated Demand Response resources are automatically eligible to participate.

5.1.2 Load Modifying Demand Response programs

LMDR programs are designed to reshape or reduce the net load curve by incentivizing load reduction or load shifting. The value streams proposed for the SVCE market often coalesce around peak pricing periods leveraged by LMDR programs. For the SVCE market to avoid conflict with LMDR programs, the market validation methodology must prove additionality on top of the modified load curve.

Potential competing LMDR programs include[21]:

- **Time of Use (TOU) tariffs:** TOU rates incentivize energy consumers to modify their energy consumption throughout the day, charging more during peak evening periods (4pm – 9pm) and less during periods of load demand or high renewable generation. The value streams proposed for the SVCE market coalesce around peak pricing periods, when SVCE is exposed on the wholesale market and is more likely to encounter peak customer demand. This means that the SVCE market will likely request load shed additional to what consumers are already providing in response to TOU.

- **Behind the Meter Solar + Storage Virtual Power Plant (VPP):** SVCE is currently piloting a VPP with Solar + Storage provider SunRun. The program is intended to reduce SVCE's RA

[19] While individual assets may not be able to bid into the SVCE market at the same time as CAISO as an RA-qualified PDR, aggregators may be able to bid into both markets simultaneously by ensuring that each Resource is made up of different assets.
[20] PG&E Capacity Bidding Program Overview: https://www.pge.com/en_US/large-business/save-energy-and-money/energy-management-programs/energy-incentives/third-party-programs-capacity-bidding.page
[21] Other Load Modifying programs such as Critical Peak Pricing or Peak Time Rebate are not relevant here, since only non-CCA PG&E customers are eligible.

capacity requirement by consistently reducing SVCE's peak demand through load shedding each day. The VPP is not integrated into the CAISO market. VPP assets wanting to participate in an SVCE market also operating during the evening peak would need to reduce shed load beyond the capacity they have committed to the VPP[22].

5.2 Value stacking

The SVCE market is designed to enable value stacking when a single action (e.g. shed) can provide benefit to one or many parties (e.g. SVCE and PG&E) or to one or many products (e.g. capacity and energy) at the same time. The ability for an asset to simultaneously participate in multiple markets is dependent on the type of traded commodity (e.g. carbon vs. energy), the direction of the request (demand shed or demand increase), and existing contractual obligations and market rules.

The most notable conflict is with Resource Adequacy – qualified proxy demand response (PDR) resources which are required to bid into the DA and RT markets between 10:00 AM and 5:00 PM. Table 1 below outlines the opportunities for the SVCE market products to value stack with the CAISO DA and RT energy market products and resource adequacy.

Table 1. Market Interactions

		SVCE Market Products				CAISO		
		Emissions Reduction	RT Energy	DA Energy	Resource Adequacy	RT Energy[2][3]	DA Energy[2][3]	RA**Error! Bookmark not defined.**
CAISO	DA Energy[23]		Outside peak DA price hours			Outside peak DA price hours		
	RT Energy[23]		During different RT periods	Outside peak DA price hours				
	RA Qualified		Outside of RA Must Offer hours	Outside of RA Must Offer hours				
SVCE	Resource Adequacy		RT price spikes are shorter and more volatile, variable	Yes – high alignment between DA / RA				
	DA Energy							
	RT Energy							
	Emissions Reduction							

[22] The SunRun VPP does not currently allow participating assets to trade in other markets. This example is illustrative of how an SVCE market would need to interact with a LMDR program to prove additionality.
[23] Non-RA qualified

Interactions between the markets are defined as follows:

- Green: markets are always able to stack
- Amber: markets are able to stack, pending certain conditions are met
- Red: markets are unable to stack due to an inherent contract or timing restriction

The Green interaction label in Table 1 is given to markets interacting with an emissions reduction market. As emissions reduction is an additive attribute not explicitly accounted for in these markets, it can be stacked on the value already realized through energy or capacity reduction.
Most markets interactions are amber, signifying a nuanced relationship between market timings and existing contract relationships. In general, the following rules will apply:

- RA-qualified resources can only participate in markets outside the hours they are required to bid as part of the RA program.
- RA and DA markets stack well: there is a high probability of alignment between SVCE experiencing peak load and a high SVCE DA price.
- SVCE DA market can stack with SVCE RT market outside of peak DA price hours

Red interactions have been given to markets which can never co-exist. Of the markets in Table 1, the two Resource Adequacy / Peak Reduction markets are disallowed from co-existing. An asset already counted towards one resource adequacy program cannot contribute to a reduction in peak load to impact future RA levels.

6 Market Design Specification

6.1 Overview

SVCE can run two markets to coordinate with the Real-Time and Day-Ahead CAISO energy markets. In both markets, SVCE can make a request for flexibility based on the following information:

i) Forecast wholesale exposure: determines the volume of flexibility SVCE requests from the market

ii) Forecast marginal grid emissions

iii) Forecast annual peak period

Both markets require a set of shared processes and features which are described in more detail in Section 7.

- Participant Registration
- Asset (Aggregator) Registration
- Market Engagement
- Asset Dispatch / Delivery
- Asset Settlement

During the market operations, data must be shared between Aggregators, SVCE, and the market platform. At this point, data sharing between the SVCE market and the existing CAISO markets is not explicitly outlined. To avoid double counting, data sharing with CAISO will be integral to local

market success. The definition and design of the required data link is out of scope of the current analysis.

The distinctions between the Day Ahead and Real-Time markets are outlined in Sections 6.3 and 6.4. Each must align with the existing CAISO market windows to reduce the risk of conflicting with CAISO services. The DA and RT market timings predominately impact the timing of SVCE notification periods and market gate closure.

6.2 Market Entities

The SVCE market requires participation from several entities and interaction with a broader ecosystem of stakeholders. Each is briefly described below with their relevant relationship to the SVCE market.

6.2.1 Silicon Valley Clean Energy

Silicon Valley Clean Energy (SVCE) is a Community Choice Aggregator that provides electricity to 270,000 residential and business consumers across 13 Silicon Valley communities. SVCE is both the market owner and sole buyer. It will use the marketplace to buy flexibility services from aggregators located in its region.

6.2.2 Aggregators

An aggregator is defined in the SVCE market as the service provider. Aggregators will group and operate DERs belonging to SVCE customers according to their existing contracts. Aggregators will respond to requests made by SVCE for flexibility by submitting bids.

6.2.3 CAISO

CAISO is the electricity market System Operator in California. CAISO is not a direct participant in the SVCE market; however, the SVCE market has been designed to align with existing CAISO market timings and the technical requirements CAISO places on DERs trading in its markets.

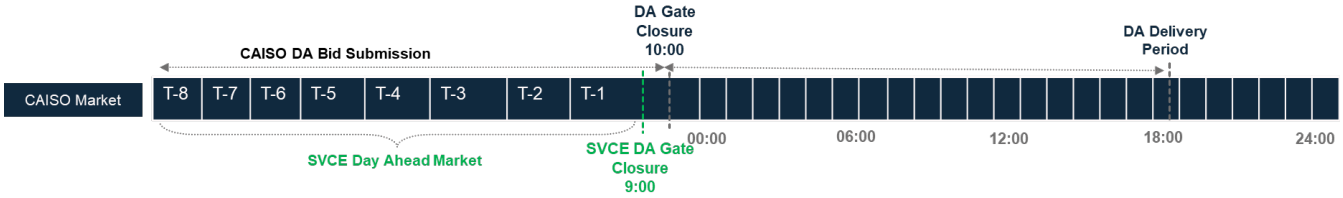
6.2.4 Scheduling Coordinator

Scheduling Coordinators are entities certified by CAISO to act on behalf of Load Serving Entities for a range of tasks such as submitting Bids to CAISO markets, settling trades and coordinating changes in Demand and Generation. SVCE's Scheduling Coordinator manages its position on the CAISO wholesale markets. It therefore needs to be informed of changes to SVCE's load caused by the SVCE market.

6.2.5 Pacific Gas & Electric (PG&E)

PG&E is the regulatory distribution utility responsible for delivering power to the 13 communities served by SVCE. PG&E is responsible for providing safe and reliable electricity to customers connected to its grid. Future implementation of a local market at scale will likely require coordination with PG&E to avoid introducing grid constraints.

6.3 Day Ahead Market Specification



The SVCE day ahead market operates before the CAISO Day Ahead energy market gate closure.

- SVCE receives forecasted the DA Market prices and determines if SVCE market is economic
- SVCE market provides information to aggregators from T-7 to T-1 8 AM, based on expected forecasted needs
- After the SVCE Market Gate Closure (8:00 AM), SVCE will select the assets for participation and inform market participants.
- SVCE will inform its Scheduling Coordinator (SC) of the flexibility volume secured in the market, so that the SC can adjust SVCE's imbalance position on the CAISO markets.
- Aggregators can readjust CAISO bids if necessary based on residual quantity not reserved by SVCE
- Aggregator will integrate both CAISO and SVCE dispatch schedules into asset management system

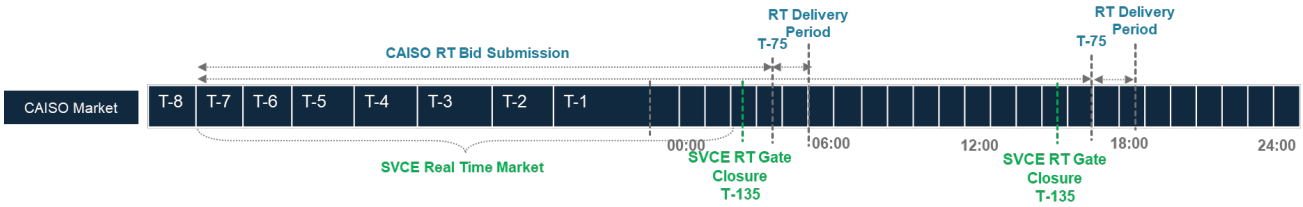
6.3.1 Day in the Life:

- Assumptions:
  - Aggregator is enrolled in SVCE market
  - Assets have been approved to provide SVCE services

Before Trading Day		
1.	SVCE can review the CAISO Day Ahead Price (available as early as T-8)	SVCE
2.	SVCE receives appropriate forecasting information needed to determine the required flexibility service: 1 Forecast load 2 Forecast generation 3 Forecast marginal emissions 4 Forecast CAISO DA/RT prices	SVCE
Market Engagement		
3.	SVCE posts the flexibility need to the market: 1 Volume (kW) 2 Dispatch start (date; time) 3 Minimum delivery (mins) 4 Price ($/kW) 5 Regulation (down)	SVCE Market Platform

4.	Aggregator reviews the flexibility request and assesses ability to meet service need.	Aggregators
5.	Aggregator responds (Y/N) 1. Volume (kW) 2. Dispatch start (date; time) 3. Minimum delivery (mins) 4. Price ($/kW) [*optional*][24]	Aggregators Market Platform
6.	8am T-1: SVCE DAM Gate closure	Market Platform
7.	Market platform reviews offers from aggregators to determine optimum dispatch characteristics to achieve carbon, RA, and wholesale exposure goals	Market Platform
8.	Market platform clears and confirms: 1. Volume (kW) 2. Dispatch start (date; time) 3. Minimum delivery (mins) 4. Price ($/kW)	Market Platform
9.	Market platform sends dispatch schedule to selected aggregators	Market Platform Aggregators
Initiating Trade		
10.	Market platform sends dispatch instruction to Aggregator at time of service delivery	Market Platform Aggregator
11.	Aggregator performs asset dispatch	Aggregator
12.	Aggregator sends SVCE operational data demonstrating dispatch	Aggregator Market Platform/ SVCE

6.4 Real-Time Market Specification



- The SVCE real-time market operates before of the CAISO RT energy market gate closure.
- SVCE receives a forecast of the RT Market prices and determines if a RT market is economic
- The SVCE market will provide information to aggregators based between 14.00 T-7 and T-135 mins, based on its expected forecasted needs
- After the SVCE RT Market Gate Closure (T – 135mins), SVCE will select the assets for participation and inform market participants of dispatch requirement.

[24] Future versions of the market may include the ability for bidirectional prices submission.

- Aggregators can readjust CAISO bids if necessary based on residual quantity not reserved by SVCE
- Aggregator will then have both CAISO and SVCE dispatch schedules for RT dispatch

6.5 Participation Requirements

6.5.1 Market Requirements

The SVCE marketplace is designed to support assets with a broad range of characteristics that can contribute flexibility for energy, capacity, and emissions reduction. At this stage, only assets which reduce load will be considered; however, the ambition is for this market to integrate assets which generate only or reduce load and generate.

Market participation will align with existing wholesale processes, except where specified otherwise. The following conditions apply for enrolment of Resources in the SVCE market:

- Participants must be served by SVCE as their Load Serving Entity
- Participants must only be served by one LSE
- Resources must consist of assets from within a single Sub-LAP
- Minimum 30 kW load curtailment
- Assets must have an interval meter capable of recording usage in 15-minute intervals installed. Meter data must be accessible to the SVCE market platform via API.
- Resources must consist of the same asset types[25]

Participant registration details must include:

- Resource ID
- Resource Type(s)
- Fuel Type
- Ramp Up / Ramp Down rates
- GHG information
- PMin/Pmax
- Minimum on/off Time
- MSG configurations
- Variable energy resource indicator
- Daily Limitations, e.g. maximum start-ups per day, maximum daily on time

The additional operational parameters below are for initial consideration and will continue to be reviewed with partners:

- Minimum Duration: 5 minutes

[25] For the purposes of this pilot, Electron recommends that Resources consist of the same asset type to reduce the complexity of calculating dispatch windows and resource baselines.

- Maximum Duration: 4 hours[26]

6.6 Market Mechanics

The proposed market will modify load based on a price signal communicated by SVCE. The marketplace will not integrate into the CAISO market, but will align with CAISO timings to ensure compatibility with existing third-party contracts, where applicable. All properties are consistent across the DA and RT markets.

6.6.1 Order Properties

SVCE will include the following properties when sending a flexibility request:

1. Requested Capacity (kW)
2. Minimum duration
3. Maximum duration
4. Time parameters: Start time, duration / end time
5. Regulation**:** Down
6. Value contribution: Mitigation of wholesale exposure, reduction of peak load, reduction of emissions
7. Location parameters: Sub-LAP
8. Price: Variable ($/kWh)

6.6.2 Bid Properties:

1. Response (Y/N)
2. Capacity (kW)
3. Regulation: Up or Down
4. Ramp Up/Ramp Down times

6.6.3 Matching Mechanics

Several options are available to SVCE to optimizes trades during an event.

6.6.3.1 Option 1: Asset Bidding

Overview:

Assets can be matched in a merit order stack, using the bid price of the aggregation to create a price ranking order until the SVCE capacity requirement is met. Settlement will be managed through 'Pay-as-Clear' with all assets receiving the market clearing price or 'Pay-as-Bid' at the levels with assets receiving the price they bid.

Advantages:

Asset bidding allows SVCE to potentially contract at the lowest cost solution, considering the value and opportunity cost asset owners put on providing flexibility. Asset bidding is used in existing CAISO

[26] Interviews with third-party aggregators suggest that a maximum duration of 2 or 3 hours better reflects asset capabilities and system needs.

markets to form the basis for the LMP calculations for supply side resources. The PG&E Supply Side DR Pilot also permitted asset bidding, with imposed price ceilings.[27]

Risks:
Stakeholder feedback suggested that the complexity of calculating a DER's opportunity cost per event is excessively high relative to asset size.

6.6.3.2 Option 3: Reservation Payment + Pay for Performance

Overview:
SVCE market participants will be provided a monthly reservation payment for providing market availability ($/kW-month) and an energy payment for energy reduced during an event. The energy payment will be defined by the relative contributions from carbon, peak reduction, and reduction in SVCE wholesale exposure.

Advantages:
Reservation payments for capacity can help to secure liquidity during the early stages of a market by providing an upfront payment to aggregators and customers.

Risks:
Discussions with third parties raised the following challenges and risks associated with a reserve payment:

1. Introduction of a reserve payment will reduce the value provided in the pay-for-performance payment. A reduced pay-for-performance value may reduce participation in an SVCE market if the value through the CAISO markets is higher.
2. Conditions of a reserve payment would need to be set to ensure that devices weren't receiving a value stream without a requirement for market participation or bidding. With multiple market opportunities, a reserve payment could result in assets accepting the reserve payment and then bidding into more lucrative markets, reducing the value to SVCE.
3. The single SVCE price will change according to SVCE's forecast exposure, customer load levels and the CAISO marginal carbon intensity. It will be difficult for SVCE to determine a single reserve price while the three value components of the real time price are changing.
4. The SVCE price ceiling for wholesale exposure will be determined by the CAISO market price. Resources which are qualified into CAISO markets may be unwilling to pre-commit to an SVCE market when the CAISO price is more profitable.

6.6.3.3 Option 2: Variable Price Pay-for-Performance

Overview:
SVCE market participants receive a variable, volumetric price for participation (e.g. $/kWh) based on the respective contributions to carbon, peak reduction, and wholesale exposure avoidance.

[27] https://olivineinc.com/wp-content/uploads/2020/04/2019-SSP-Summary-Report-Redacted.pdf

Variable prices, set by the market operator, are currently used in the Capacity Bidding Program (SCE[28]; SDGE[29]) and Base Interruptible Program[30].

Advantages:
This structure would allow SVCE to price the value of the requested demand reduction and demand shift service. Conversations with stakeholders indicated that programs with reservation payments often penalized participants for non-performance. The potential for competing calls on DER flexibility during market events is sufficiently high that stakeholders are willing to take lower priced, pay for performance programs rather than risk penalties. Stakeholders additionally suggested that their customers value having an opt-out, even if it is not frequently used.

Risks:
Removal of a reservation payments can impact enrollment and reduce liquidity during the early stages of a market. For example, 2121MW of demand response capacity bid into NYISO's Special Case Resources program, which offers a capacity payment, compared with 19MW in its the energy only Emergency Demand Response Program which only offers a pay-for-performance tariff[31].

6.6.3.4 Recommended Matching Mechanism

Electron recommends the SVCE marketplace use a pay-for-performance value based on forecasted need in the day-ahead market. The pay-for-performance methodology was reinforced during stakeholder interviews to be the ideal compensation structuring, ensuring that devices are adequately rewarded for their demand reductions and value is representative of real-time system needs. Static, traditional program compensation methodologies prohibit traders from making the optimal financial and operational decisions for their portfolios.

6.7 Event Trigger

SVCE will call an event when:

- The CAISO day-ahead market price exceeds a specified value.[32]
- SVCE in its sole opinion forecasts that generation resources may not be adequate or carbon emissions are exceeding an internal target;
- SVCE forecasts a peak day

6.8 Considerations for Shift Resources

Local markets are providing greater opportunity for resources such as storage and electric vehicles which can shift load to allow for curtailment (discharging) and consumption (charging) of load based

[28] https://www.enelx.com/content/dam/enel-x-na/resources/data-sheets-and-brochures/CA_SCE_CBP_Program_Guidelines.pdf;
[29] http://regarchive.sdge.com/tm2/pdf/ELEC_ELEC-SCHEDS_CBP.pdf
[30] https://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/demandresponse/fs_baseinteruptibleprogram.pdf
[31] https://www.nyiso.com/documents/20142/2226333/2020-Gold-Book-Final-Public.pdf/9ff426ab-e325-28bc-97cf-106d792593a1; p.50
[32] The PG&E Capacity bidding programs calls an event with the CAISO DA Energy Price exceeds $95/MWh; The SVCE value is subject to future analysis.

on market bids.[33] The introduction of load shifting as distinct from load shedding results in additional considerations for baselining and settlement as well as customer communcations.

First, shiftable assets considered for hourly carbon consumption must be restricted from charging from carbon-intensive electricity. Settlement and compliance must consider:

1) The business-as-usual periods of when the asset charges and dispatches.

2) Whether the shiftable asset has met its bid requirement by shifting to charge when SVCE is exposed on the wholesale market, the grid is carbon intensive, or SVCE believes it is a peak hour for RA obligation-setting purposes.

Second, SVCE should communicate the financial risk to consumers of reducing their overall benefit from the market by charging when retail prices are higher. For example, a consumer who is paid to shift their consumption during the morning into the evening peak may be exposed to higher TOU rates.

6.9 Baselining Methodology

Various baselining methodologies have been used and are under development to ensure DERs and market resources are adequately compensated for the services they provide to a market. The preliminary SVCE trial market would remain aligned with existing, approved, baseline methodologies for simplicity, ease of computation, and to ensure alignment with CAISO markets. The 'Day Matching' baselines, which take an average from a sample number of similar days without a Demand Response event to assess DER reduction levels, are well understood and would be simple to implement in an early pilot. Examples of 'Day Matching' include the CAISO '5 in 10' and '10 in 10' methodologies[34].

Notably, stakeholder conversations have indicated that the 'Day Matching' approaches disadvantage DERs and that there is opportunity for an SVCE market to use new baselining methodologies more appropriate for DER aggregations. For example, stakeholders raised that weather conditions that drive market events frequently occur for two or three days. A baseline developed using the '10 in 10' or '5 in 10' method would therefore reflect a lower load consistent with the asset behavior before the more extreme weather conditions. Further exploration is required to finalize a methodology for commercial implementation.

6.9.1 Future Baselining Considerations

Future opportunity exists for SVCE to mature the baseline approach it uses as the method of market interaction by battery storage devices evolves. The initial phase of the SVCE market will support load reduction, with future phases expanding to allow generation or asset export. Future scenarios

[33] https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Electric_Power_Procurement_and_Generation/Procurement_and_RA/RA/Official%20BTM%20Workshop%20slides.pdf

[34] CAISO BPM for Demand Response; Section 1.14ff

for baselining may follow the existing CAISO methodologies for behind the meter battery storage registered for the PDR LSR program:

1. Customer Load Baseline: A Baseline is created for the participant's home or building. This method is used where only the behind-the-meter storage device provides load curtailment and consumption.
2. PDR LSR with Baseline: Allows the facility load (e.g a residential house) to offer load curtailment, while behind the meter storage provides load curtailment and consumption. The facility load nets out any consumption / export from the energy storage device and uses the resulting customer baseline to calculate load curtailment for that customer[35].

Conversations with stakeholders suggested that creating a joint baseline for the battery device and a household can undermine the battery performance, and that they would prefer to measure asset performance at the battery inverter rather than at the home meter. The resulting baseline for the battery would be more simple and easier to assess performance against.

6.10 Settlement

Payment for participating in market events will be determined during a settlement process using the baselining methodology. As discussed in section 6.6.3, payment levels will be decided on a pay as bid basis with the variable value set by SVCE before the market event.

7 Systems Overview

Deploying an SVCE market will require the design, development, and deployment of new systems to enable market operations and coordination between various market participants.

ElectronConnect provide systems to support the required level of functionality while maintaining simplicity and ease of integration. The various systems can be summarized as follows:

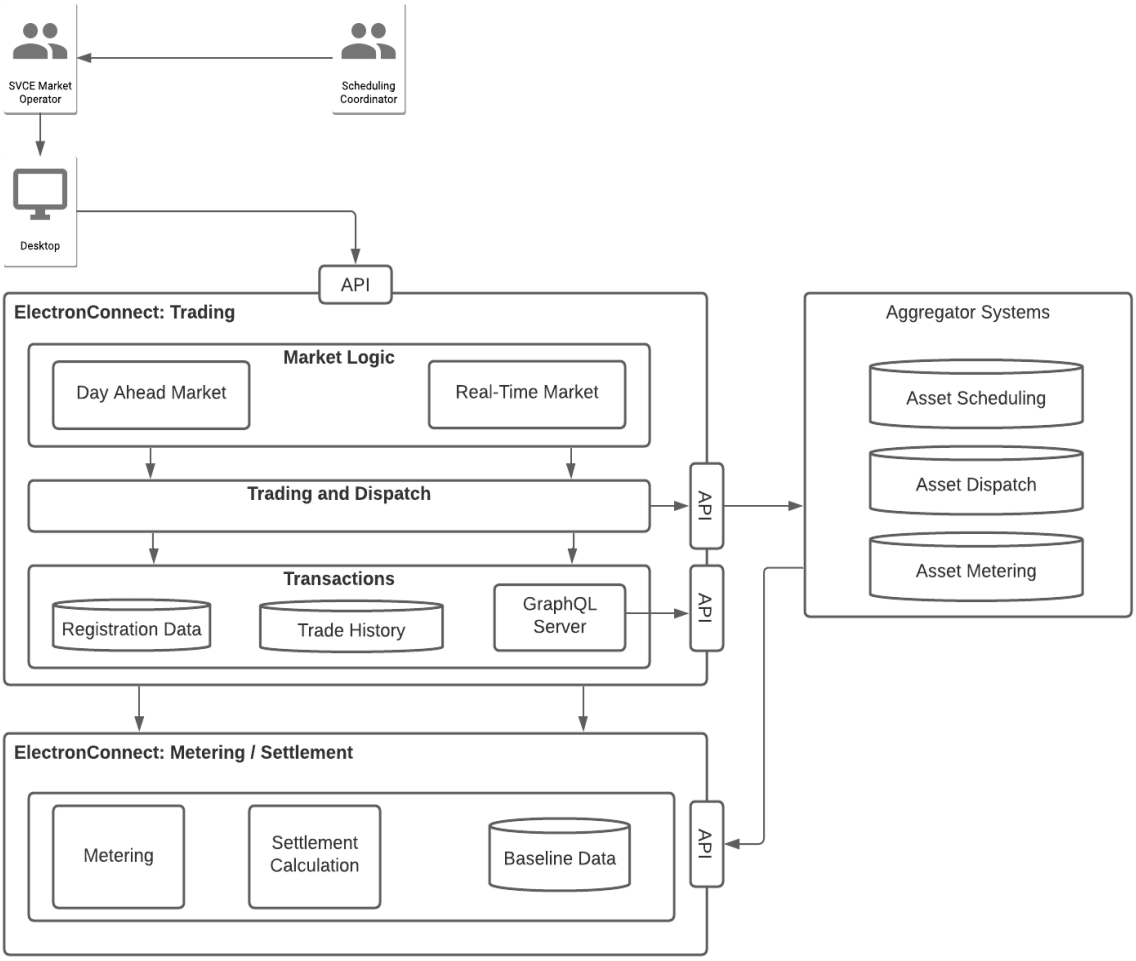
1. Trading Platform
2. Settlement System
3. Metering System
4. Aggregator Systems

The trading platform will manage the intake of bids and offers and clear the market on the described timelines. The settlement system will manage baseline calculations and ex post settlement. Interaction with these two systems will be enabled by a Graphical User Interface (GUI) or a series of APIs, dependent on market operator or participant requirements.

The existing ElectronConnect market platform will provide the foundation for the Market Platform and Settlement System, with the final design informed by specific SVCE market implementation requirements.

[35] DR BPM p.46

ElectronConnect relies on the existence of digital Aggregator platforms to provide access to device scheduling, control, and metering systems. Integration with multiple Aggregator platforms ensures that multiple device and customer types will be included in an SVCE market. As third-party metering systems will be used to provide the appropriate levels of data access, Electron will ensure that the standards used to define metering specifications are aligned with existing regulations and consider simplification of integration processes.



7.1 Key SVCE and Market Participant Technology Constraints

7.1.1 SVCE

SVCE is required to forecast and value a market requirement, post the requirement to ElectronConnect, and communicate market outcomes to its Scheduling Coordinator. The market requirement can be posted to the market using a market GUI developed by Electron. Selection and notification of assets which meet the market requirement will be managed by the ElectronConnect platform and communicated via API.

7.1.2 Market Participants

Market participants must have sufficient ability to forecast and respond to market signals. The nature of the markets, particularly the real-time market, is better suited to assets with short ramp-up times and automated dispatch and control platform. Market participants will also benefit from having the

ability to forecast supply and demand profiles to ensure optimal scheduling of assets and price formation.

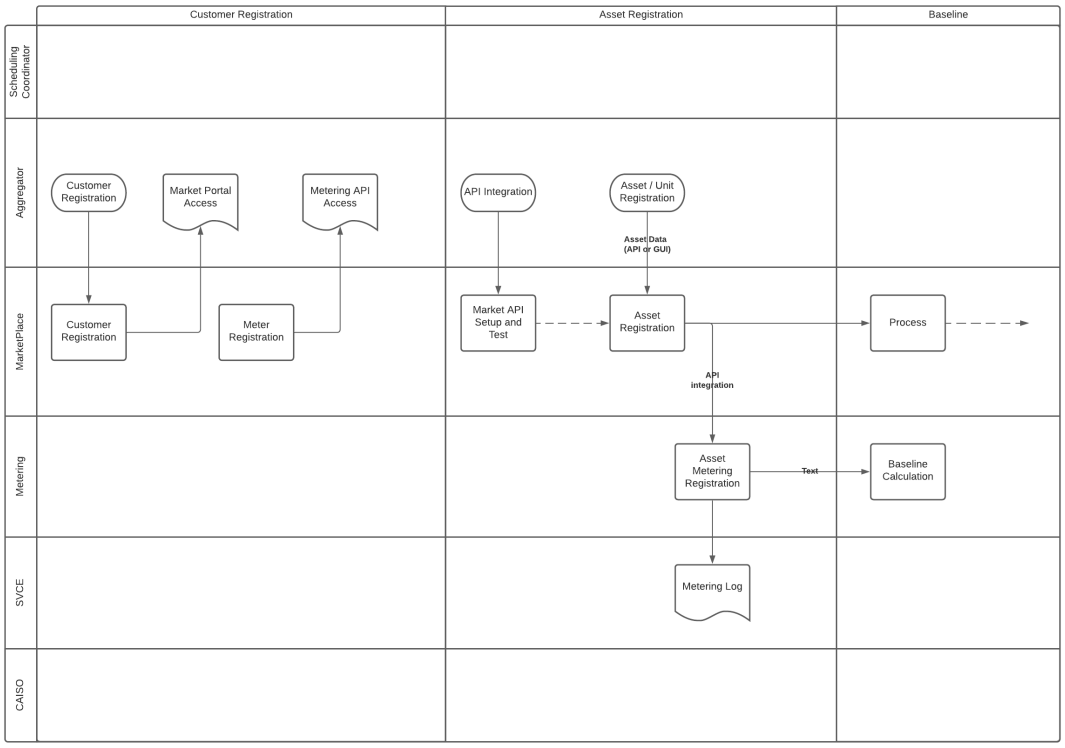
Asset selection and dispatch notifications will be managed via an API interface provided to the Aggregators enrolled in the market.

7.2 Participant Journey

The sections below detail the steps of each market function.

7.2.1 Registration

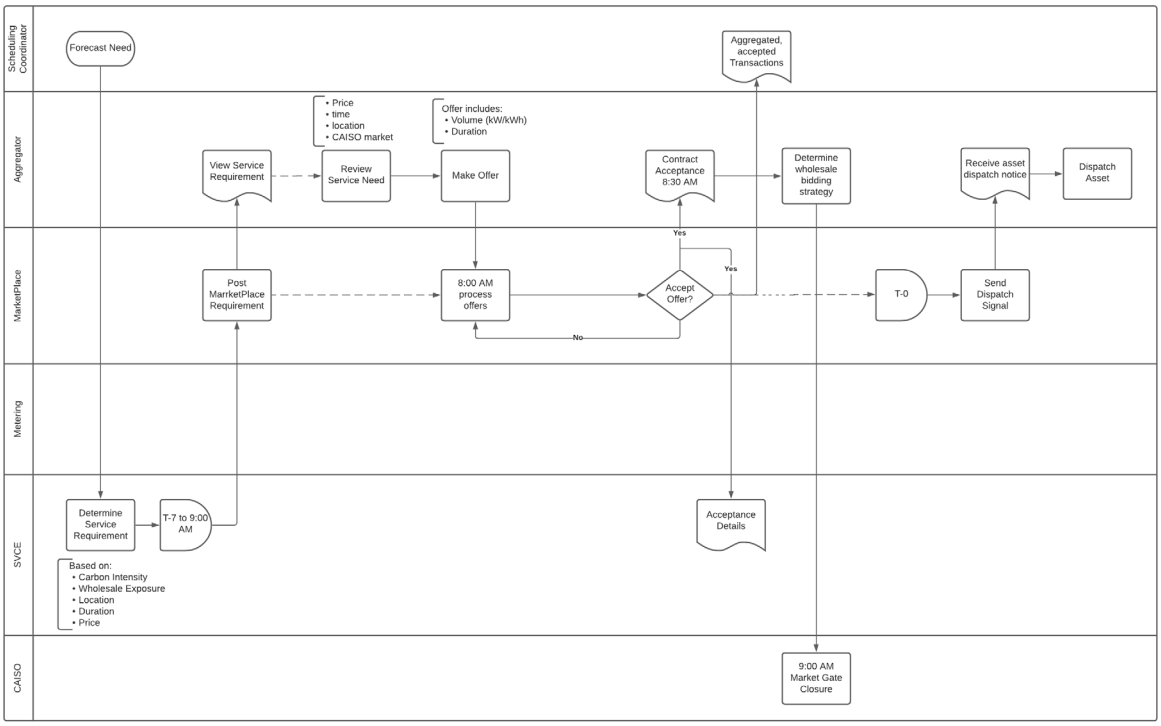
Participants are required to register and enroll before any action in an SVCE market can occur. Registration requires customer (Aggregator) registration and individual asset (or unit) registration. The process below shows the anticipated order of events.



7.2.2 Market Participation / Delivery

SVCE will generate a Service Request after receipt of its energy, load, and emissions forecasts from the Scheduling coordinator. The market request will be sent after the initial CAISO Day Ahead signals and assets will be selected before the CAISO Day Ahead Gate closure to provide an aggregator sufficient time to assess and modify Wholesale participation.

Asset selection will be communicated to Aggregators using the ElectronConnect API.



8 Regulatory Considerations:

The creation and design of a new market construct requires examination of existing and emerging regulation. This section overviews key areas to consider.

8.1 Value Streams

8.1.1 Resource Adequacy

There is currently no established methodology to determine RA capacity value for DER Aggregations[36] that reduce on an 'event' basis rather than regularly systematically reducing load. SVCE is currently piloting an approach for non-event-based load modifying demand response to count towards its RA capacity value as part of a trial with SunRun; however, event-based demand response, which cannot be forecast, will not qualify for this program.

Because SVCE cannot therefore guarantee the financial value in reduced Resource Adequacy payments, there is uncertainty about the value SVCE can gain from running a near real time market, rather than a procurement program.

8.2 Avoidance of double counting

8.2.1 Multi-Market Participation

Multiple service participation is currently managed by rules defined by CAISO and the CPUC. CAISO limits customer participation to a single CAISO resource, whereas the CPUC limits customers to a

36 https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Electric_Power_Procurement_and_Generation/Procurement_and_RA/RA/Official%20BTM%20Workshop%20slides.pdf

single Demand Responsive program. Restrictions ensure devices are not compensated for providing the same service through multiple aggregations or programs.

Double counting between the SVCE market and the CAISO market will be initially addressed through a series of contractual rules outlining the times in which assets cannot participate in both a local SVCE market and a CAISO market. For the purposes of a trial, absent explicit collaboration with CAISO, participation rules will be conservatively defined following the multiple application rules framework (D. 18-01-003).[37] In a future state, verification of double counting should be managed through a combination of contractual market rules, managed on or off the market platform, and validated asset performance data.

8.2.2 Double Counting Resource Adequacy Value

CCAs have raised concerns regarding the usage of demand-side resources deployed by LSE customers for reducing peak demand to reduce the RA obligation of the distribution utility.[38] In the context of an SVCE market, SVCE would be investing in peak load reduction through the implementation of a local marketplace. This investment could reduce PG&E's overall RA need, meaning that SVCE and its customers subsidise PG&E's other LSE customers who are not part of the SVCE program.

8.3 Data Privacy

All Demand Response Providers and Aggregators must obtain customer approval in order to access electric usage data or personal information regarding the customer's service account from the Utility. Customer consent is provided through their utility's Authorization or Revocation of Authorization to Disclose Customer Information Request (CISR) form (Form 79 – 1095 or Form 79-1152 depending on the purpose).[39]

Aggregators that receive customer usage information from the utility are required to maintain privacy and security of customer data according to the California Public Utilities Commission's (CPUC) privacy policies: Decisions (D.) 11-07-056. Pursuant to Decision 12-08-045, SVCE is also required to maintain privacy of customer usage information that it receives to operate its system; however, the applicability of these rules to the SVCE market is unclear: While D.12-08-045 requires a CCA to maintain the privacy of customer usage information and provides a CCA with the ability to obtain and use information it obtains from the utility for several purposes, including planning and operating its system, since information being received in this case comes from the aggregator, there is no clear Commission guidance guarding this relationship. The CPUC's decision may therefore not apply to the SVCE market.

[37] https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M206/K462/206462341.pdf

[38] https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Electric_Power_Procurement_and_Generation/Procurement_and_RA/RA/Official%20BTM%20Workshop%20slides.pdf [pg 58]

[39] https://www.cpuc.ca.gov/General.aspx?id=6306

8.4 Existing CCA Marketplaces

Community Choice Aggregators are beginning to explore the role that local marketplaces and DER flexibility can bring to their operations. Only one example of a CCA-based marketplace currently exists despite several examples of DER procurement platforms available for flexibility procurement for RA programs.

8.4.1 Marin Clean Energy

Marin Clean Energy (MCE) recently launched a flexibility marketplace aiming to enroll 20 MW of demand-side flexibility in their new Demand FLEXmarket, operated by Recurve.[40] The marketplace compensates customers $150 per MWh of verified load reducing during periods of peak demand. Uniquely, the MCE DemandFLEX market permits enrolment by multiple aggregators to bring a diverse set of customers and DER types, and avoid vendor lock-in with DER providers. The MCE DemandFLEX market has received interest from 32 *providers*, indicating high interest in new market approaches and value streams from DER operators.

This approach is distinct from that suggested here, in that we advocate for a variable 'pay-for-performance' value based on the hourly value of the product offered by the asset, rather than a reservation payment and standard 'pay-for-performance'.

9 Future Market Evolution

The initial SVCE marketplace is designed to provide a first demonstration of utilizing a pay-for-performance, variable price to incentivize load reduction within a Load Serving Entity's territory. In an initial pilot phase, the scale of impact is limited and lessons learned will inform pricing, compensation, and baselining strategies. As the scale of a marketplace evolves, the impacts of a local market increase and necessitate coordination with additional stakeholders and existing marketplaces. Figure 5 shows a schematic of a marketplace which coordinates with CAISO and PG&E as two potential future market operators.

This is but one example of how information could be shared between CAISO, SVCE, and PG&E in a future scenario. Increased complexity could be introduced if PG&E procured services via a market mechanism using the same set of assets enrolled in a CAISO and SVCE market.

[40] https://www.mcecleanenergy.org/news/press-releases/mce-launches-new-grid-responsive-demand-flexmarket/

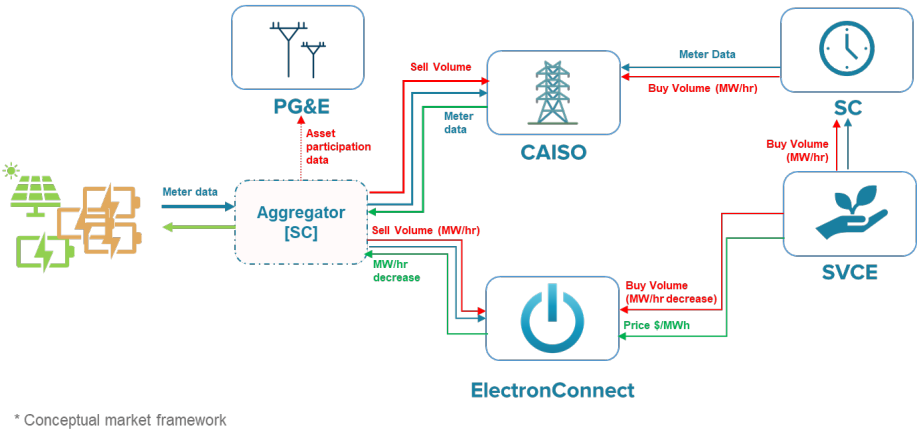


Figure 5. Integrated Marketplace

9.1 Future coordination with CAISO

Coordination with CAISO has been described in detail above regarding dual participation rules. As more assets of varying sizes and types are used across the electricity supply chain, rules must be defined to ensure fair compensation and avoid double counting. Several strategies are being pursued globally to design price-based coordination schemes where multiple market operators are able to set a positive or negative price for complementary or contradictory actions.[41] To date, these pilots and trials have been limited to TSO/DSO coordination, thus, immense opportunity exists to consider integration of the LSE as a third market operator.

Future work would involve discussion and design with CAISO to pursue any new opportunities to explore price or rule-based coordination.

9.2 Coordination with Pacific Gas & Electric

The transition from distribution network ownership to distribution system operations is driving conversations about the role of the traditional distribution utility. As power flows on the distribution network become increasingly bi-directional and as assets provide more opportunities to contribute flexibility to grid operations, markets operated by the distribution network are increasingly of interest.

A future SVCE marketplace would be required to set dual participation rules with PG&E to ensure that devices are fairly compensated for actions that could benefit grid operations as well as provide the benefits to SVCE described herein. As with CAISO, incorporation of any PG&E programs would require additional discussion and design work between SVCE, PG&E, and potentially CAISO to begin to explore tri-lateral coordination of assets in a shared geographic area. Options include rule-based coordination (e.g. dual participation rules and exclusivity) and price-based coordination (e.g. shared payment for a mutually beneficial action).

[41] https://www.centrica.com/media/4609/the-future-of-flexibility-centrica-cornwall-lem-report.pdf