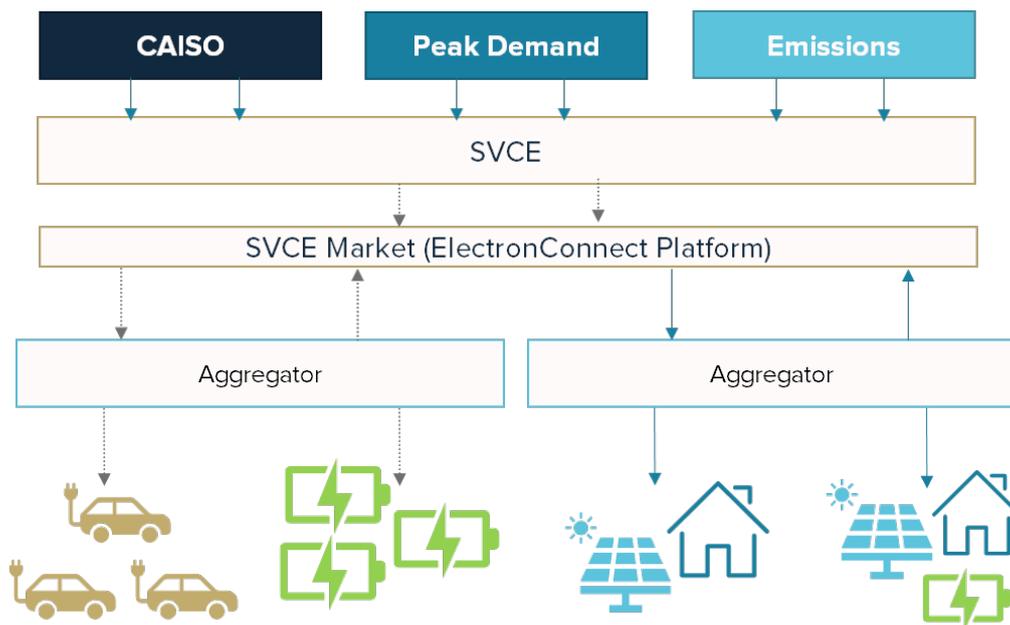


Local Market Design Project Summary

Silicon Valley Clean Energy (SVCE) Innovation

Onramp Program



Summary

Electron and SVCE collaborated through the Innovation Onramp program to design a new market to incentivize grid resiliency. The pilot designed a prototype of a new local marketplace where SVCE can procure clean energy services from its customers. Using a local marketplace, SVCE can generate new revenue streams for owners of flexible technologies, such as batteries, and will therefore help to reduce the cost of resiliency for these consumers. This document summarizes the market design and participation requirements for a continuous, pay-as-bid Day Ahead Market.

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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.

The Role of Local Markets for SVCE

As a Community Choice Aggregator (CCA), SVCE is responsible for procuring energy on behalf of retail electricity customers in its geographic area. For the thirteen communities it serves, SVCE procures 100% clean energy supplied by renewable wind, solar + storage, geothermal and carbon-free hydropower resources. While renewable targets can be met on an annual or monthly basis, the nature of renewables result in high-cost procurement of carbon-producing generation on the wholesale market during times of high demand and low renewable generation. CCAs have an opportunity to use local markets to shape the load on their system, providing value to their consumers by leveraging the inherent flexibility in DERs.

Through the Innovation Onramp program, SVCE and Electron have undertaken a nine-month project to evaluate the role a market can play in helping manage costs and achieve decarbonization goals for SVCE. Local markets have been implemented as a way to match supply and demand in real-time and compensate local resources using performance-based methodologies. Real-time markets introduce more options for participants to account for changing conditions which influence energy or capacity availability, such as weather or existing demand constraints.

Marketplace Objectives

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

- Improved Customer Satisfaction
- Cost Reduction
- Minimized Environmental Footprint
- Scalability

Value Streams and Markets

Five different value streams were identified to be accessed directly or indirectly by SVCE via a local market. 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. In all cases, consumers receive an indirect value of bill savings from energy reduction.

Direct streams

- **Minimize Exposure on CAISO Markets** by leveraging demand flexibility to shed or shift load, reducing the total procurement volume required.
- **Hourly Emissions Reduction** by incentivizing flexible demand to shed or shift load during times of peak demand.
- **Reduce Future Resource Adequacy** requirements by incentivizing flexible demand to shift or reduce during peak periods.

Indirect streams

- **Non-Wires Alternatives.** Incentivizing demand-side flexibility allows utilities to shifting investment from physical assets to operational improvements (e.g. through a non-wires alternative), offering an opportunity reduce grid investment and compensate customers for DER services.
- **Facilitate Access to Wholesale Markets.** SVCE could create a separate entity to transact in the wholesale market, enabling DERs to be paid by the counterparties trading in CAISO.

Market Assessments

SVCE reviewed eight market options to pursue based on the following four factors:

1. The underlying value stream
2. The product traded (e.g. energy, capacity, green credits / attributes)
3. The mechanism by which this product could be accessed
4. The position of the market within the existing California market landscape

The markets were then reviewed against criteria in the following categories:

- **SVCE and seller surplus** – value of market to SVCE and sellers
- **Market liquidity** – ease of market entry for participants
- **Transferability** – ease of adoption by other LSEs, retailers and CCAs in California
- **Scalability** – market accessibility for aggregators and devices types
- **Decarbonization** – the impact of the market on GHG emissions on an hourly basis
- **Grid reliability** – the impact of the grid on reliability and reduction in T & D upgrades
- **Strategic alignment and market positioning** – how well the market aligns with SVCE's strategy and whether SVCE is uniquely placed to operate the market

Market Selection

The market options are summarized below along with a qualitative (green, orange, red) assessment rank for each. Markets 2, 3, and 5 were selected as the highest value options.

#	Value Stream	Market Mechanism	Product	Market Structure	Overall Assessment
1	Minimize Wholesale Exposure	Load Shedding	Energy	CAISO	Medium
2	Minimize Wholesale Exposure	Load Shedding/ Shifting	Energy	SVCE-only	High
3	Reduce Peak Demand (Resource Adequacy)	Load Shedding	Capacity	SVCE-only	High
4	Reduce Peak Demand (Non-Wires Alternatives)	Load Shedding/ Shifting	Capacity	PG&E	Medium
5	Reduce hourly emissions	Load Shifting	Energy	SVCE-only	High
6	Reduce hourly emissions	Load Shedding	Energy	SVCE-only	Medium
7	Reduce hourly emissions	REC Procurement	REC	SVCE-only	Low
8	Provide access to CAISO wholesale markets	Load Shedding	Energy; Ancillary Services	CAISO	Low

High Medium Low TBD

- **Market 2**, SVCE-owned marketplace to minimize wholesale exposure through load shedding/ load shifting.
- **Market 3**, SVCE-owned marketplace to minimize Resource Adequacy payments through load shedding.
- **Market 5**, Hourly emissions reduction by load shifting.

Markets 2 and 3 help SVCE reduce its energy procurement costs through management of wholesale exposure and reduction of RA payments. As SVCE-only markets, each allows SVCE to strengthen customer relationships, whilst avoiding the added administration costs of integrating with existing CAISO and PG&E markets.

Market 5 is strategically aligned with SVCE objectives to decarbonize with a high potential for market liquidity driven by assets which can shift their overall demand; however, the direct monetary value placed by SVCE on decarbonization remains challenging to define.

Market Structure

The SVCE market was defined based on the following foundational principles:

- 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
- SVCE will time market events to coordinate with the Day Ahead and Real-Time CAISO energy markets

- The price signal and volume required for flexibility will be based on the relative value of flexibility to the reduction of wholesale exposure costs, reduction of resource adequacy costs, and reduction of hourly emissions

By using these criteria, SVCE aims to lower barrier to entry for participants and reduce complications which arise when creating additional market opportunities for DERs.

After communicating with a variety of different stakeholders who are active in California markets, the SVCE local market was defined as an auction market, using a 'pay-as-bid' mechanism. The market will have expected activity during three key periods:

- **Before SVCE Wholesale Exposure:** Using DA price forecasting, SVCE can determine whether a local demand response action is more beneficial than procuring energy in the Real-Time or Day Ahead energy markets
- **During Days and Times of Peak Demand:** Periods of 2 – 3 hours several times a year drive the calculation of SVCE's resource adequacy requirements. Reduction during these times may have an impact on future year's requirements.
- **Times of High Carbon Intensity:** During periods of wholesale exposure, SVCE is subject to the carbon intensity of the CAISO grid mix. SVCE can call an event to reduce demand and avoid a percentage of wholesale procurement.

Each component of the value stack contributes independently to form a single, variable price signal. The market will operate in parallel with the existing CAISO energy markets and will continue to evolve as California regulations address barriers to entry in the existing Demand Response and Energy markets.

Market Value

SVCE market signals will be generated based on the valuation of the relative energy, capacity, and carbon contributions of load reduction. Prior internal reports have generated upper bound estimates for the ability of flexibility to contribute to cost savings at SVCE.¹

Market Value

Wholesale Exposure

SVCE estimated the 10-year net present value (NPV) achievable using load shedding to avoid wholesale exposure in the Day-Ahead and Real-Time markets at \$4.5M and \$6M, respectively.

Peak Reduction

Prior SVCE analysis found that peak reduction for 2 -3 hours of the first 20 – 30 MW can result in a 10 year 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.

Hourly Reduction of Emissions

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. 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 based on the SVCE marginal emissions factor, and approximately \$30k/year in total value.

¹ <https://www.svcleanenergy.org/wp-content/uploads/2020/02/SVCE-IRP-Narrative-Report-1.pdf>

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. Combining these three value streams enables SVCE to compensate at different levels throughout the day, enabling DERs more opportunities to provide services outside of the traditional 4 – 9 PM window. Furthermore, the stacking of these value streams enables stacked returns for DERs which can provide energy, capacity, and carbon reduction services. Average annual values range from \$50/MWh to \$400/MWh depending on the relative contribution of each value driver.

Market Design Specification

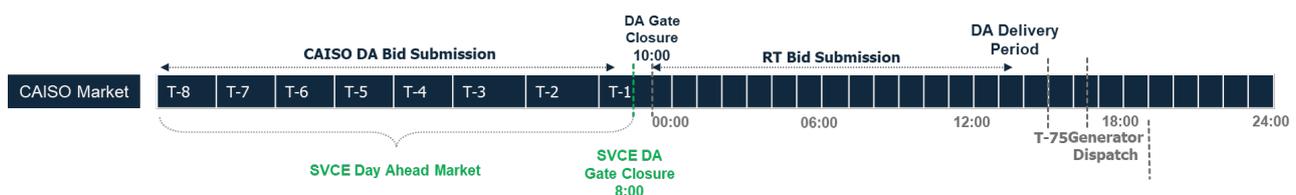
An SVCE market must be aligned with the existing CAISO Day Ahead and Real-Time energy markets to enable coordination with existing aggregators' and suppliers' existing portfolios. Two markets, aligning with the DA and RT market were explored, to determine the value of requesting flexibility during each time frame based on each of the following triggers:

- Forecast wholesale exposure – determines the volume of flexibility SVCE requests from the market
- Forecast marginal grid emissions
- Forecast annual peak period

Ultimately, the DA market was found more immediately valuable as stakeholder engagement suggested that DA participation provides residential market participants a greater opportunity to plan for participation, ultimately helping manage risk of non-performance.

Day ahead market specification

The SVCE day ahead market operates as a continuous market based on forecasted DA energy prices, closing before the CAISO Day Ahead energy market 10:00 AM gate closure.



The market functions as follows:

- 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

Real-time market specification

The SVCE real-time market operates similarly to the DA market, closing before the CAISO RT energy market gate closure. A real-time market is lower priority due to the complications forecasting and procuring requirements on a short time scale.

Participation requirements

The SVCE market is designed to enable multiple aggregators operating multiple device types to enroll and participate. SVCE would launch and enrolment and registration process to on-board assets which can abide by the following requirements.

- **Optional Service** – Assets can be called to provide demand reduction for Day Ahead Dispatch
- **Delivery** – Assets must be able to sustain up to 4-hr delivery, but 1 – 2 hour delivery is expected²
- **Selection** – Assets will be accepted in a first-come, first-serve order
- **Dispatch** – Service is an ‘All or Nothing’ Service whereby 100% of the volume will be accepted or rejected
- **Communication** – Aggregators must be able to register and communicate via API
- **Settlement** – Variable \$/MWh. Paid using Pay-as-Bid mechanism with price defined by SVCE
 - Asset settlement will initially be calculated using the 10-in-10 methodology

Recommendation for matching and compensation mechanism

Electron recommends the SVCE marketplace use a variable pay-for-performance value, set by SVCE and based on forecasted needs. 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. The variable approach avoids the drawbacks of static, traditional program compensation methodologies which prohibit traders from making the optimal financial and operational decisions for their portfolios. Furthermore, by maintaining SVCE as a price-marker, the barrier to entry for aggregators is lowered through the avoidance of defining opportunity cost of consumer participation.

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 product, the direction of the request (demand shed or demand increase), and existing contractual obligations and market rules. California market rules restrict participation during certain time periods in certain markets. The most notable conflict is 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. Dual participation rules prohibit these resources from participation in other markets.

In general, the following rules will apply:

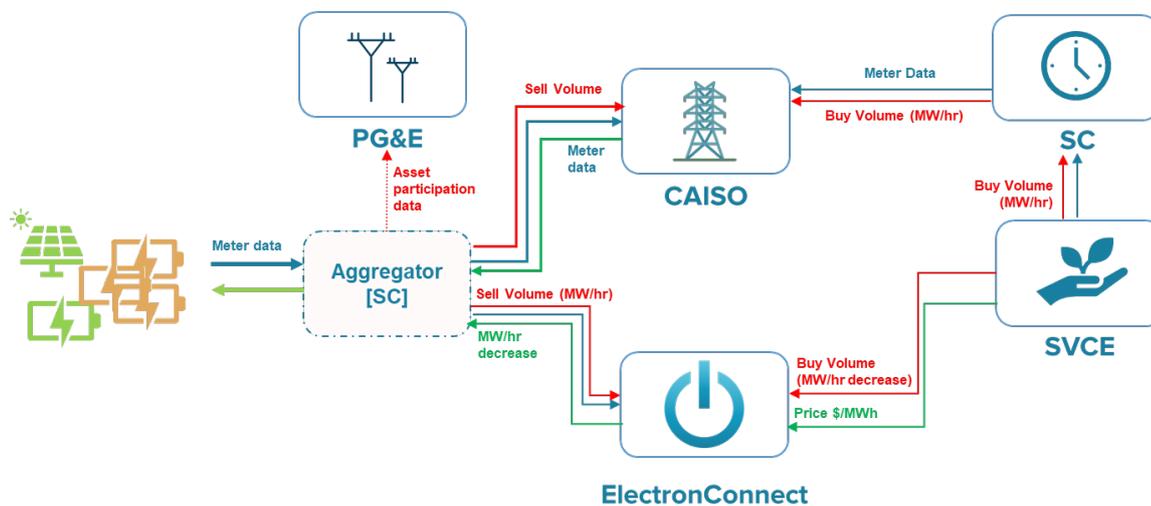
- RA-qualified resources can only participate in markets outside the hours they are required to bid as part of the RA program.

² Stakeholder conversations indicate that shortened delivery time periods are more advantageous than firm compensation values as it allows operators to more efficiently manage market participation.

- 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 hour.

Scalability

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 within a single LSE's territory. As the scale of a marketplace evolves, the impacts of a local market increase and necessitate coordination with additional stakeholders and existing marketplaces. Figure 2 shows a schematic of a marketplace which coordinates with CAISO and PG&E as two potential future market operators.



* Conceptual market framework

Figure 1: Conceptual market framework

Future coordination with CAISO and PG&E will be required to manage dual participation and mitigate any distribution – level grid constraints which may emerge as a result of local market participation.