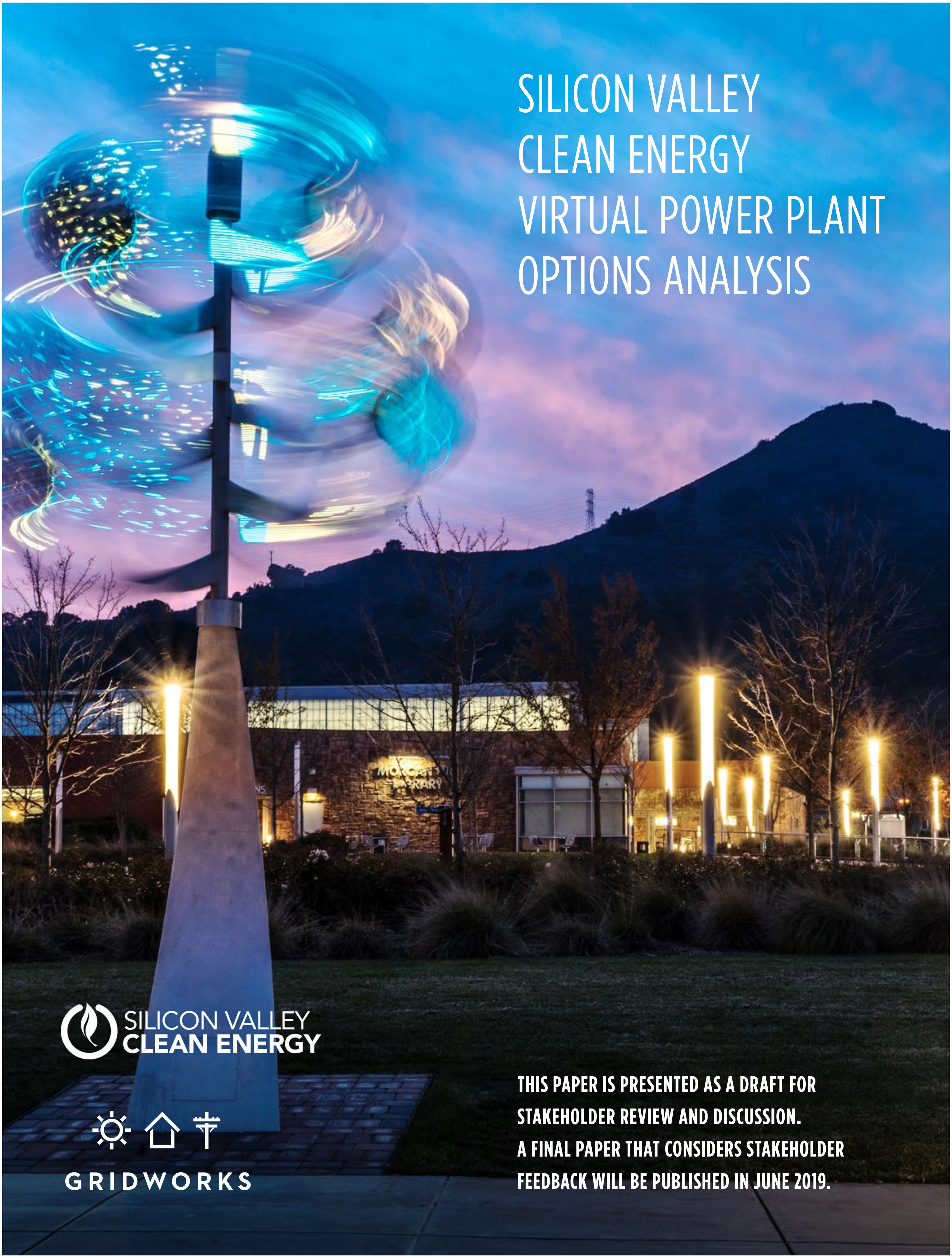

SILICON VALLEY CLEAN ENERGY VIRTUAL POWER PLANT OPTIONS ANALYSIS

SILICON VALLEY CLEAN ENERGY

GRIDWORKS

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DISCUSSION DRAFT

1. INTRODUCTION

CONTENTS

Silicon Valley Clean Energy's primary mission is to reduce greenhouse gas emissions and has set ambitious targets to achieve 30% reduction from 2015 baseline levels by 2021, 40% by 2025, and 50% by 2030. One critical component to achieving these milestones is monetizing and harnessing the value from distributed energy resources (DER) aggregations, also referred to as virtual power plants. The term "virtual power plant" has emerged as an industry term, though it has different connotations to different audiences. Here, we use the term virtual power plant to refer generally to shifts in energy demand or injections to the grid from distributed resources that provide grid services.[1] Grid services could be offered based on a range of triggers, from price signals to complex and focused load aggregation and shaping.

Virtual power plants provide numerous benefits to customers, communities, and the electricity grid. For customers, virtual power plants offer low- to zero-emissions electricity and help lower the cost of electrical service.[2] For communities, virtual power plants can replace high-emissions peaker plants, reducing localized air pollution.[3] On the electric grid, virtual power plants provide grid services such as capacity, ramp smoothing, and voltage regulation, and reduce need to upgrade or construct transmission and distribution infrastructure.[4] Table 1 describes recent

1 Virtual power plants would not have all the same characteristics as a physical power plant. Characteristics would depend on the load serving entity's needs and program goals. Grid services can include generation, capacity, and ancillary services.

2 Consolidated Edison Company, January 2018, *Brooklyn Queens Demand Management Program Implementation and Outreach Plan*, http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B8FF8D6D6-7E2B-4D83-9B9C-8B3E54612B8C%7D

3 NRDC, March 2018, *Replacing a Polluting Plant with Clean Energy*, Accessed April 7, 2019, https://www.nrdc.org/experts/mohit-chhabra/pge-replace-aging-jet-fuel-power-plant-oakland-s.

4 GridLab and Gridworks, August 2018, *The Role of Distributed Energy Resources in Today's Grid Transition*, https://gridlab.org/s/GridLab_RoleOfDER_online.pdf.

virtual power plant projects. These projects point to ongoing innovation in the realization of customer, community, and grid services through virtual power plants, setting an example of what can be achieved in California.

	SDG&E'S POWER YOUR DRIVE[5]	SUNRUN WHOLESALE CAPACITY MARKETS[6]	SCE/AMS HYBRID ELECTRIC BUILDINGS[7, 8]
DESCRIPTION	Electric vehicle charging stations owned and maintained by SDG&E are grid integrated through an hourly rate to encourage customers to charge at off-peak times. Multiple electric vehicle service providers were engaged to offer customers a choice of vendor, equipment, and service.	Network of roughly 5,000 distributed solar and storage systems providing 20 MW of capacity for the Independent System Operator (ISO) of New England.	Aggregation of batteries across 21 buildings in Southern California capable of providing up to 10 MW of instantaneous load reduction for up to four hours.
GRID SERVICES PROVIDED	Demand management, load shift, ancillary services	Generation, capacity, backup power	Demand management, load shift, generation, capacity, backup power
IMPACT/ OUTCOME	High customer interest and uptake, including at multi-family housing sites and workplaces – over 900 charging stations have been installed at 85 sites. 94% of vehicle charging time was during off-peak hours.	Demonstrates the capability of, and confidence in, distributed resources to provide reliable grid services.	Each building is capable of reducing building peak demand by 25% and reducing energy expenses and operating costs by about 10%. Batteries have also been dispatched as Proxy Demand Resources in the CAISO market.

2. ROLE OF COMMUNITY CHOICE AGGREGATORS

CCAs, such as SVCE, are in a unique position to develop and offer virtual power plants. As community-owned agencies, CCAs have a detailed understanding of local needs and issues and an interest in reinvesting in their communities. CCAs are therefore uniquely able to offer tailored energy solutions that reflect the values of local communities. Benefits can also spill over to the broader community through reducing emissions from electricity generation, supporting local economic development, and advancing the clean energy market.

Transportation electrification and building decarbonization are priority initiatives for SVCE to help its communities meet their emissions reductions goals. These initiatives will inevitably increase electricity demand and dependence on the grid. Virtual power plants can help manage anticipated load growth by mitigating the burden on existing infrastructure and keep electricity costs low. New clean energy resources, technologies, and rate options deployed as virtual power plants are opportunities to serve customers and communities with low-emissions, low-cost electricity.

Virtual power plants, however, are in an emerging market and strategic evaluation of options available to CCAs is necessary to define viable models that help CCAs achieve their goals.

3. VIRTUAL POWER PLANT OPTIONS

SVCE has identified five virtual power plant options with varying levels of complexity for consideration in this document. These options are not a comprehensive representation of virtual power plants options and there may be other options or modifications on options described below that would be a good fit to meet SVCE's goals.

Real Time Pricing charges customers electricity rates that vary with wholesale electricity market prices and are generally higher during periods of high demand on the electricity system. Real Time Pricing has the possibility to lower electricity bills without requiring customers to change behavior when compared to flat rate pricing.[9] Customers under a Real Time Pricing rate may or may not receive real-time notification from their electricity provider during periods of high rates. Real Time Pricing can be a relatively passive method to lower bills and encourage shifts in energy demand based on price signals.

Peak Day Pricing is a rate option available to commercial and industrial (C&I) customers that offers a discount on summer electricity rates in exchange for higher prices during nine to 15 Peak Pricing Event Days per year. Customers are notified the day before a Peak Pricing Event Day and expected to respond by lowering or shifting their demand to alleviate pressure on the system.[10] By lowering demand on those peak days, customers are able to lower their overall electricity bills over the course of the year. In 2018, less than half of the eligible PG&E customers participated in Peak Day Pricing.[11]

Demand Response Auction Mechanism (DRAM) is a relatively new process to aggregate demand response resources for Resource Adequacy (RA) and offer the energy in the California Independent System Operator (CAISO) wholesale market. Throughout the DRAM pilot (2015-19),

5 San Diego Gas & Electric, February 2019, *Electric Vehicle-Grid Integration Pilot Program (Power Your Drive) Fifth Semi-Annual Report (Corrected) of San Diego Gas & Electric Company*, https://www.sdge.com/regulatory-filing/10676/sdge-electric-vehicle-grid-integration-pilot-program

6 Spector, Julian, January 2019, *Sunrun Wins Big in New England Capacity Auction with Home Solar and Batteries*, Accessed April 7, 2019, https://www.greentechmedia.com/articles/read/sunrun-wins-new-england-capacity-auction-with-home-solar-and-batteries#gs.3kyfht

7 Advanced Microgrid Solutions, April 2018, *Irvine Company Complete's World's First Collection of Hybrid Electric Buildings; 21 High-Rises Outfitted with Tesla Energy Batteries*, Accessed April 7, 2019, http://advmicrogrid.com/irvine-company-completes-worlds-first-collection-of-hybrid-electric-buildings-21-high-rises-outfitted-with-tesla-energy-batteries.html

8 St. John, Jeff, April 2018, *Advanced Microgrid Solutions' Hygrid-Electric Building Fleet Goes Live*, Accessed April 7, 2019, https://www.greentechmedia.com/articles/read/advanced-microgrid-solutions-and-irvine-co-s-hybrid-electric-building-fleet#gs.3kysdj

9 Zethmayr, Jeff, Kolata, David, and Environmental Defense Fund, November 2017, *The Costs and Benefits of Real Time Pricing*, https://citizensutilityboard.org/wp-content/uploads/2017/11/20171114_FinalRealTimePricingWhitepaper.pdf

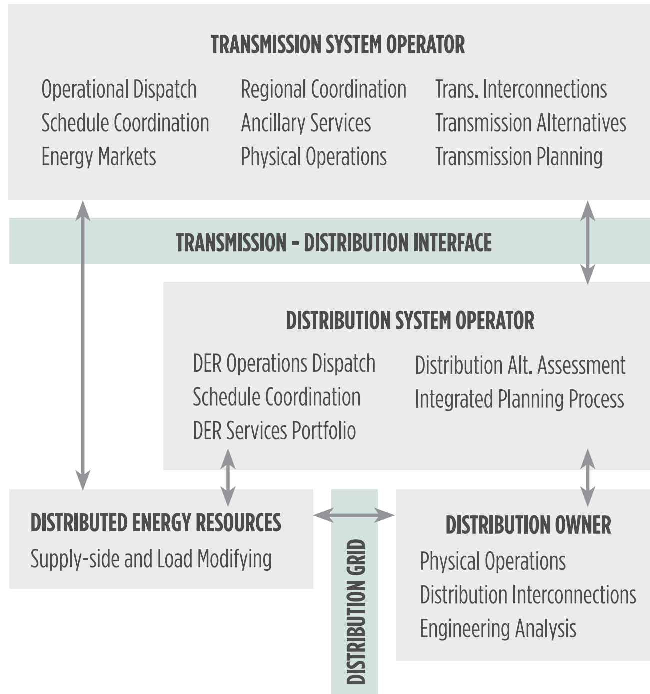
10 PG&E Peak Day Pricing website, Accessed April 7, 2019, https://www.pge.com/en_US/small-medium-business/your-account/rates-and-rate-options/peak-day-pricing.page.

11 PG&E, January 2019, *Pacific Gas and Electric Company Monthly Report on Interruptible Load and Demand Response Programs for December 2018*, https://www.pge.com/pge_global/common/pdfs/save-energy-money/energy-management-programs/demand-response-programs/case-studies/December2018_ILPreport.pdf.

integration challenges such as customer registration, meter data access, and understanding CAISO, IOU, and CPUC rules presented significant barriers to participation and product delivery for DR providers. That, however, did not deter customer enrollment. Between 2016 and 2017, the number of customers, primarily residential, participating in DRAM increased four-fold from 12,500 to 52,000. In its DRAM pilot evaluation, Commission staff recommended that the Commission adopt a revised auction mechanism based upon evaluation results.[12]

Load Shift Resource (LSR) program is a generic term to describe a program that actively modifies electricity demand to better fit grid needs. Here we focus on two program design options - one that shifts demand to off-peak times in response to grid conditions, as is the approach for Sonoma Clean Power's GridSavvy program,[13] and one with market-integrated dispatchable resources, as newly possible through the CAISO's Proxy Demand Resource—Load Shift Resource tariff. In a grid-responsive program, the customer has the opportunity to be compensated for changing consumption patterns in real-time but retains the option to opt out as needed. Customers would be compensated based on energy market savings, capacity cost savings (generation, transmission, distribution), and other performance-based values.[14] In a market-integrated program, an LSE would aggregate dispatchable DERs and bid those resources into wholesale energy markets to take advantage of low or negative electricity prices. Resources would be capable of both load curtailment and dispatchable consumption under both design options.[15]

Distribution Service Model describes a paradigm where a Distribution System Operator (DSO) proactively coordinates with load serving entities, distribution system operators, and DER aggregators to procure and dispatch resources that meet distribution system needs. The DSO would optimize DERs to provide grid services and offer products into wholesale markets as appropriate. This targets more sophisticated technologies that can receive and respond to dispatch signals such as electric vehicle chargers, advanced inverters with photovoltaic, and/or battery storage. For the purposes of this document, the DSO would be independent non-profit entity. Participating customers are on a unique tariff that compensates distribution system grid services.[16] This model relies on a proactive approach to distribution system operations not currently in place in California, but under discussion. Figure 1 shows how a DSO would coordinate within an integrated systems operation framework.[17]



12 CPUC, January 2019, *Energy Division's Evaluation of Demand Response Auction Mechanism Final Report (Public Version - Redacted)*, http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442460092.

13 Sonoma Clean Power, February 2019, *Residential Charging Station and GridSavvy Frequently Asked Questions*, Accessed April 7, 2019, https://sonomacleanpower.org/uploads/documents/GridSavvy-Program-FAQs-2.4.19.pdf

14 *The Final Report of the California Public Utilities Commission's Working Group on Load Shift*, January 2019, https://gridworks.org/wp-content/uploads/2019/02/LoadShiftWorkingGroup_report-1.pdf.

15 CAISO, July 2018, *Energy Storage and Distributed Energy Resources Phase 3 Draft Final Proposal Market and Infrastructure Policy*, http://www.caiso.com/Documents/Revised-DraftFinalProposal-EnergyStorage-DistributedEnergyResourcesPhase3.pdf.

16 *The Final Report of the California Public Utilities Commission's Working Group on Load Shift*, January 2019, https://gridworks.org/wp-content/uploads/2019/02/LoadShiftWorkingGroup_report-1.pdf.

17 De Martini, Paul and Kristov, Lorenzo, October 2015, *Distribution Systems in a High Distributed Energy Resources Future, Planning Market Design*, Operation and Oversight, https://emp.lbl.gov/sites/default/files/lbnl-1003797.pdf.

4. EVALUATION CRITERIA

To identify the virtual power plant options that best fit SVCE customers' needs, SVCE is evaluating possible options against its decarbonization criteria.18 Virtual power plant options are evaluated on a 1-4 scale for each criteria. Table 2 details these criteria and what constitutes the bookend scores for each.

CRITERIA	DESCRIPTION	SCORE OF 1 ENTAILS	SCORE OF 4 INCLUDES
CUSTOMER, COMMUNITY, AND PUBLIC VALUE	Reduces costs and improves service quality of electricity grid	Increases electricity bills and offers no grid services	Customer able to earn on provision of grid services and grid services mitigate or avoid grid upgrades
EMISSIONS REDUCTIONS	Reduces emissions, including those which may result from transportation electrification and load growth in buildings	Does not reduce or increases emissions	Eliminates emissions and facilitates local renewables integration
SCALABLE AND TRANSFERRABLE	Ability to be replicated within and beyond SVCE territory	Unable to be replicated	Easily transferable and able to start immediately
EQUITY IN SERVICE[19]	Accessible to customers and limits negative impacts to non-participants	Inaccessible to majority of customers and significant cross subsidy from non-participants	Accessible to all customers and no cross subsidy from non-participants
CORE ROLE FOR SVCE	Leverages SVCE's position as a load serving entity and a joint powers authority with close customer and community ties[20]	Option could be implemented by any entity and does not rely on customer engagement	Option dependent on close customer relationships and engagement throughout design and implementation
VIABILITY	Operational, legal, and regulatory readiness/risks of projects	Significant technical barriers and legal and regulatory action required	Option is able to launch today

18 Silicon Valley Clean Energy, December 2018, *Decarbonization Strategy and Programs Roadmap*, https://www.svcleanenergy.org/wp-content/uploads/2018/12/SVCE-Decarb-Strategy-Programs-Roadmap_Dec-2018.pdf

19 Note SVCE's definition of this criteria is broader in the adopted *Decarbonization Strategy and Programs Roadmap*. This definition has been limited for the purposes of this evaluation.

20 SVCE is a joint powers authority comprised of thirteen local communities including Campbell, Cupertino, Gilroy, Los Altos, Los Altos Hills, Los Gatos, Milpitas, Monte Sereno, Morgan Hill, Mountain View, Saratoga, Sunnyvale, and unincorporated Santa Clara County.

5. EVALUATION MATRIX AND DISCUSSION

Virtual power plant options are evaluated to indicate how well they align with criteria. **LOWEST SCORE** ◻ ◻ ◻ ◼ **HIGHEST SCORE**

OPTION	CUSTOMER, COMMUNITY, AND PUBLIC VALUE	EMISSIONS IMPACT	SCALABLE & TRANSFERABLE	EQUITY IN SERVICE	CORE ROLE FOR SVCE	VIABILITY
REAL TIME PRICING *rates based on hourly wholesale market prices*	Can lower customer bills but change in demand is not certain. Value increases and extends to community and public if customer is active energy manager. Indirect impact on grid services.	Emissions are correlated with wholesale prices. If customer responds to price signals, emissions reductions increase.	Theoretically replicable but technical challenges for CCA to offer real time pricing exist, as introduced herein.	Accessibility depends on program design. Using real time pricing limits potential for cross subsidy from non-participants.	CCA could take a passive or active role in marketing and education customers on rate. CCA could engage more closely with its customers to offer technical assistance and guidance for customers to shift load.	Substantial technical barriers and deterrents to CCA implementation exist, as introduced herein.
PEAK DAY PRICING *commercial and industrial (C&I) rate structure that targets summer peak load reduction*	Year-round customer bill savings possible. Provides RA value. Decline in summer peak can improve grid stability and provide grid services but impacts limited to the season.	Reductions are limited to summer season. May lead to more consumption overall.	As an existing program, easily replicable, scalable, and transferrable.	Only available to C&I customers. Limited cross subsidy from non-participants.	Same as RTP.	If program design fits within utility billing structure, program could launch quickly.
DRAM *demand response aggregation for resource adequacy (RA)*	Direct impact on grid services, providing RA. Grid services such as capacity and load smoothing benefit the community.	Potential to reduce peak emissions but depends on when resources are scheduled.	Aggregation approach could be replicated and transferred to other load serving entities.	Accessible to all customer classes but updated program rules still under development. Limited cross subsidy from non-participants.	CCA's role in the community can engage participants closely and solicit innovative bids to meet RA requirements. CCA can also engage with CPUC and CAISO to provide input on program rules that would optimize benefits for, or encourage participation from, its customers.	CCA can participate in development of updated program rules today. Market nascence may make it challenging to keep customers engaged throughout CAISO integration process and realize total program potential; this challenge is not specific to a CCA.
LSR - GRID- RESPONSIVE *load shift from targeted dispatch signals, customer can opt out*	Customers can earn value on provision of grid services. Community and public benefit from grid services, increased DER integration, and avoided renewable curtailment.	Broad DER eligibility and grid-related dispatch signals can maximize emissions reductions.	Relatively easy scalability and transferability; depends on local DER adoption rates.	Accessible to all customers with communicating DERs. Some cross subsidy from non-participants but grid services benefit everyone.	CCA's understanding of local DER adoption rates and grid needs are critical to success. CCA can leverage close customer relationships to target participants and ensure responses.	Program could launch relatively quickly but delayed access to customer meter data might impact operations.
LSR - MARKET-INTEGRATED *load shift to take advantage of low to negative prices, requires storage*	Customers can access low or negative energy prices. Community and public benefit from avoided renewable curtailment and local grid management.	Only uses zero emissions electricity.	Limited scalability since currently only storage is eligible. Transferability is possible.	Only available to storage resources. Limited cross subsidy from non-participants.	CCA engagement would diversify market actors. Close customer relationships needed to engage participants.	Limited to storage resources. CAISO market is not open until Fall 2020.
DISTRIBUTION SERVICE MODEL *proactive, independent non-profit distribution system operator (DSO) optimizes DERs to provide grid services*	Customers earn on monetized grid services and contribution to local grid management. Community and public benefit from optimized operation of distribution grid, renewable integration, and avoided renewable curtailment.	Assumes DERs replace conventional resources	Dependence on DSO limits ability to scale or transfer.	All DERs could participate. Non-participants benefit from optimized distribution grid.	CCA leverages close customer relationships and detailed understanding of local DER adoption rates to engage participants and liaise with DSO.	Lack of independent DSO, optimization tools, and access to grid and customer data are significant barriers.

REAL TIME PRICING

Real Time Pricing offers a relatively simple opportunity as a virtual power plant but its impacts depend on the participants' load that can be shifted or conserved. As previously noted, customer bills could be lowered under Real Time Pricing even without behavior change. There is not, however, certainty that a customer will change demand in response to price signals so electricity, emissions, and grid services impacts can be uncertain in the near-term.[21] A CCA may be able to leverage targeted customer education and technical assistance to encourage greater customer value, load shift, and emissions reductions. Over the long-term, a CCA would adapt its procurement decisions and increase value based upon the long-term changes in demand resulting from Real Time Pricing. There are, however, barriers and deterrents that inhibit scalability and viability(see call out box).

PEAK DAY PRICING

Peak Day Pricing can also be a simple virtual power plant opportunity if it is designed to fit within utility billing constraints. Reduced use of peaker plants in the summer would contribute to grid reliability, provide grid services, and reduce emissions but impacts are limited to the season. As an existing program, it is easily scalable and transferable though it is limited to C&I customers. Given CCAs' close customer relationships and local insight, CCA administration could enhance program impacts and customer messaging and experience as new customers are enrolled and supported to respond to peak day events.[22] Many utilities already offer a Peak Day Pricing program. Assuming that program design fits within utility billing constraints, a CCA could begin offering Peak Day Pricing quickly.

DEMAND RESPONSE AUCTION MECHANISM

DRAM is a unique option for a CCA to participate in the development of a new market mechanism as the pilot transitions to a broader program. The customer has the opportunity to earn on its provision of RA and the broader community benefits from grid services such as capacity and load smoothing. Emissions reductions, however, are somewhat uncertain since DRAM resources during the pilot phase were scheduled far less frequently during the highest CAISO peak.[23] A CCA could leverage its position in the community to engage closely with participants and solicit innovative bids that can meet the CCA's Resource Adequacy needs. A CCA can also engage with CPUC and CAISO to provide input on program rules that would optimize benefits for, or encourage participation from, its customers. Market nascence, however, may also make it challenging to keep customers engaged and realize total program potential. Other challenges related to program viability, such as non-competitive bid prices,[24] would not be unique or specific to a CCA.

Under California's Public Utilities Code, CCAs are free to set rates for the generation component of their customer bills as they choose, including Real Time Pricing. However, there are barriers and deterrents, including:

- **Comparability:** variation between the rate designs of incumbent utilities and CCAs make it more difficult for customers to compare their relative cost of service under each option.
- **Data Access Under Consolidated Billing:** CCAs are currently required to rely on the incumbent utilities to issue customers consolidated bills. To ensure accurate bills, the CCA and utility need a shared understanding of billing determinants (e.g., time interval, rate), interoperable systems supporting automated daily billing, and a consistent, predictable exchange of billing quality meter data. The needed data access has been reliably achieved in Southern California Edison's territory, has not been achieved in PG&E's territory, and remains too soon to tell in San Diego Gas & Electric's territory.
- **PCIA Impact on RTP:** The PCIA is deducted from rates on a flat basis for every kWh consumed, with no seasonality or TOU component. This diminishes the opportunity to closely align customer rates with marginal costs.
- **Informed Customers:** In order to respond to RTP, a customer needs access to its load and price data. While some large C&I customers have this access, others do not and residential customers are lagging behind. These customers will need solutions.

LOAD SHIFT RESOURCE | GRID-RESPONSIVE

An LSR-grid responsive, out-of-market program is an option for providing more sophisticated load management in response to the grid but without bidding into the CAISO market. Customer value results from the provision of and compensation for grid services and the community benefits from increased DER integration and avoided renewable curtailment. All communicating DERs would be eligible, which supports the potential for relatively greater emissions reductions, customer and community value, and operational viability. The CCA's understanding of local DER adoption rates and grid needs are critical to targeting participants and aligning grid services. There seem to be limited viability issues as a program could launch relatively quickly. Settling customer incentive payments, however, may be a challenge depending on timing of access to customer meter data.

LOAD SHIFT RESOURCE | MARKET-INTEGRATED

A market-integrated LSR program adds complexity and

21 Barbose, Galen and Goldman, Charles, December 2004, *A Survey of Utility Experience with Real Time Pricing*, http://eta-publications.lbl.gov/sites/default/files/report-lbnl-54238.pdf

22 Sacramento Municipal Utility District, September 2014, *SmartPricing Options Final Evaluation*, https://www.smartgrid.gov/files/SMUD-CBS_Final_Evaluation_Submitted_DOE_9_9_2014.pdf.

23 CPUC, January 2019, *Energy Division's Evaluation of Demand Response Auction Mechanism Final Report (Public Version - Redacted)*, page 10, http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442460092.

24 Ibid.

sophistication to the virtual power plant. Resources could offer greater value to participants and communities as they are able to take advantage of low or negative energy prices, avoid renewable curtailment, and actively contribute to local energy management and emissions reductions. CCA engagement with this program type would diversify market actors and facilitate local renewables integration. Strong relationships and communication lines with customers are essential to success. CAISO's existing PDR-LSR offering is not available until Fall 2020 and is limited to storage, which could constrain accessibility and program impact.

DISTRIBUTION SERVICE MODEL

A Distribution Service Model is a technically complex option for a virtual power plant and would require substantial time and resources to develop. It offers localized control and contribution to distribution system management, including facilitating renewables integration and avoiding renewable curtailment, which could support added grid resilience and stability over other virtual power plant options. Customers are able to earn on monetized grid services and the broader community and public benefit from the DSO's optimization of the distribution grid. Assuming that DERs replace all conventional resources, this option maximizes emissions reductions and supports grid disaggregation. A CCA would leverage its close customer relationships and detailed understanding of local DER adoption rates to engage participants and work with the DSO. There are, however, significant operational, legal, and regulatory viability issues such as lack of an independent DSO, technologically advanced optimization tools, and access to grid and customer meter data.

6. RECOMMENDATIONS AND NEXT STEPS

Based upon the assessment in this paper, Peak Day Pricing, DRAM, and LSR-grid responsive are immediately viable options for a virtual power plant for SVCE customers. For Peak Day Pricing, SVCE could explore program design options that fit within existing utility billing boundaries, as well as consider how program design should evolve over time to match the electricity generation resource mix. A DRAM offering may take additional time and effort to procure resources and demonstrate value because the CPUC will be updating program rules, but it is a technically viable option. A grid-responsive LSR program offers the opportunity gain experience with a program design that will likely be leveraged more in the future as DER adoption and electrification increase. An add-on option to the design would be to offer any storage products into the CAISO's PDR-LSR market.

Other virtual power plant options may become viable if certain technical or regulatory barriers are addressed. For instance, Real Time Pricing and different Peak Day Pricing options could be more feasible and valuable if CCAs had more control over electric rates. Additionally, like other DER providers, CCAs are constrained by the lack of a DSO focused on optimizing resources. The constraint creates a preference for traditional energy resources over DERs. Overall, for all Californians to realize the benefits of DER aggregations and virtual power plants, additional transparency and information exchange regarding customer load profiles, distribution grid conditions, and grid management needs are imperative.

CCAs' detailed understanding of local DER adoption rates and customer values allow a unique opportunity to offer virtual power plant solutions that can mitigate anticipated load growth and improve grid stability and resilience. CCAs are able to develop targeted customer messaging and focused technical assistance which can engage more customers as active contributors to local grid management. Additionally, a CCA's close relationship with its customers and community leaders can increase customer trust and confidence that program offerings are designed to meet local needs and maximize benefits. CCAs should work with member cities and counties to share expected load growth and DER adoption scenarios, identify anticipated grid needs, and prioritize options that can serve all customers.