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FINAL PROJECT REPORT

The Richmond Advanced Energy Community Project

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PREFACE

The California Energy Commission's (CEC) Energy Research and Development Division supports energy research and development programs to spur innovation in energy efficiency; renewable energy and advanced clean generation; energy-related environmental protection; transportation; and energy transmission and distribution.

In 2011, the Electric Program Investment Charge (EPIC) was established by the California Public Utilities Commission to fund public investments in research to create and advance new energy solutions, foster regional innovation, and bring ideas from the lab to the marketplace. The EPIC Program is funded by California utility customers under the auspices of the California Public Utilities Commission. The CEC and the state's three largest investor-owned electric utilities — Pacific Gas and Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company — were selected to administer the EPIC funds and advance novel technologies, tools, and strategies that provide benefits to their electric ratepayers.

The CEC is committed to ensuring public participation in its research and development programs to promote greater reliability, affordability, and safety for California electric ratepayers. EPIC investments advance these values by:

- Providing societal benefits.
- Reducing greenhouse gas emissions in the electricity sector at the lowest possible cost.
- Supporting California's loading order to meet energy needs, first with energy efficiency and demand response, next with renewable energy (distributed generation and utility-scale projects), and finally with a clean electricity supply.
- Supporting low-emission vehicles and transportation.
- Providing economic development.
- Using ratepayer funds efficiently.

The Richmond Advanced Energy Community Project is the final report for EPC-19-005 conducted by Zero Net Energy Alliance. The information from this project contributes to the CEC Energy Research and Development Division's EPIC Program.

For more information about the Energy Research and Development Division, please visit the CEC's research website (www.energy.ca.gov/research/) or contact the Energy Research and Development Division at ERDD@energy.ca.gov.

ABSTRACT

This report communicates key findings from the Richmond Advanced Energy Community Project, led by the Zero Net Energy Alliance with MCE, a community choice aggregation that serves four counties in Northern California, as part of the California Energy Commission's Advanced Energy Community grant. The California Energy Commission has identified adoption of advanced energy solutions as a promising pathway for enhancing grid reliability and resilience while lowering overall carbon intensity; however, barriers to adoption persist. This project addresses these barriers by creating a scalable, community-focused virtual power plant, operated by MCE, functioning as a demand response provider, along with a robust distributed energy resource deployment program focusing on rehabilitated affordable housing in the disadvantaged community of Richmond, California. The project demonstrated that: 1) community choice aggregations can function as demand response providers to generate value and realize cost savings through active load shaping and market integration; 2) community choice aggregations can optimize the value of virtual power plants using purpose-built, enterprise-level distributed energy resource management systems to which they retain perpetual licenses; and 3) a diverse range of customers would participate in programs to install distributed energy resources and grant community choice aggregations the ability to orchestrate those assets through a virtual power plant in return for turnkey project installation and a value-sharing tariff. Learnings from this project included effective use of pay-for-performance compensation models, the benefits of open-source code stacks, and the need for turnkey distributed energy resource program management frameworks that integrate distributed energy resource selection optimization, customer relationship management, financing, and virtual power plant integration. These learnings will inform MCE's follow-on California Energy Commission grant, Virtual Power Plant Approaches for Demand Flexibility, which will scale the Richmond Virtual Power Plant to cover MCE's entire service territory, thereby reinforcing and expanding the positive results demonstrated in this project.

Keywords: community choice aggregation, virtual power plant, demand response provider, distributed energy resource management system, active load shaping, market integration, value-sharing tariff

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Project Purpose and Approach

Advanced energy solutions — particularly the deployment and orchestration of distributed energy resources — offer a promising pathway for enhancing grid reliability and resilience while lowering the overall carbon intensity of the grid. The Richmond Advanced Energy Community (AEC) Project was undertaken by MCE, a community choice aggregation (CCA) that serves four counties in Northern California, to address key challenges in realizing advanced energy solutions as identified by the California Energy Commission, including:

- The presence of social inequity in accessing advanced energy solutions.
- A lack of meter-based data for energy planning and effectiveness evaluations.
- A lack of community engagement in clean energy planning.
- Ineffective financing strategies.

To address these challenges, MCE sought to demonstrate how a community-focused virtual power plant in the CalEnviroScreen-designated disadvantaged community of Richmond, California, could optimize economic and resilience value, direct new revenues and societal benefits to low-income residents, and remain financially feasible and scalable. A virtual power plant is a network of decentralized, medium-scale power generating units and flexible loads, such as batteries, electric vehicles, smart appliances, and flexible heating and cooling loads that can be effectively managed to the benefit of grid operators. A community-focused virtual power plant ensures that the resulting value is shared fairly and transparently among all stakeholders, including participating customers, enabling partners, the CCA, and the entire community of ratepayers. The project also sought to show how an innovative financing strategy — social impact bonds — could be leveraged to rehabilitate blighted homes to meet zero net carbon ready standards, meaning the buildings are prepared to operate with net-zero carbon emissions once renewable energy sources are added.

The city of Richmond was chosen as a project site due to its CalEnviroScreen status as a disadvantaged community, with the intention of increasing access to advanced energy solutions in a low-income community that has been burdened by environmental hazards, demonstrating how all communities can be part of statewide climate solutions.

An overarching goal of this project was to show that a CCA could operate a virtual power plant as a demand response provider to integrate directly with state energy markets while fostering broad participation from a diverse range of customers in a disadvantaged community. Such a demonstration would show that CCAs can mobilize virtual power plants to generate revenue and achieve cost savings through market-integrated and non-market-integrated use cases by expanding access and retaining the value of locally sited, behind-the-meter advanced energy solutions. Accordingly, key outcome metrics have included: 1) the number and diversity of customers and customer classes successfully enrolled in the virtual power plant; and 2) the effective demonstration of a market-integrated demand response event orchestrated directly by MCE.

MCE and project partners shared project learnings with state regulators, legislators, and grid operators in support of statewide scaling of advanced energy community solutions. In addition, CCA governing boards, staff, and community stakeholders have been targeted for education and engagement activities to support the adoption of new virtual power plant and AEC-aligned strategies, tools, and business models.

In close collaboration with MCE, the AEC project team developed these key strategies to support virtual power plant implementation with a focus on CCA-specific needs and opportunities.

- **Implementing a CCA-operated virtual power plant by registering the CCA as a demand response provider:** This approach allows the CCA to participate in state energy and ancillary service markets without relying on a third-party aggregator. This configuration also ensures that the CCA can capture the full value of its virtual power plant through both revenue generation and cost savings. These value streams have been shared with participating customers and virtual power plant partners and will support long-term efforts to reduce electricity rate increases.
- **Developing a purpose-built, enterprise-level distributed energy resource management system to which the CCA retains a perpetual user license:** The enterprise-level distributed energy resource management system developed under the AEC project by Serious Controls provides MCE with full visibility and control over its virtual power plant while safeguarding long-term operational autonomy and data security. The distributed energy resource management system is purpose built to function with data accessible by the CCA, which includes telemetry data and near-real-time meter data on distributed energy resource assets deployed through MCE programs and partnerships. This capability for building and device-level transparency and control has created an entirely new level of situational awareness for CCA procurement and operations teams, providing the tools needed to leverage the power of active load shaping. To further promote adoption and long-term use of the platform, MCE and Serious Controls (in partnership with fellow AEC grant recipient and Southern California CCA, Lancaster Energy) also pioneered development of a perpetual user license, which minimizes ongoing fees while encouraging ongoing co-development of the platform by granting all users access to future updates and enhancements to the platform.
- **Compensating participating customers directly through an innovative value-sharing virtual power plant tariff codified through a Virtual Power Plant Agreement:** The value generated by the virtual power plant is shared with participants through monthly bill credits. For residential customers, the bill credit amount is determined by the number and type of assets installed and other factors, including income levels. For commercial and industrial customers, this is determined by measured load flexibility, which is validated by an independent third party. Terms of participation are delineated through an agreement that establishes a long-term, mutually beneficial relationship between participating customers and the CCA, supporting financial stability and scalability and providing equitable access to California's energy markets.

Key Results

The Richmond AEC Project is a proof-of-concept demonstrating that CCAs can implement in-house virtual power plant programs cost effectively and can use the program to deliver community-wide benefits. The project has demonstrated that:

- There is broad and diverse interest in participating in virtual power plant programs, even in low-income and disadvantaged communities.
- Advanced energy solutions can be integrated with community efforts to transform blighted properties into zero net carbon ready homes while increasing first-time homeownership among low-income residents.
- CCAs can register as demand response providers to directly bid, schedule, and settle virtual power plant loads with the California Independent System Operator.
- Direct access to device-level data enabled by the enterprise-level distributed energy resource management system allowed MCE to overcome current data limitations.

The project demonstrated that it is financially and technically feasible for CCAs to deploy virtual power plants to deliver grid-level benefits — including reliability, resilience, and decarbonization — as well as local benefits such as increased customer access to advanced energy solutions, resilience, utility cost savings, local economic development, and enhanced CCA financial stability.

Knowledge Transfer and Next Steps

To support scale-up of advanced energy communities and virtual power plants, the AEC project team developed the following knowledge transfer deliverables.

- **AEC Deployment Needs and Opportunities in California's Cities Whitepaper:** This whitepaper provides information and inspiration for utilities (especially CCAs), local governments, and key market actors to collaboratively develop advanced energy communities that meet the nine key elements of the AEC vision articulated by the California Energy Commission:
    - Minimize the need for new energy infrastructure costs, such as transmission and distribution upgrades.
    - Provide energy savings by achieving and maintaining zero net energy community status (accounting for behavior and increasing loads from vehicle and appliance electrification).
    - Support grid reliability and resilience by incorporating technologies such as energy storage.
    - Provide easier grid integration and alignment with the California Public Utilities Commission Long-Term Procurement Plan and the California Independent System Operator local capacity requirements process.
    - Replicate and scale up to further drive down costs.

   - Develop financially attractive AEC solutions from a market standpoint (including developers, home buyers, renters).
   - Provide affordable access to renewable energy generation, energy efficiency upgrades, and water efficiency and reuse technologies that reduce electricity consumption for all electric ratepayers within the community.
   - Make use of smart-grid technologies throughout the community.
   - Align with other state energy and environmental policy goals at the community level.
- **Richmond VPP Project Case Studies:** The project team prepared four project case studies to communicate key project components to community stakeholders. Case studies discuss the Zero Net Carbon Ready Homes program, multifamily property applications, a California Alternative Rates for Energy residential customer story, and integrated CCA-distributed energy resource management system solutions.
- **Presentation Tour (2022–23):** MCE and project partners engaged in a series of workshops and other presentations attended by community members, industry leaders, policy makers and regulators, and other grid actors.

To further refine project learnings and foster AEC adoption, MCE is scaling the Richmond virtual power plant to cover its entire service territory in the follow-on Virtual Power Plant Approaches for Demand Flexibility project of the California Energy Commission's Electric Program Investment Charge program. This initiative will expand the pay-for-performance compensation model to additional partners, further develop the enterprise-level distributed energy resource management system open-source code packages by standardizing communication protocols around OpenADR, and explore dynamic tariffs for large commercial and industrial customers. This next phase of the AEC effort will further validate the financial viability and scalability of AEC concepts and virtual power plant market integration strategies and will seek to demonstrate cost effectiveness and meaningful return on investment. In summary, the Richmond AEC Project has shown that CCAs can realize new value streams that can be scaled cost effectively and shared with a broad array of community partners, and all communities can play a role in advancing clean energy solutions.

CHAPTER 1: Introduction

California's energy landscape is undergoing a profound transformation as the state pursues ambitious goals to decrease the carbon intensity of the grid while addressing emerging challenges related to grid harmonization. In this context, advanced energy solutions — particularly the deployment and orchestration of distributed energy resources (DER) — offer a promising pathway for improved grid management. In particular, the California Energy Commission (CEC) has identified virtual power plants (VPP) as a key strategy to enhance grid reliability and resilience while lowering the carbon intensity of the grid (California Energy Commission 2025a). However, the CEC has also identified a persistent set of barriers to the widespread adoption of these strategies, including economic disadvantage, low community engagement, ineffective financing strategies, and technical barriers to DER adoption and optimization, including adequate meter data collection for energy planning, resource management, and evaluation. The Richmond Advanced Energy Community (AEC) Project was designed to demonstrate how a community-focused VPP can address these barriers to the adoption of advanced energy solutions and serve as a proof-of-concept for workable VPP deployment by community choice aggregations (CCA) in California.

By selecting the city of Richmond as the focal point of the AEC project, the project team sought to demonstrate that a community-focused VPP is capable of: 1) optimizing economic and resilience value at the community and the grid levels while directing new revenues and societal benefits to low-income residents, and 2) generating measurable and verifiable value for the CCA, which can allow the VPP to scale cost effectively, even in hard-to-reach market segments and disadvantaged communities. In addition, the AEC project team partnered with RCF Connects (formerly the Richmond Community Foundation) to demonstrate how innovative social impact bonds could be used to rehabilitate blighted homes to meet the zero net carbon ready standards, enroll these residents in the VPP program, and thereby lower long-term energy costs and help local residents retain stable and affordable housing.

VPPs[1] are a new way of building and managing energy infrastructure that reduces reliance on inflexible and inefficient central generation, especially fossil fuel and natural gas peaker plants. VPPs use software to connect DERs into a virtual network that is capable of collectively responding to energy demands. VPPs use digital control systems, orchestrated through distributed energy resource management systems (DERMS), to shift or reduce overall demands on the grid at key times of day. Using the aggregated capacity of connected DERs, VPPs provide a cost-effective and efficient solution to mitigate grid congestion, lower system costs, enhance system reliability and resilience, and support grid decarbonization.[2] By

[1] The terms flexible loads, load flexibility, demand response (DR), and DERMS are often used interchangeably with VPP.

[2] Studies from the Rocky Mountain Institute (Brehm et al. 2023) and the Brattle Group (Hledik et al. 2024a) have identified the environmental and load management potential of VPPs.

addressing grid congestion and easing coincident peak load,[3] VPPs support the integration of renewable energy onto the grid and reduce dependence on peaker plants that contribute significant local air pollutants. VPPs can also support CCA compliance with new load management standards (LMS) and other emerging regulations (California Energy Commission 2025b).

As locally controlled public agencies that are directly responsive to their communities, CCAs are uniquely suited to deploy VPP technologies to advance goals that serve the public good. However, due to the tendency to outsource VPP implementation to third-party aggregators, paired with the lack of access to real-time meter data, it can be exceedingly challenging for a CCA to create measurable and verifiable value for the organization and the broader community it serves. Further, installation and enrollment of DERs have tended to concentrate among more affluent residential customers and large commercial and industrial customers. When third-party aggregators bid these assets in state energy markets, there tends to be no communication or coordination with the local CCA about the planned load shift. This lack of transparency and communication can result in higher costs for the CCA due to unexpected load shifts that can create imbalances. This results in a regressive "trickle-up" economic bias in the system. With CCAs serving roughly one third of all Californians, the Richmond AEC Project has focused on demonstrating a financially feasible — and socially equitable — VPP deployment model for a growing sector of California communities.

The Richmond project was designed to develop best practices focused on the implementation of a *community-focused VPP,* capable of maximizing value creation and organizational cost savings for CCAs and allowing the CCA to share the value created by the VPP with participating customers, VPP partners, and entire communities. The goal of this project was to develop and test a set of strategies that would allow a CCA to operate its own VPP as a demand response (DR) provider without relying on a third-party aggregator to realize market-integrated use cases,[4] while fostering broad participation from a diverse range of ratepayers, including low-income residential and small commercial customers. Key outcome metrics have included: 1) the diversity of customers enrolled in the VPP and 2) the effective demonstration of a market-integrated DR event orchestrated directly by MCE.

Learnings from this project can help inform state regulators, legislators, and grid operators as they seek to support advanced energy solutions across the state and especially in CCA contexts. These actors have been pivotal in supporting grid stability and decarbonization goals through a variety of strategies, including LMS, load flexibility, and integrated demand side management initiatives. With the effective demonstration of a financially viable and scalable CCA-operated VPP, MCE seeks to demonstrate that VPP programs can provide a cost-effective pathway for LMS compliance that is feasible without risking the increased ratepayer costs associated with relying on hourly dynamic rates, noting that CCA access to the real-time data is limited and this constrains its ability to implement dynamic hourly rates. Further, by showing

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[3] Coincident peak demand refers to instances in which electricity demand peaks across multiple areas or systems simultaneously. Regulators, grid operators, utilities, and CCAs use coincident peak demand to plan maximum generation and transmission capacity. Reducing coincident peak demand lowers these requirements, which can lower system costs.

[4] Use cases refers to ways that VPPs can be used to generate revenue, mitigate costs, and deliver value.

how CCAs can use VPPs to generate new sources of revenue and realize cost savings, MCE hopes to provide a proof-of-concept of a new CCA business model. As such, the learnings communicated in this report can greatly benefit the governing and executive bodies and all stakeholders of CCAs throughout California.

CHAPTER 2: Project Approach

The Richmond AEC Project team selected the city of Richmond as the project demonstration site due to its commitment to clean energy adoption and its status as a CalEnviroScreen-designated disadvantaged community faced with acute environmental and economic challenges. By implementing a community-focused VPP in Richmond, MCE and the project team sought to demonstrate how a VPP can optimize economic and resilience value at the community and the grid level while directing new revenues and societal benefits to low-income residents. To support these efforts, the project leveraged an existing social impact bond program to demonstrate the economic viability of DER and efficiency-focused home upgrades for lower-income residents, including first-time homeowners. Additionally, the project team developed an innovative VPP tariff that offered greater incentive levels for low-income and disadvantaged customers. MCE also implemented an innovative residential financing program that leverages a revolving loan fund concept to provide a sustainable funding source to help customers afford to implement meaningful energy upgrades, which also was structured to provide disadvantaged customers with enhanced value. The revolving loan offers below-market rates for all participants, including zero percent interest for income-qualified customers, 2.5 percent interest for qualified customers (including medical baseline), and 5 percent interest for all other customers. Through this project, MCE has sought to demonstrate that all communities can be part of and benefit directly from affordable, accessible, and advanced clean energy solutions.

Project Partners

MCE was supported by an interdisciplinary project team of consultants and contractors led by the AEC prime contractor, Zero Net Energy Alliance, in a partnership that included Community Energy and Equity Resources, Serious Controls, Energy Solutions, GPT, TRC, and RCF Connects, with early-stage contributions from Olivine. The project team worked with a curated set of original equipment manufacturers to provide dispatchable DERs, including SolarEdge, Evercharge, Equana, LG Electronics, SolArk, Discover, and Rainforest. Installers included Alco Building Solutions, Grid Alternatives, Sonomarin, EP Builders, TLC Construction, and Next Solar, with Serious Controls serving as a general contractor overseeing DER installations and VPP integration. MCE also partnered with National Energy Infrastructure Fund (NEIF), a certified B-Corp, non-bank financial institution, to offer low-interest loans to residential customers wishing to install home battery systems through an innovative revolving loan fund.

Piloting a Community-Focused VPP: A New Path Forward for CCAs

VPPs serve as flexible assets that transform decentralized, consumer-side DERs — including generation assets, storage assets, and load management tools such as smart thermostats and electric vehicle (EV) chargers — into grid management resources. By using the aggregated capacity of connected DERs, VPPs provide a cost-effective and efficient solution to mitigate grid congestion, lower system costs, enhance system reliability and resilience, and support the transition toward a more sustainable energy future. This advanced technology can also reduce overall carbon intensity on the grid and support CCA compliance with the new LMS and other emerging regulations.

Despite these prospective benefits, the CEC has identified several key challenges facing such advanced energy solutions, including a lack of meter-based data for energy planning and effectiveness evaluations, ineffective financing strategies, the presence of social inequity in accessing advanced energy solutions, and a lack of community engagement in clean energy planning. While VPPs can contribute to grid health, decarbonization, and regulatory compliance, challenges in program design and implementation in the CCA context can result in limited uptake among low-income residential and small commercial customers. The innovative program strategies described below were intended to address each of these challenges.

CCA as Demand Response Provider

The MCE VPP mobilizes a set of roles available to all CCAs that work together in a unique way to position the CCA to harness new use cases. All California CCAs are scheduling coordinators, which enables them to participate in the state energy and ancillary service markets and empowers CCAs to become registered demand response providers (DRP). DRPs can form and operate aggregations of behind-the-meter DERs capable of providing measurable load flexibility. By functioning as their own DRPs, CCAs can access new revenue streams through market integrated use cases and realize cost savings by pursuing non-market integrated use cases.

Many CCAs have opted to outsource DRP functions and VPP implementation to third-party aggregators, which increases implementation cost and often sacrifices revenue generation to the third-party provider. Further, opportunities for cost avoidance are often lost or diminished because these external vendors are not integrated with the CCA’s operations or procurement processes, which compromises the potential for the VPP to deliver operational cost savings. Thus, while VPPs can be leveraged to generate a stable return on investment for CCAs that own and operate their own VPPs, outsourcing DRP functions to third-party aggregators can effectively render VPPs financially neutral, unsustainable, or even infeasible in some CCA contexts.

MCE determined that operating as its own DRP provides greater visibility and control over critical VPP functions and helps ensure that the fleet of connected DERs is being used to create optimal value for the organization and its customers. By capturing the full value of the VPP, MCE is further able to leverage the VPP to stabilize retail rates and provide valuable customer programming and community energy initiatives that benefit all ratepayers by lowering system costs for the community. The CCA is also empowered to establish VPP program designs that create open, fair, and transparent local markets that prioritize customer choice and rapid uptake of beneficial DERs by remaining vendor and technology agnostic.[5]

[5] Technology agnostic systems are those that can accommodate a wide range of different technologies, either as a matter of policy design or software architecture.

Enterprise-Level DERMS

MCE's VPP is the first of its kind to use an enterprise-level DERMS (eDERMS) platform that is designed to provide MCE full visibility and control over its VPP, including transparent access to real-time insights and control of the VPP's operation and performance, while meeting high standards for cybersecurity and safeguarding long-term operational autonomy.[6] MCE's eDERMS marks an important departure from commonly used aggregator-owned DERMS (aDERMS), which are hosted externally in the aggregator's cloud software environment. Hosting DERMS externally presents a range of potential coordination problems because the aDERMS architecture and methodology are not fully visible to the CCA. Further, to preserve operational integrity and personal privacy, it has been necessary to restrict access to the CCA's data lake, which impairs data integration and VPP performance optimization. Finally, proprietary aDERMS are typically configured to work with a narrow band of vendors and technologies, which contributes to vendor lock-in,[7] while termination of any contracts with the aDERMS provider can result in stranded assets.[8]

MCE chose to work with Serious Controls to develop an eDERMS that is located behind the MCE firewall, enabling enhanced visibility and control, full integration with MCE's software system and customer relationship management system, and enhanced cybersecurity. Because the eDERMS is owned and operated by the CCA, MCE can integrate the full range of vendors and technologies into its VPP while also accommodating interconnections with other aDERMS. In this way, the eDERMS can facilitate an accelerated scale-up of VPP capacity by integrating many competing vendors and guaranteeing customers a wide range of options to participate in the VPP using the vendors and products they trust.

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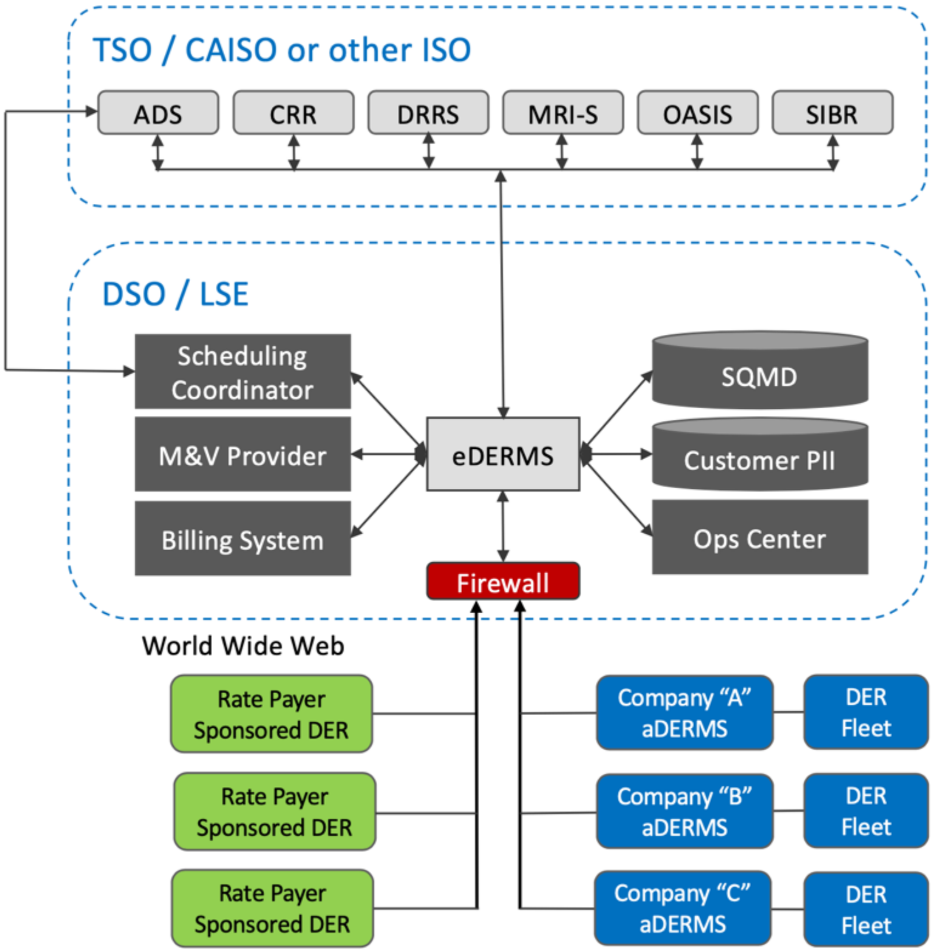
[6] See *Appendix A: Enterprise-Level DERMS Case Study*.

[7] Lock-in refers to instances wherein systems become so entrenched that they cannot easily be changed, even when more favourable alternatives present themselves, including system upgrades or partnerships, which may be impossible in proprietary systems.

[8] Stranded assets are investments that were made in the past but whose value cannot be recouped. Proprietary systems commonly produce stranded assets when key vendors can no longer provide services or critical software can no longer be updated.

Figure 1: MCE eDERMS Hosted on Internal Servers



This diagram illustrates how the eDERMS functions in relation to other entities, systems, and data. The diagram uses the following acronyms and initialisms that do not appear elsewhere in this document: organizations responsible for operating, managing, or participating in the electricity grid and markets, including TSO (transmission system operator), CAISO (California Independent System Operator), ISO (Independent System Operator), DSO (distribution system operator), and LSE (load serving entity); market or operational systems and platforms that participants must interface with to participate in the wholesale electricity market, including ADS (automated dispatch system), CRR (congestion revenue rights), DRRS (demand response registration system), MRI-S (market results interface – settlements), OASIS (open access same-time information system), SIBR (scheduling infrastructure and business rules); and categories of sensitive data, including SQMD (settlement quality meter data) and customer PII (personally identifiable information).

Source: Serious Controls, 2025.

Purpose-Built eDERMS

MCE's eDERMS was purpose-built for CCA applications by Serious Controls, which means it was designed to function and produce measurable value within the operational constraints of the CCA. Off-the-shelf DERMS platforms tend to require data that is not readily available to CCAs or mobilize use cases that do not produce measurable value for CCAs. A key challenge identified by the CEC that has prevented CCAs from capturing the value of advanced energy solutions is a lack of access to real-time meter data; as such, it has been crucial to adopt a

DERMS platform designed to produce value through the use cases and data streams that are available to CCAs. Serious Controls' purpose-built DERMS allows MCE to leverage the data and systems it already has access to, including near-real-time revenue-grade metered load and DER performance data. By giving MCE the ability to use these data effectively, the DERMS gives MCE the situational awareness required to leverage the power of active load shaping to dynamically optimize scheduling, mitigate trading risks, and make real-time adjustments to enhance VPP program performance.

Innovative DERMS Licensing and Co-Development

The value of the eDERMS is enhanced by the unique perpetual user license that allows the CCA to host the software on its own servers and enterprise system in perpetuity while providing significant cost savings. The typical license for off-the-shelf software-as-a-service (SaaS)-based DERMS platforms can cost as much as $1 million per year and often comes with substantial hidden fees and escalators. While investor-owned utilities can recoup these costs through rate increases, CCAs must generally absorb such costs, which is challenging for public agencies operating with thin margins. By contrast, Serious Controls' purpose-built eDERMS is available to CCAs for an affordable one-time licensing fee that is based on the agency's service population and ranges from $20,000 to $200,000. All users that execute the perpetual user license agreement can make targeted investments in the platform, develop new features and use cases, and automatically receive updates that allow them to access enhancements made by other users. The perpetual user license thus encourages a robust co-development paradigm.

Open-Source Code Packages and Open Communication Protocols

MCE has embraced open-source software and communication protocols well suited for public agency use. Serious Controls has incorporated several open-source code packages in the development of the eDERMS platform to help constrain the cost of maintaining the software, as well as to improve the cybersecurity and overall durability of the system. These open-source bits of software were developed collaboratively by a vast ecosystem of software developers led by the Linux Foundation, and they are actively patched, maintained, and hosted on a publicly accessible web-based server called Github. This use of open-source code packages can help constrain long-term operation and maintenance costs, because the ongoing maintenance and cybersecurity of these packages are handled by the open-source community, at no cost to users like MCE.

Value-Sharing Tariff and VPP Agreement

A key component of Richmond's VPP is the opportunity to share value generated by the VPP with participating customers while enhancing the accessibility of DER assets.[9] To support these objectives, MCE has adopted a first-of-its-kind value-sharing VPP tariff that ensures that customers are compensated fairly and transparently for their participation. The terms of participation are codified through an innovative Virtual Power Plant Agreement (VPPA) that establishes a long-term, mutually beneficial relationship between VPP participants and the

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[9] For a closer look at the residential customer experience, see *Appendix B: CARE Residential Customer Case Study*.

CCA. In this way, MCE aims to address those barriers to widespread uptake of advanced energy solutions that have to do with social inequity and community engagement.

The value-sharing VPP tariff, disbursed through a monthly bill credit, is designed to be an attractive incentive that customers, including low-income customers and renters, can plan around and access throughout the year.[10] Residential customers can earn stackable credits ranging from $2 to $20 per enrolled device, with a cap of $50 for those enrolled in low-income discount programs, including California Alternative Rates for Energy (CARE) and Family Electric Rate Assistance (FERA), and $40 for those who do not qualify for these discounts.[11] Commercial and industrial customers, whose participation is rewarded through a pay-for-performance compensation model, can even use their participation to generate revenue. These customers can receive bill credits at a rate of $0.11/kilowatt-hour (kWh) of measured load flexibility delivered to MCE's VPP annually, capped at $300 per month for commercial customers and $750 per month for industrial customers.[12] This monthly bill credit is estimated at one-third of the total estimated performance payment, divided by 12 months to create a monthly credit that is both manageable for MCE and predictable for the customer. Participants receive an annual true-up payment that is validated by a rigorous, independent third-party measurement and verification (M&V) process, which ensures accuracy and transparency.

Tariff terms are protected by the VPPA, which enrolls customers in five- to seven-year contracts for residential and for commercial and industrial customers, respectively. Together with the VPPA, these terms help customers secure loans for installing assets, thus enhancing access to advanced energy solutions and innovative financing tools.[13] Built on an agreement structure that was originally developed for the MCE Energy Storage Program, the VPPA is designed to enable retail customers, including low-income and disadvantaged customers, to generate revenue from California's structured energy markets. This mutually beneficial relationship between MCE and participating customers provides the foundation on which MCE can build a VPP that is financially feasible, equitable, accessible, and scalable.

End-to-End Installation and Services

Complex design and installation procedures can limit access to advanced energy solutions, especially among residential and small commercial customers. To address this barrier, the project team streamlined the process of upgrading energy equipment by creating turnkey project design and installation solutions. The project team worked with customers to design systems with various technology options, weaving together incentives and rebates offered by various agencies, and then independently securing permits and completing installations. With stackable rebates for residential customers, MCE ensured that enrollment would not require a full-scale remodel of customers' homes, allowing customers to join at their own pace. Because the VPP was designed to be technology and vendor agnostic, participation could be inclusive of customers with different comfort, tolerance, and space requirements.

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[10] See *Appendix C: Virtual Power Plant Tariff and Staff Memo*.

[11] This monthly bill credit is referred to in the VPP Agreement as the Residential Monthly Advanced Payment.

[12] This monthly payment is referred to in the VPP Agreement as the Commercial Monthly Advanced Payment.

[13] See *Appendix D: Virtual Power Plant Agreement*.

The Richmond AEC Project also included a special program, the Zero Net Carbon Ready Homes Program, which was designed to integrate affordable housing rehabilitation with clean energy technology.[14] This program brought MCE together with RCF Connects (formerly the Richmond Community Foundation), which acquires abandoned and blighted homes and rebuilds and retrofits them with clean energy assets eligible for enrollment in the VPP. These homes were made available to first-time, low-income homeowners at below-market rates through another partnership with SparkPoint Contra Costa. This program prioritizes low- and moderate-income first-time home buyers who are already Richmond residents, ensuring zero displacement. The program was designed to increase access to homeownership, boost local property values, reduce blight, address historical inequities due to redlining, and contribute to neighborhood stabilization. It has been supported by a social impact bond, which is supported by Mechanics Bank and the balance sheet of the city of Richmond. This novel financing method provides loan guarantees that ensure below-market-rate interest, while maintaining these homes in an ongoing affordable housing program context upon resale.

Expected Benefits of a Community-Focused VPP

The Richmond VPP was designed to demonstrate a wide range of benefits that a CCA-operated, community-focused VPP can deliver to the grid, the environment, and its entire community. By introducing the suite of innovations that underpin its VPP, MCE has advanced these benefits.

- Grid Health Benefits
    - *Enhanced Grid Reliability* — VPPs enable CCAs to better align DER deployment and performance with supply and demand patterns, to mitigate energy imbalances. During supply shortfalls, coincident peak loads can be shifted to off-peak hours; grid congestion can be alleviated by using and storing renewable energy when it is abundant.
    - *Enhanced Resilience for Participating Customers* — Customers who enroll solar assets with battery energy storage systems can gain resilience support through the VPP during planned and unplanned grid outages, during which the DERMS can coordinate these assets to modulate energy storage and use patterns to meet resilience needs.
    - *Enhanced Resilience for the Community* — Solar assets sited alongside battery energy storage systems at critical facilities can support community resilience centers that can provide critical services and shelter during emergencies, including extreme weather events.
- Environmental and Environmental Justice Benefits
    - *Reduced Solar Photovoltaic (PV) Curtailment* — VPPs can orchestrate DER fleets to store solar PV energy when it is abundant, reducing the need for curtailment.

[14] See *Appendix E: Zero Net Carbon Ready Homes Program Case Study.*

- *Reduced Carbon Intensity of the Grid* — By delivering load flexibility during peak demand periods, VPPs ease dependence on gas-fired peaker plants currently used to address energy shortfalls.
- *Reduced Local Air Pollutants in Urban Areas* — Due to discrimination in public planning, peaker plants tend to be located in urban, industrialized areas; thus, reducing dependence on peaker plants also reduces localized air pollutants in these areas.

- Economic Benefits to the CCA
  - *Revenue Generation* — By operating its own VPP, MCE is empowered to participate in California Independent System Operator (California ISO) markets to generate revenue for the CCA. The VPP thus enables a truly novel CCA business model, based on wholesale market participation, that provides CCAs financial stability, as margins from the traditional CCA business model have become unreliable.
  - *Operational Cost Savings Through Cost Avoidance* — VPP deployment also enables a wide range of non-market integrated cost avoidance use cases, collectively referred to as active load shaping use cases, as well as soft cost avoidance use cases where savings are embedded within broader operational benefits or bundled with other program features.
  - *Reduced Licensing Fees* — The eDERMS perpetual user license substantially reduces operation and maintenance costs.
  - *Risk Mitigation* — The purpose-built eDERMS improves MCE’s situational awareness and enhances load forecasting capabilities, enabling the agency to better manage risk. MCE’s commitment to vendor and technology agnostic program design mitigates the threat of vendor lock-in and stranded DER assets.
- Economic Benefits for Customers and Communities
  - *Compensation for Participating Customers* — The VPP tariff directly compensates participating customers through monthly bill credits.
  - *Cost Savings for Participating Customers* — Participating customers gain access to advanced energy assets that mitigate time-of-use rates and enhance energy efficiency.
  - *Social Equity Benefits for Non-Participating Customers* — The VPP can lower and stabilize rates for all customers by providing MCE with a steady source of revenue not reliant on retail rates. Because this benefit is enjoyed by all customers, the VPP can enhance social equity across the service area.
  - *Local Economic Development* — Programs that encourage DER adoption drive local job growth in the renewable energy sector, which is especially impactful in Richmond and other disadvantaged communities.

- *Local Financial Stability* — By lowering energy costs and installing assets that increase property values, community-focused VPPs and aligned DER deployments enhance local financial stability. Innovative programs like the Zero Net Carbon Ready Homes Program, which pair affordable housing rehabilitation with clean energy technologies, increase property values and contribute to neighborhood stabilization. More resilient and efficient energy infrastructure can help recruit and retain businesses, thus boosting local tax revenue and attracting investments.

- Operational Benefits
  - *Full Ownership, Visibility, and Control of VPP* — By operating its own VPP as a DRP using its own eDERMS platform, MCE retains full ownership, visibility, and control of its VPP.
  - *Enhanced Situational Awareness* — The purpose-built eDERMS allows the CCA to leverage accessible telemetry and meter data to gain the situational awareness required to maximize the value of the VPP.
  - *Integration With CCA Enterprise and Cloud Environment* — Because the eDERMS is situated within MCE's firewall, the VPP can operate with tighter integration with MCE's enterprise system and cloud environment.
  - *Enhanced Cybersecurity* — Secured within MCE's firewall, MCE's VPP can operate at a higher standard for cybersecurity.
  - *Mitigated Risk of Vendor Lock-in and Stranded DER Assets* — The purpose-built eDERMS and perpetual user license give MCE the ability to implement vendor and technology agnostic program design, thus mitigating the risks of vendor lock-in and stranded assets.
  - *Enhanced Internal Capacity for CCAs* — CCA-operated VPPs build internal capacity for VPP implementation, management, optimization, and expansion.
- Regulatory Benefits
  - *Compliance with LMS Regulations* — The VPP offers CCAs a method for complying with LMS that does not rely on dynamic pricing strategies, which pose operational challenges for CCAs that lack real-time meter data.
  - *Enhanced Credibility Among Regulators and Policy Makers* — By operating their own VPPs, CCAs can demonstrate their core competency in delivering grid services and market integrated DR programs.

Key Project Milestones

Key project milestones are described in Table 1.

Table 1: Key Project Milestones

Task	Product(s)	Duration
Richmond AEC Implementation Project Proposal	Agreement and Revised Scope of Work	7/2020
Technical Advisory Committee (TAC) Formation	List of Potential and Final TAC Members; Documentation of TAC Member Commitment	7/2020
Phase II Relaunch of MCE VPP Community Program	Disadvantaged Community Program Participation Guide; Pre- and Post-Technology Installation Photographs; Contract Performance Report #1	4/15/2020–9/15/2020
Modify Existing MCE VPP Community Technology Suite	DER Community Use Case and Technical Requirements Report	9/15/2020
MCE VPP Community Marketing, Education and Outreach	Disadvantaged Community Program Marketing Plan; Disadvantaged Community Outreach Materials; Richmond VPP Community Program Case Study	4/15/2020–1/15/2021
Operate, Enhance, and Scale MCE VPP Community	Quarterly Progress Reports and VPP Participation Agreements	7/10/2020–12/15/25
Design Zero Net Carbon Ready Homes Project and Select Technologies	Zero Net Carbon Ready Homes Procurement Brochure; Request for Quote; Copies of Permit Applications and Construction Documents	3/01/2020–3/01/2020
Construct Zero Net Carbon Ready Homes	Training Memoranda; Pre- and Post-Technology Installation Photographs; Project Metrics Document	3/01/2020–12/15/25
Educate and Support Zero Net Carbon Ready Homeowners	New Zero Net Carbon Ready Home Educational Materials; Home Walk-Through Memorandum	3/01/2020–12/15/2020
Conduct Zero Net Carbon Ready Marketing, Education, and Outreach	Contractor Zero Net Carbon Ready Education Materials; Public Agency Zero Net Carbon Ready Education Materials; Zero Net Carbon Ready Career Roadmap; Model Zero Net Carbon Ready Webpages; Zero Net Carbon Ready Program Development Case Study	4/01/2020–10/01/2022
Creation of M&V Plan	M&V Plan	3/01/2020–5/01/2020
M&V of DER Community	DER Community M&V Performance Report	7/01/2023

Task	Product(s)	Duration
M&V of Zero Net Carbon Ready Homes	Zero Net Carbon Ready M&V Report; Zero Net Carbon Ready Home Cost-Effectiveness Report; Survey Results	7/01/2023
Evaluation of Project Benefits	Kick-Off, Midterm, and Final Benefits Questionnaire	3/31/2020–1/31/2025
AEC Environmental Dashboard and AEC Open Data Guidebook	Richmond AEC Environmental Dashboard; Richmond AEC Data Exchange Procedures Manual	6/01/2022–2/01/2022
Develop AEC Solutions Center and AEC Solutions Toolkit	Annotated Bibliography of AEC Resources; AEC Solutions Toolkit; AEC Deployment Needs and Opportunities in California's Cities Whitepaper	8/03/2020–4/30/2021
Final Meeting	Final Meeting Agreement Summary; Schedule for Completing Agreement Closeout Activities; All Draft and Final Written Reports	3/15/26
Completion of Final Report	Draft and Final Reports	08/25–03/26

CHAPTER 3: Results

The Richmond AEC Project team was successful in demonstrating how CCAs can use a suite of programmatic innovations to implement a community-focused VPP that can be financially feasible while delivering crucial economic and resilience benefits to disadvantaged communities. The project team was able to secure participation from a diverse range of customers and leverage additional grants and social impact bonds to retrofit dilapidated housing stock with advanced energy technologies to deliver lower energy costs and community-wide VPP benefits.

Securing Participation From a Diverse Range of Customers

The Customer Journey

The VPP customer journey was designed to be accessible and attractive for all customer classes, regardless of prior knowledge of advanced energy solutions. MCE offered end-to-end project management and turnkey design and installation services to ensure a smooth customer journey.[15]

Outreach and Engagement

MCE used its data systems to identify accounts in the city of Richmond that could optimize the value of the VPP and advance its community benefit goals. Data analysis was used to find commercial and industrial customers with load profiles that matched MCE's active load shaping use case, especially those accounts with existing solar PV with significant energy demand in the 4:00 p.m.–9:00 p.m. window. For residential customers, MCE prioritized outreach to low-income, CARE/FERA, and medical baseline customers. MCE then assessed load profiles to identify the best candidates for active load shaping and emailed them to apply. Follow-up communications were sent in the mail to eligible customers on co-branded letterhead between MCE and the city of Richmond. All customers were also welcome to reach out proactively to MCE regarding VPP participation through a newly produced webpage, mcecleanenergy.org/virtual-power-plant.

Eligibility

Before enrolling in the VPP, customers were required to meet a set of eligibility requirements, listed in the virtual power plant tariff.[16] Requirements were as follows.

- Electric Service Provider: must be an MCE customer
- Revenue-Grade Meter: must have a revenue-grade internal meter that monitors energy consumption

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[15] Customer participation was designed with the ratepayer's interests in mind, and the strategies adopted by MCE have also been shown by the Brattle Group and Lawrence Berkeley National Labs to increase VPP enrollment (Hledik et al. 2024b, 6).

[16] For a full list of specific eligibility requirements, please see *Appendix C: Virtual Power Plant Tariff and Staff Memo*.

- Program and Market Participation Conflicts: must not be currently enrolled in another DR program or rate tariff
- Load Shifting Potential: assets must have the ability to shift load in response to program events
- Technology Vendor/Management Service: must use a technology vendor/management service that meets the criteria for technology vendor participation
- Execution of Agreement: must agree to MCE's VPPA, including the terms within, such as agreeing to connect DERs to the local WiFi connection
- Consent to Share Data: must consent to share meter and telemetry data with MCE

Enrollment

Once customers applied and MCE verified their eligibility, the Serious Controls team coordinated an on-site visit where members could review existing equipment, recommend upgrades, and field questions. The Serious Controls team then created a customized proposal of eligible DERs — a rigorous process that involved generating a personalized baseline, forecasting price impacts, and providing various modeling scenarios — and the customer chose the option that was right for them. The customer then reviewed and signed the VPP Agreement. The enrollment process, which was facilitated by program partners and MCE, typically lasted 4–6 weeks.[17]

Approvals and Installation

The project team next applied for permits from the relevant authorities, including any applicable interconnection and permission-to-operate approvals, Mutual Homes Corporation or city permitting offices. Once permissions were secured, the project team scheduled and completed the installation of new equipment, and local officials and utility representatives conducted necessary inspections to ensure that installations and interconnections met all required codes and regulations. This process usually took between 4 and 12 months, depending on the complexity of installation.

MCE worked with a curated set of original equipment manufacturers that could provide the smart and dispatchable DERs needed for the project, including SolarEdge, Evercharge, Equana, LG Electronics, SolArk, Discover, and Rainforest. A suite of installers was also brought in, including Alco Building Solutions, Grid Alternatives, TLC Construction, Sonomarin, EP Builders, and Next Solar. Serious Controls served as a general contractor.[18]

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[17] For details on residential customer enrollment processes, see *Appendix F: Homeowner Customer Journey* and *Appendix G: Homeowner Outreach Brochure*. For details on commercial and industrial customer enrollment processes, see *Appendix I: Commercial and Industrial Customer Journey* and *Appendix J: Commercial and Industrial Outreach Brochure.*

[18] Serious Controls created a guide for contractors working on the Zero Net Carbon Ready Homes Project: see *Appendix H: Contractor Guidelines*.

Operations

Once projects were completed, participants received a welcome packet of informational materials and equipment warranties to help them understand their new system. The project team conducted a final walk-through, during which they explained how the equipment worked and answered any questions. Customers could then begin receiving the on-bill credits, energy savings through more efficient appliances and time-of-use rate management, and, where storage systems were installed, the benefits of enhanced resilience during planned and unplanned grid outages.

Serving the Needs of Diverse Customer Classes

Residential Customers

MCE designed the project and coordinated with equity investors to ensure that participation was accessible to all customers, regardless of income, with a focus on minimizing out-of-pocket expenses. MCE succeeded in offering low- or no-cost options by collaborating with NEIF, a certified B-Corp, non-bank financial institution. NEIF was able to offer loans with a mix of market and below-market rates to residential customers wishing to install home battery storage systems. MCE allocated $4 million in reserves to help fund the loans with NEIF administration. Pooling their efforts, they were able to extend three categories of loans:

- Low-income customers qualified for a 10-year, zero percent-interest loan.
- Customers on medical baseline and those who lived in high-fire threat districts qualified for a 10-year, 2.5-percent-interest loan.
- All other eligible customers qualified for a 5-year, 5.5-percent-interest loan.

This strategy was designed with the understanding that higher-income participants with higher-interest loans would offset any loan fees, losses, or subsidies associated with low-income customers. The loans were thus self-sustaining and allowed the staff to use the initial investment as a revolving loan fund.

As previously noted, the Zero Net Carbon Ready Homes Program was funded through RCF Connects, which succeeded in leveraging funds from a social impact bond, established in 2015 by the city of Richmond, to purchase and rehabilitate abandoned properties and make them available to first-time homebuyers at below-market rates. Each home was outfitted with advanced energy assets and automatically enrolled in the Richmond VPP. This program element was designed as a holistic response to a host of community challenges, including persistent barriers to equitable homeownership and a large stock of blighted housing, much of which is legacy temporary housing built during World War II. This stock has depressed property values and contributes to Richmond’s designation as a CalEnviroScreen disadvantaged community. This project element also addressed key challenges identified by the CEC, including uneven access to advanced energy assets, acute local clean energy and resilience needs, and high energy costs associated with time-of-use rate management. In total, five homes were rehabilitated during the grant period, with more ongoing as of the first quarter of 2026. As new owners of zero net carbon ready homes, participants can access the full set of economic, resilience, and project management benefits associated with VPP participation while reversing a key driver of social and financial inequity.

Commercial Customers

MCE was able to engage a diverse set of participating commercial customers, including Essex Property Trust, a large and well-regarded multifamily real estate investment trust.[19] Participation in the VPP was attractive to Essex because the VPP brought together and enhanced the value proposition of rooftop solar and EV charging assets. Many real estate companies have legacy solar assets and are planning to install EV charges in alignment with new mandates. With new Net Energy Metering 3.0 terms[20], many entities with solar installations will end up paying for energy exports rather than earning revenue. However, pairing solar with battery storage and smart EV chargers dispatched by the VPP can optimize energy flows to minimize peak costs and demand charges and enable solar and EV charger assets to be used together to improve the economics of each. The VPP provides a means of using EV chargers to minimize exports and maximize the on-site use of solar while minimizing EV grid draws during peak time-of-use windows. Using these assets together and enrolling them in the VPP allows property owners to lower costs, increase their margins on EV charging, and earn $0.11/kWh for their load flexibility. MCE was also able to recruit other commercial and municipal customers into the VPP program, including Bridge Arts and the city of Richmond, allowing them to secure upgrades that align with their community benefit mandates while supporting the CCA's goals.

Barriers, Challenges, and Lessons Learned

Attracting Industrial Customers

The Richmond VPP succeeded in gaining participation from key customer classes that tend to be underrepresented in advanced energy solution uptake, including CARE/FERA and medical baseline customers and small commercial customers. However, the VPP was unable to gain participation from industrial customers. While the $0.11/kWh credit for delivered load flexibility, with the expectation for everyday load shaping, was attractive to smaller customers because it allowed customers to generate steady revenue throughout the year, this tariff proved an insufficient value proposition for large industrial customers. Instead, industrial customers expressed their preference for participating in a handful of load-shifting events, each with a larger payoff.

An important lesson from the project was that differentiated tariff structures are needed to attract the broadest possible participation, suited to the operational preferences of MCE's diverse customer base. From this learning, MCE plans to develop a dynamic tariff as part of its Virtual Power Plant Approaches for Demand Flexibility (VPP FLEX) pilot. This dynamic tariff will use market data and real-time meter data to offer a much higher compensation rate that will be more attractive to industrial customers.

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[19] See *Appendix K: Multifamily Residential Customer Case Study.*

[20] Effective April 15, 2023, reduced compensation for excess rooftop solar energy sent to the grid by approximately 75%.

Coordinating With Government and Public Agency Customers

The VPP project demonstrated both unique challenges and opportunities for government and public agency participation. The city of Richmond proved an asset to the project due to the relationships and revenue streams it was able to use to advance the goals of the AEC grant. The city was able to leverage its existing contract with GRID Alternatives, a nonprofit that installs solar PV assets and provides job training for underserved communities, to provide solar installations in low-income residential units. These efforts directly supported the VPP by increasing the VPP's residential customer base. The city of Richmond also led the Zero Net Carbon Ready Homes Program with RCF Connects.

The project also revealed challenges for the city as a VPP customer. Due to the complexities and competing priorities that municipal governments often face, the city was unable to install and enroll assets in the VPP, despite several attempts to do so. Key challenges included non-operational legacy DERs that could not be economically upgraded or integrated into the VPP and tight limitations on capital spending for items with a longer payback period. A key learning from MCE's experience working with the city of Richmond is that collaborations with government and public agency customers can be a force multiplier, bringing many different actors and revenue streams together in support of complex program goals; however, to make the most of these relationships, project teams must remain nimble and open to the range of possible collaborations rather than overemphasizing municipalities' roles as customers.

Identifying VPP Use Cases

During the project, MCE elected to pursue a set of use cases for its VPP that could be demonstrated to reduce costs on energy procurement, generate revenue for customers, and serve as proof-of-concept for wholesale market participation. The following market integrated and non-market integrated use cases were selected from a broad set of potential use cases for their simplicity and their promise of delivering clear value for the CCA, customers, and the grid.

Non-Market Integrated Use Cases

Peak Load Reduction

Peak load reduction is part of a broader strategy of active load shaping — using the VPP to "shape, shift, shimmy, and shed"[21] load — and is targeted at reducing system-level coincident peak load. This use case requires that the VPP coordinate its DER assets to prepare for significant load reductions during the 4:00 p.m.–9:00 p.m. window, especially by shifting demand from this "duck neck" to the "duck belly" of 11:00 a.m.–3:00 p.m. each day. The DERMS issues signals and attempts to secure the broadest possible fleet participation, though customers reserve the power to override signals. Given current methodologies for calculating customer baselines, which are used to value active load shaping, peak load reduction use cases may be used for 6 to 9 months out of the year.

[21] For a full explication of this four-part framework, which describes the four service categories of demand response systems, see Lawrence Berkeley National Laboratory (2025).

By shifting toward more time-sensitive and cost-sensitive purchases, peak load reduction lowers procurement costs and can also lead to future reductions in resource adequacy requirements, which ensure that LSEs have contracted enough capacity to meet 110 percent of their projected demand. In other words, by reducing projected demand through active load shaping, load serving entity-operated VPPs can significantly reduce resource adequacy obligations. MCE can then pass these savings on to the entire customer base — not just VPP participants — through lower, more predictable rates. Additionally, peak load reduction directly lowers electricity rates for participating customers, who not only get monthly bill credits but also save on their monthly bills by avoiding costs associated with high energy use during time-of-use hours, which correspond to coincident peak demand.

Planned Grid Outages

The VPP can realize another set of use cases associated with planned grid outages. In the case of planned grid outages such as Public Safety Power Shutoffs, wherein CCAs receive up to 75-hour notices, MCE can temporarily suspend active load shaping use cases and deploy assets to meet customer resilience needs. To prepare for grid outages, the DERMS can instruct solar PV systems to pre-charge home battery systems and signal heating, ventilation, and air conditioning (HVAC) systems and water heaters to perform precooling and preheating functions. During the planned outage window, the system reverts to its autonomous mode and deploys batteries, overriding the battery's minimum state of charge. Planned grid outage use cases enhance resilience for participating customers who enroll storage assets.

Unplanned Grid Outages

The VPP can also coordinate DERs to support customer resilience, even during unplanned grid outages. While unplanned grid outages do not afford VPPs the lead time required to coordinate DERs prior to the event window, the DERMS can establish protocols that allow systems to revert to their autonomous modes with instructions to maximize customer resilience. During these events, the DERMS can prioritize solar self-consumption, instruct home battery systems to override battery state of charge pre-set levels, and direct smart appliances to reduce energy use to extend the life of the battery.

Market Integrated Use Cases

The project effectively demonstrated that CCAs can use their status as scheduling coordinators to operate as DRPs to aggregate behind-the-meter DER assets using the Demand Response Registration System and the proxy demand resource market participation model. The Proxy Demand Resource mechanism enables registered DRPs to bid demand reductions or load shift capabilities of the behind-the-meter DERs directly into wholesale energy and ancillary services markets and settle directly with the California ISO. During the project, MCE participated in the California ISO's day-ahead wholesale markets by self-scheduling load. While the project was too small and time-limited for MCE to participate in a market integrated DR event, the project provided the opportunity for MCE to interface with California ISO systems and was successful in setting up the premise that a CCA acting as a DPR can settle with the California ISO directly. Participation in these markets could make available significant new sources of revenue that can be leveraged to generate a stable return on investment for CCAs that own and operate their own VPPs. In future projects, MCE hopes to prove that market integration use cases can delineate a new business model for CCAs.

Barriers, Challenges, and Lessons Learned

To pursue a full complement of DER and VPP use cases, MCE evaluated a range of options for VPP/DER management, including outsourcing the VPP to a third-party aggregator, licensing an off-the-shelf DERMS platform, and collaborating on a purpose-built eDERMS. Important lessons were learned regarding the various tradeoffs among these VPP management options, informing the ultimate VPP strategy.

While it may have been possible for MCE to outsource VPP management to a third party, thus optimizing operational simplicity, this approach did not align with the business model MCE aimed to pursue through its VPP. This business model requires: 1) the autonomy to pursue market integrated use cases independently to generate revenue, and 2) the control and visibility required to ensure that non-market integrated, cost-avoidance use cases are pursued that maximize value for the CCA.

Committed to operating its own VPP as a DRP, MCE next pursued an initially promising contract with another SaaS vendor in orchestration and optimization software to license its off-the-shelf DERMS platform. However, MCE quickly discovered that 1) the Saas agreement would require continued support, guidance, and payments to operate the software, which was not forthcoming, and 2) the off-the-shelf DERMS would have required significant modifications to deliver value to the CCA. As such, while the SaaS agreement would have theoretically provided MCE with the autonomy to operate its own VPP, serious technical and commercial risks posed barriers to realizing the value of the VPP.

Ultimately, MCE chose to collaborate with Serious Controls to create a purpose-built eDERMS. Serious Controls had been working with Southern California CCA Lancaster Energy to provide similar services through its AEC grant, also led by Zero Net Energy Alliance, and MCE was able to gain a perpetual user license that supports co-development of the eDERMS with Lancaster Energy, along with all subsequent licensees. The eDERMS allows MCE to capture the full value of market integrated and non-market integrated use cases.

Because this platform was built from the ground up for CCA applications in California, it is designed to leverage the near-real-time telemetry and meter data accessible to CCAs to mobilize the use cases most likely to deliver value to the CCA. Because the eDERMS is secured through a perpetual user license, MCE can avoid expensive licensing fees and escalators that typically accompany off-the-shelf SaaS platforms. Finally, unlike proprietary aDERMS that are typically configured to work with a narrow band of technologies and vendors, the eDERMS is built to integrate the full range of assets and grid-edge partners, even including multiple aDERMS providers. This vendor and technology agnostic design will help facilitate an accelerated scale-up of VPP capacity and ensure that MCE’s network of VPP partners remains fair, diverse, and open.

Scaling the Community VPP Solution

The Richmond AEC Project has demonstrated that CCAs can implement financially feasible VPPs to address a wide range of grid and environmental needs while expanding access to behind-the-meter assets and delivering value to communities. Recognizing the VPP's potential to identify and resolve program challenges, the CEC has committed to help scale the VPP to all MCE customers through its subsequent grant, VPP FLEX. With the transition to VPP FLEX, the VPP FLEX project team will demonstrate that concepts developed through the project can scale while ensuring a robust return on investment. MCE aims to recoup 20 percent of its costs within four years by operating a cost-effective VPP that opens up new possibilities for revenue generation.

Strategies for implementing VPP FLEX are built on key learnings from the Richmond VPP. In VPP FLEX, MCE will develop a dynamic tariff that will allow it to maximize the financial benefits that flow to participating customers to better attract large industrial customers. MCE will also enter into formal contracts with VPP partners and extend an adapted pay-for-performance compensation model tested with customers. These pay-for-performance metrics will be customized to each partner category and, where metrics are based on total kWh of delivered load flexibility, validated through a third-party M&V process. This pay-for-performance model is designed to align incentives in support of a functional, trustworthy system that can generate value for all stakeholders.

Finally, MCE will deepen its efforts to create an open, fair, and diverse market by standardizing its eDERMS communication protocols around OpenADR.[22] As an open-source, non-proprietary protocol, OpenADR is an optimal option for public agencies such as MCE. OpenADR benefits VPP partners by ensuring inclusive integration and interoperability; gaining OpenADR certification will help these partners scale their operations to other DERMS without being forced to rebuild their systems, minimizing costs and administrative burdens.

Public Outreach Activities and Reports

To support scale-up of AECs and VPPs, the Richmond AEC Project developed a comprehensive array of outreach activities and materials, including the following key elements.

- **Richmond AEC Promotional Materials and Guides:** MCE created a suite of materials and guides designed to promote participation in the VPP and guide customers through their participation journey. These guides include: 1) MCE VPP Community Program Participation Guide; 2) MCE VPP residential and commercial and industrial brochures; 3) MCE VPP residential and commercial and industrial customer journey documents; 4) Zero Net Carbon Ready Homes Procurement brochure; and 5) New Zero Net Carbon Ready Home educational materials, including webpages, designed for homeowners, contractors, and public agencies. The MCE Virtual Power Plant Playbook

[22] For information on use of OpenADR, see the DERMS OpenADR Guidelines at https://tinyurl.com/DERMSOpen ADR and *Appendix L: Technology Vendor Participation Requirements*.

was also created to communicate project objectives and benefits to broader audiences.[23]

- **AEC Deployment Needs and Opportunities in California's Cities Whitepaper:** This whitepaper provides a strategic roadmap to AEC and VPP scale-up in California, drawing on lessons learned from the Richmond and Lancaster AEC projects, sister AEC projects throughout the state, and comparable projects nationally. This resource included the creation of an AEC Solutions Toolkit, and an Annotated Bibliography of AEC Resources.
- **Richmond VPP Project Case Studies:** The project team prepared four project case studies to communicate key project components to community stakeholders: 1) "From Distressed and Abandoned to Smart and Climate-Friendly," sharing the success of the Zero Net Carbon Ready Homes Program, 2) A Multifamily Residence Showcase featuring the Essex solar and electric vehicle supply equipment installations, 3) "A CARE All-Electric Home Showcase" demonstrating integrated heat pump water heaters/HVAC at the home of a CARE residential customer, and 4) "Community Choice VPP/DERMS in Action" showing integrated CCA-eDERMS operations.
- **Presentation Tour (2022–23):** MCE engaged in a series of workshops and other presentation opportunities. These presentations were well attended by key stakeholders, community members, industry leaders, policy makers and regulators, and other grid actors. Presentations included:
  - "Building a Resilient & Equitable Grid for the Future." The Climate Center, webinar, December 7, 2022.
  - "Advanced Energy Communities in Practice", UC Berkeley Goldman School of Public Policy, March 21, 2023.
  - "Virtual Power Plants in California Community Choice Energy Agencies." RE+ Conference, Sacramento, California, March 28, 2023.
  - "Building Resilience: The Lights on in an All-Electric Future," BayRen, Online, September 20, 2023.
  - "Equitable and Affordable Clean Energy," Lawrence Berkeley National Laboratory, Berkeley, California, November 13, 2023.
  - "VPP Workshop." The Alliance to Save Energy, February 22, 2024.
  - "VPP for a Climate-Safe Electricity Grid." California Climate Summit, Sacramento, March 19, 2024.
  - "VPPs in Practice." North County Climate Change Alliance, September 12, 2024.

[23] The MCE Virtual Power Plant Playbook, *How MCE's Virtual Power Plant Is Building the Future of Energy, can be found at https://mcecleanenergy.org/wp-content/uploads/2024/07/MCE-Virtual-Power-Plant-*Playbook_0723 2024.pdf.

- "VPP Panel." Lawrence Berkeley Labs CalFlexHub Symposium, Berkeley, California, September 24, 2024.
- Moderated VPP Panel at California Climate Policy Summit, April 22, 2025.

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- **Telling the MCE Story:**
    - Awarded April 2024 East Bay Innovation Award for Community Impact.
    - Informed "Solar cities: A case study analysis of city-level enablers of expanded solar energy access" (E. O'Shaughnessy, A. Duckworth, S. Houck, and G. Barbose. 2025. *Energy Research & Social Science*, 127, 104321. https://www.sciencedirect.com/science/article/pii/S2214629625004025.)
    - Nominated RCF Connects for MCE's McGlashan Award.
    - Submitted VPP panel to the Environmental Protection Agency's annual conference, Q4 2025.
    - Presented VPP press event video at the CEC's Electric Program Investment Charge (EPIC) Symposium: https://vimeo.com/1041267963?fl=pl&fe=sh.

CHAPTER 4: Conclusion

The Richmond AEC Project addressed key challenges to adoption of technologies critical to supporting California's clean energy and climate goals, including: 1) the presence of social inequity in accessing advanced energy solutions, 2) a lack of community engagement in clean energy planning, 3) a lack of meter-based data for energy planning and effectiveness evaluations, and 4) ineffective financing strategies. MCE addressed these challenges by making DER assets available to customers through turnkey project installation services at low- or no-upfront cost and by creating a CCA-operated, community-focused VPP capable of overcoming persistent data access and market barriers. The project showed that this VPP can secure a robust return on investment through market integrated and non-market integrated use cases while fostering deep community participation and sharing value among diverse customer classes. The project was also successful in leveraging social impact bonds to support advanced energy technology implementation in disadvantaged communities. In summary, the project showed that:

- **There is broad and diverse interest in participating in virtual power plant programs.** Adoption of the program among many different customer classes and income levels has shown that the initial program communications, tariff, and agreement terms were attractive to customers.
- **Community choice aggregations can register as DR providers to directly bid, schedule, and settle with the California Independent System Operator.** The project team interfaced with California ISO systems in preparation for market integrated DR events, including by registering customers in the Demand Response Registration System, the Automated Demand Server, the Market Results Interface Settlements, and other processes necessary to form and operate an aggregation for the purposes of California ISO market participation. Market participation will be tested in the subsequent grant, VPP FLEX.
- **Direct access to device-level data enabled by the eDERMS allowed MCE to overcome current data limitations.** This access allows the CCA to remain informed about the performance of its system, protects the value of the system's energy assets, and enables real-time innovation.

Implications for Climate Goals and Regulatory Compliance

By supporting the adoption of advanced energy solutions among diverse customer classes and demonstrating the financial feasibility of VPPs for CCAs across the state, learnings from the Richmond VPP can assist grid decarbonization statewide. The VPP can orchestrate DER fleets to store solar PV energy when it is abundant, reducing the need for curtailment of renewable energy. By delivering load flexibility during peak demand periods, VPPs can also ease dependence on gas-fired peaker plants that are currently used to address energy shortfalls. In curbing the use of peaker plants, California can reduce not only carbon emissions but local air pollutants, which, due to discrimination in public planning, disproportionately impact disadvantaged communities. VPPs are thus a means of advancing environmental and environmental justice benefits. The project also shows that CCAs can use VPPs to comply with emerging LMS, providing them with an alternative to dynamic pricing mechanisms that typically do not function well in CCAs contexts where access to real-time meter data remains a persistent challenge.

Market Implications for CCAs and Communities

The key lesson from the project has been the successful participation of this VPP in California ISO markets, which opens up the possibility for an entirely novel CCA business model. The VPP project has functioned as a proof-of-concept that shows that CCAs can use VPPs to generate revenue, cut costs, and share value with customers and partners. This effort has demonstrated that VPP programs can be an investment in a new and vibrant business model for CCAs, and the project has shown how a unique set of innovations centered on the CCA's ability to operate its own VPP with a purpose-built eDERMS and unique value-sharing mechanisms can enable that business model. These innovations involve CCAs:

- Operating their own VPPs as DRPs.
- Managing their VPPs through purpose-built eDERMS secured with a perpetual license.
- Exercising a preference for open-source code packages and communication protocols.
- Creating value-sharing tariffs codified through long-term contracts.
- Providing end-to-end installation services.

These innovations enable revenue generation through market integrated use cases, cost savings through active load shaping use cases, and rate reduction and stabilization for all customers, regardless of their ability to participate in the VPP. Customers who do participate gain access to energy efficiency upgrades, enhanced resilience, turnkey project management, and a value-sharing tariff codified through an innovative agreement that establishes a mutually beneficial paradigm between customers and the CCA. While MCE's approach to VPP implementation requires internal professional development, capacity building, and staff involvement, the cost savings and the revenue generation opportunities that a community-focused VPP makes possible are substantial.

Key Learnings and Future Development Opportunities

The project demonstrated that CCAs can operate their own VPPs to participate directly in California ISO markets, and that it is possible to engage a diverse range of customers — including low-income customers, nonprofit organizations, municipal operations, and multifamily commercial customers — in long-term, stable, mutually beneficial relationships that generate private benefits as well as public goods. By demonstrating the financial viability of this community-focused VPP, the project serves as a model for expanding VPPs in communities across MCE's service area and across California.

As MCE scales the Richmond AEC Project to cover its entire service area with the CEC's VPP FLEX grant, the VPP FLEX project team will use learnings derived from key challenges and barriers to improve performance. To attract large industrial customers, the VPP FLEX project team will develop a dynamic tariff capable of maximizing value-sharing based on real-time market data while expanding the pay-for-performance compensation model. Finally, it will further advance open-source communication protocols by standardizing use of OpenADR across diverse devices. The Richmond AEC Project successes and key learnings will pave the way for a more reliable, resilient, and sustainable energy system and a promising new business model for CCAs.

List of Terms/Glossary

Term	Definition
AEC	advanced energy community
aDERMS	aggregator-owned DERMS
California Independent System Operator	The neutral operator responsible for maintaining instantaneous balance of the grid system in California. The California ISO performs its function by controlling the dispatch of flexible plants to ensure that loads match resources available to the system.
CARE	California Alternative Rates for Energy
CCA	community choice aggregation
CEC	California Energy Commission — the state's primary energy policy and planning agency. The agency was established by the California Legislature through the Warren-Alquist Act in 1974. It has seven core responsibilities: developing renewable energy, transforming transportation, increasing energy efficiency, investing in energy innovation, advancing state energy policy, certifying thermal power plants, and preparing for energy emergencies.
DR	demand response — providing wholesale and retail electricity customers with the ability to choose to respond to time-based prices and other incentives by reducing or shifting electricity use, particularly during peak demand periods, so that changes in customer demand become a viable option for addressing pricing, system operations and reliability, infrastructure planning, operation and deferral, and other issues. (Source: Dan Delurey, U.S. Demand Response Coordinating Committee).
DER	distributed energy resource — small-scale power generation technologies (typically in the range of 3 to 10,000 kilowatts) located close to where electricity is used (for example, a home or business) to provide an alternative to or an enhancement of the traditional electric power system
DERMS	distributed energy resource management system
dispatch	The operating control of an integrated electric system, used to: assign generation to specific generating plants and other sources of supply to effect the most reliable and economical supply as the total of the significant area loads rises or falls; control operations and maintenance of high-voltage lines, substations and equipment, including administration of safety procedures; operate the interconnection; schedule energy transactions with other interconnected electric utilities.

Term	Definition
distribution	the delivery of electricity to the retail customer's home or business through low voltage distribution lines
DRP	demand response provider
eDERMS	enterprise-level DERMS
EPIC	Electric Program Investment Charge
EV	electric vehicle — a broad category that includes all vehicles that are fully powered by electricity or an electric motor
FERA	Family Electric Rate Assistance
HVAC	heating, ventilation, and air conditioning — a system that provides heating, ventilation and/or cooling within or associated with a building
interconnection	The linkage of transmission lines between two utilities, enabling power to be moved in either direction. Interconnections allow the utilities to help contain costs while enhancing system reliability.
ISO	Independent System Operator
kW	kilowatt — one thousand (1,000) watts; a unit of measure of the amount of electricity needed to operate given equipment. On a hot summer afternoon, a typical home, with central air conditioning and other equipment in use, might have a demand of four kW each hour.
kWh	kilowatt-hour — the most commonly-used unit of measure telling the amount of electricity consumed over time, meaning one kilowatt of electricity supplied for one hour. In 1989, a typical California household consumed 534 kWh in an average month.
LMS	load management standards
load	The amount of electric power supplied to meet one or more end user's needs; an end-use device or an end-use customer that consumes power. Load should not be confused with demand, which is the measure of power that a load receives or requires.
load management	Steps taken to reduce power demand at peak load times or to shift some of it to off-peak times; this may refer to peak hours, peak days, or peak seasons. The main thing affecting electric peaks is air-conditioning usage, which is therefore a prime target for load management efforts. Load management may be pursued by persuading consumers to modify behavior or by using equipment that regulates some electric consumption.
LSE	load serving entity
M&V	measurement and verification

Term	Definition
meter	a device for measuring levels and volumes of a customer's gas and electricity use
NEIF	National Energy Infrastructure Fund
peak load or peak demand	The electric load that corresponds to a maximum level of electric demand in a specified time period; the highest electrical demand within a particular period. Daily electric peaks on weekdays occur in late afternoon and early evening. Annual peaks occur on hot summer days.
peak load power plant	a power generating station that is normally used to produce extra electricity during peak load times
PV	photovoltaic
reliability	Electric system reliability has two components: adequacy and security. Adequacy is the ability of the electric system to supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and unscheduled outages of system facilities. Security is the ability of the electric system to withstand sudden disturbances, such as electric short circuits or unanticipated loss of system facilities.
SaaS	software-as-a-service
tariff	a document, approved by the responsible regulatory agency, listing the terms and conditions, including a schedule of prices, under which utility services will be provided
time of use, esp. time-of-use rates	Electricity prices that vary depending on the time periods in which the energy is consumed. In a time-of-use rate structure, higher prices are charged during utility peak-load times. Such rates can provide an incentive for consumers to curb power use during peak times.
VPP	virtual power plant — A network of decentralized, medium-scale power generating units and flexible loads, such as batteries, EVs, smart appliances, and flexible heating and cooling loads that can be effectively managed to the benefit of grid operators.[24]
VPP FLEX	Virtual Power Plant Approaches for Demand Flexibility, MCE's subsequent grant
VPPA	Virtual Power Plant Agreement

[24] Assembly Committee on Utilities and Energy. (2025, March 12). *AB 740 (Harabedian) – Virtual power plants: load shifting: integrated energy policy report* (As amended March 12, 2025). California State Assembly.

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Project Deliverables

This section lists all project deliverables associated with AEC Grant Technical Tasks, as per the EPIC Grant Project Schedule. All project deliverables, including interim project reports, are available upon request by submitting an email to pubs@energy.ca.gov.

The following deliverables were completed in satisfaction of the DER Community Program portion of the AEC Grant:

- Disadvantaged Community Program Participation Guide
- Pre and Post Technology Installation High-Quality Digital Photographs #1
- PCR Report #1
- DER Community Use Case and Technical Requirements Report
- Disadvantaged Community Program Marketing Plan
- Disadvantaged Community Outreach Materials
- Richmond DER Community Program Case Study
- Quarterly Progress Reports

The following deliverables were completed in satisfaction of the Zero Net Carbon Ready Homes Program portion of the AEC Grant:

- Zero Net Carbon Ready Home Procurement Brochure
- Request for Quote
- Copies of Permit Applications and Construction Documents
- Training Memoranda
- Pre and Post Technology Installation High-Quality Digital Photographs #2
- Project Metrics Document
- New Zero Net Carbon Ready Home Education Materials
- Home Walk-Through Memorandum
- Contractor Zero Net Carbon Ready Education Materials
- Public Agency Zero Net Carbon Ready Education Materials
- Zero Net Carbon Ready Career Roadmap
- Model Zero Net Carbon Ready Webpages
- Zero Net Carbon Ready Program Development Case Study

The following deliverables were completed in satisfaction of the Independent M&V portion of the AEC Grant:

- M&V Plan
- DER Community M&V Performance Report
- Zero Net Carbon Ready M&V Report
- Zero Net Carbon Ready Home Cost-Effectiveness Report
- Survey Results for M&V of Zero Net Carbon Ready Homes
- Kick-Off Meeting Benefits Questionnaire
- Mid-Term Benefits Questionnaire
- Final Meeting Benefits Questionnaire

The following deliverables were completed in satisfaction of the Technology and Knowledge Transfer Activities portion of the AEC Grant:

- Initial Fact Sheet
- Final Project Fact Sheet
- Final Presentation Materials
- Technology/Knowledge Transfer Plan
- Technology/Knowledge Transfer Report
- High-Quality Digital Photographs
- Richmond AEC Environmental Dashboard
- Richmond AEC Data Exchange Procedures Manual
- Annotated Bibliography of AEC Resources
- AEC Solutions Toolkit
- AEC Deployment Needs and Opportunities in California's Cities Whitepaper

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX A: Enterprise-Level DERMS Case Study

May 2026 | CEC-500-2026-013

Appendix A:
Enterprise-Level DERMS Case Study

Richmond Advanced Energy Community Project

case study

Designing the Next Generation of Grid Solutions — from the Ground Up

Virtual Power Plants can solve a range of grid challenges by aggregating and coordinating advanced energy technologies. How can we make sure they deliver on their promise? MCE adopted a first-of-its-kind enterprise-level Distributed Energy Resource Management System to make it happen.

California's energy landscape is undergoing a profound transformation. The state has set ambitious goals to increase renewables and electrify traditionally gas-powered systems.

However, the increased demand for renewables has intensified conversations about threats of wildfires and public safety power shutoffs, underscoring the importance of local resilience and reliability.

Meanwhile, new consumer-side distributed energy resources (DERs) – including rooftop solar, battery storage systems, EV chargers, and building automation systems – are growing and fundamentally reshaping how electricity is generated, delivered, and consumed.

Virtual Power Plants (VPPs) are a paradigm-shifting solution that use DERs to dynamically address a range of grid needs and challenges. VPPs aggregate and coordinate DER behavior, allowing VPP operators to better match energy supply with demand using software-based distributed energy resource management systems (DERMS), which function as "virtual wires" connecting assets.

VPPs use DERMS to make energy assets work in concert; reducing peak demand, minimizing power purchasing requirements, integrating intermittent renewable generation cost-effectively, enhancing local resilience, and even deferring costly grid infrastructure upgrades – all while allowing VPP operators to generate revenue by delivering valuable energy and grid services to California's wholesale markets.

MCE — California's first Community Choice Aggregator (CCA) — is poised to use its VPP to achieve all these benefits. By operating its own VPP as a registered Demand Response Provider (DRP) rather than relying on a private third-party aggregator MCE can generate community-wide benefits. But it takes a special kind of DERMS platform to deliver on the promise of VPPs in a CCA setting.

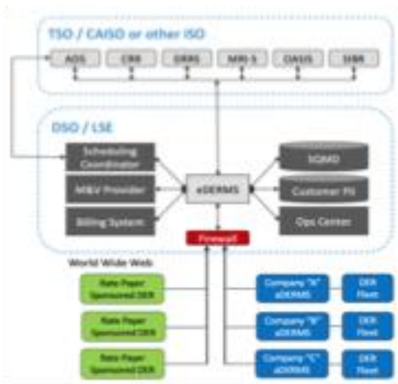
Many commercially available DERMS packages are only available with expensive software-as-a-service licensing fees, were built for different end-users (i.e., utilities, distribution system operators, etc.), and do not function well in a CCA environment. These artificially limit the technologies that can be integrated and generally do not meet the needs of not-for-profit public VPP operators like MCE which do not have a guaranteed rate of return on these investments.

That's why MCE teamed up with Serious Controls to develop an innovative approach to DERMS implementation capable of delivering unmatched visibility and control, maximizing coordination and integration, leveraging available data streams to enhance situational awareness, reducing the risks of vendor lock-in and stranded assets, and minimizing costs for public power implementors like MCE.

What sets MCE's DERMS platform apart from the rest of the pack?

First, MCE has embraced an enterprise-level DERMS (eDERMS), that resides within the internal, CCA-controlled enterprise software environment. By contrast, DERMS that are hosted by external third-party aggregators (aDERMS) must be partitioned from the CCA's enterprise systems and customer data warehouse to satisfy cybersecurity standards, which makes it harder to integrate data streams and coordinate the VPP's assets.

aDERMS are external systems, so fundamental VPP processes are visible to the CCA, undermining the CCA's control over its own system. These aDERMS are limited in how often they can be dispatched by the end-user and tend to only work with a narrow band of vendors and technologies. This artificially constrains the VPP and increasing the chances of stranded assets.



MCE's eDERMS resides within the CCA's internal systems.

In contrast, the eDERMS can fully and securely integrate with the CCA's data lake, provides the CCA total control, and facilitates daily dispatches of the DER fleet to synchronize with forecasted demand needs. It also increases security and visibility, and is technology and vendor-agnostic by design. With this eDERMS platform, MCE can achieve maximum coordination and optimize the VPP's performance through data-driven innovation, while also creating a fair and open market for DER services and coordinated load flexibility.

To function optimally in a CCA setting, a DERMS platform must work with the data and use cases accessible to CCAs. Off-the-shelf DERMS come with lots of features and modifications but aren't designed for CCAs. They require data streams that CCAs don't have access to and are designed for use cases that don't produce value for CCAs.

MCE has taken a different approach with Serious Controls to create a purpose-built eDERMS from the ground floor. With CCAs as a core client rather than a secondary market, this platform was intentionally built to integrate data that is readily available to CCAs today – including near-real time meter data and DER telemetry data – to provide CCAs with unmatched situational awareness and VPP capabilities. These advanced capabilities will allow MCE to dynamically optimize economic dispatch and scheduling, complete settlement procedures, identify and mitigate energy trading risks, and make real-time adjustments to enhance VPP performance, all while creating new value streams to share with their community members and partners.

A major benefit of this eDERMS is that user access is secured through a perpetual user license. While the typical license for an off-the-shelf DERMS can cost as much as $1 million per year, MCE's eDERMS is available for a one-time licensing fee based on the agency's service population ranging from $20,000 to $200,000. This license grants full access to the eDERMS software code in perpetuity – along with all future updates and enhancements to the DERMS platform. This license is designed to encourage robust co-development of the platform by all users, allowing CCA users to work collaboratively to accelerate the evolution of the platform strategically and cost-effectively.

The eDERMS is built using open-source code packages and communication standards (including OpenADR) that are regularly maintained by the open-source community, so the long-term cost of operating the eDERMS platform will be lower than comparable SaaS-based platforms offered by third-party aggregators and software providers.

With this eDERMS platform under perpetual user license, MCE has the control, visibility, and situational awareness it needs to ensure its VPP is realizing its full potential. With its eDERMS-powered VPP, MCE is maximizing the value it shares with its customers, member communities, implementation partners, and other stakeholders, all while advancing California's climate protection, grid reliability, and ratepayer equity goals. This approach sets a new standard for secure, equitable, cost-effective, and community-focused grid innovation in California and throughout the nation.

About the Richmond Advanced Energy Community Project:

The Richmond Advanced Energy Community Project is an invitation-only project for homes and businesses led by the ZNE Alliance and MCE. It provides low to no-cost energy efficiency and electrification equipment to participants so they can save money on their energy bills and reduce impacts on the environment. The participants agree to allow their devices to be part of MCE's Virtual Power Plant (VPP) to reduce grid load during critical times. This helps make Richmond's energy cleaner and more reliable for everyone, while reducing costs for the homeowner. The program is supported by a $5 million grant from the California Energy Commission and up to $2.8 million in match funding from various partners including the City of Richmond and MCE.

ZNE/Alliance MCE SERIOUS CONTROLS CEER

Project made possible in part by the California Energy Commission

Learn more: mceCleanEnergy.org/virtual-power-plant
Questions? virtualpowerplant@mceCleanEnergy.org

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX B: CARE Residential Customer Case Study

May 2026 | CEC-500-2026-013

Appendix B:
CARE Residential Customer Case Study

Richmond Advanced Energy Community Project

case study

Turning Costs into Assets with a Little Ingenuity — and a Lot of Care

Increasing energy bills are a major concern for many. What if we could find a way to turn those costs into assets that can generate value for customers and communities without requiring costly up-front investments? MCE found a way to make it happen.

Richmond CARE customer with new EV through MCE rebates

Clean energy technology is constantly improving as solar panels become more efficient, batteries become safer, and engineers develop smart new tools for monitoring and managing home energy use. However, many Californians simply can't afford to take advantage of these new technologies – instead, their energy bills are piling up.

Even customers who receive discounts like California Alternative Rates for Energy (CARE) don't have enough support. These customers don't just need discounts, they need access to new energy technologies that can turn their energy costs in assets.

With help from MCE, families in the City of Richmond are doing just that. The key is MCE's Virtual Power Plant (VPP). VPPs are a cutting-edge strategy to lower system costs, generate revenue, and create a healthier grid and planet by linking up new energy technologies and making them work together.

For the VPP to work, these assets need to be installed everywhere. So MCE got to work. With help from an Advanced Energy Communities (AEC) Grant, MCE found ways to stack program incentives, leverage below-market loans, and streamline the installation process to help CARE customers install advanced energy assets in their homes.

Once customers applied to be part of the VPP program, a project team led by Serious Controls reached out to schedule home visits to see how participants could reduce their energy costs and make their homes healthier and safer.

Assets like home energy monitoring devices and batteries could help them use energy when it is most cost-effective while batteries would provide them unparalleled resilience during planned and unplanned grid outages. Meanwhile, heat-pumps and mini-splits could protect them from rising gas prices and reduce exposure to harmful emissions. These DERs could be enrolled individually or stacked, allowing customers to join at their own pace – if they liked the program, they could always install more assets in the future.

Once customers selected the upgrades that were right for them, they signed the Virtual Power Plant Agreement. The Agreement is innovative in establishing a mutually beneficial, long-term value-sharing relationship between the customer and MCE. Over a 5-year term, MCE is able to monitor and dispatch the customer's assets through the VPP. In return, customers gain access to value-sharing monthly bill credits based on the assets they enroll, making them genuine participants in California's energy markets.

Eligible Assets & Monthly Credits

Smart Refrigerator	$2	Heat-Pump Water Heater	$5
Smart Freezer	$2	EV Charger, Level 2	$10
Smart Outlet	$2	EV Charger, Level 2	$20
Smart Thermostat	$5	Energy Storage < 20 kWh	$10
Smart Gateway	$5	Energy Storage > 20 kWh	$20
Mini-Split Heater & A/C	$5		

New solar system installed at participant home

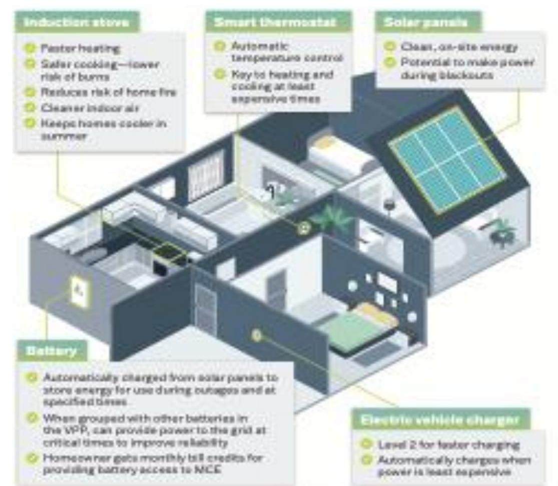
MCE's incentive programs make it possible for most assets to be installed at little or no upfront cost to customers. Still, many customers still needed additional financial help to install larger components like battery storage systems.

To enhance program participation, MCE allocated $4 million in reserves to back loans from the National Energy Infrastructure Fund (NEIF), a certified B-Corp financial group able to offer low- or no-interest loans to residential customers seeking to install home battery systems. NEIF issued three categories of loans based on financial and resilience needs, allowing MCE to use the initial investment as a self-sustaining revolving loan fund.

MCE NEIF Loan Categories

CARE/FERA Customers	
0% Interest	10-Year
Medical Baseline & High-Fire Threat	
2.5% Interest	10-Year
All Eligible Customers	
5.5% Interest	5-Year

Over 5 years, Serious Controls projects that a typical residential customer can save $785 on their monthly bills in addition to earning $1,200 in bill credits. To help pay for their new assets, they would receive $9,778 in low- or no-interest loans from NEIF on top of $4,565 in incentives from MCE. About half would pay nothing out of pocket for their upgrades. And because customers were investing in their homes, they could see their property values and financial equity increase. Their neighbors would thank them, too.



Example of discounted resources that CARE participants can link to MCE's VPP

By becoming clean energy champions, participating CARE customers are helping to reduce reliance on fossil fuels and supporting MCE's ability to keep energy affordable for all customers – all while building a cleaner, brighter energy future.

About the Richmond Advanced Energy Community Project:

The Richmond Advanced Energy Community Project is an invitation-only project for homes and businesses led by the ZNE Alliance and MCE. It provides low to no-cost energy efficiency and electrification equipment to participants so they can save money on their energy bills and reduce impacts on the environment. The participants agree to allow their devices to be part of MCE's Virtual Power Plant (VPP) to reduce grid load during critical times. This helps make Richmond's energy cleaner and more reliable for everyone, while reducing costs for the homeowner. The program is supported by a $5 million grant from the California Energy Commission and up to $2.8 million in match funding from various partners including the City of Richmond and MCE.

ZNE/Alliance MCE SERIOUS CONTROLS CEER

Project made possible in part by the California Energy Commission

Learn more: mceCleanEnergy.org/virtual-power-plant
Questions? virtualpowerplant@mceCleanEnergy.org

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX C: Virtual Power Plant Tariff and Staff Memo

May 2026 | CEC-500-2026-013

Appendix C:
Virtual Power Plant Tariff and Staff Memo

MCE Empowering Our Clean Energy Future
CONTRA COSTA | MARIN | NAPA | SOLANO

September 16, 2020

TO:	MCE Technical Committee
FROM:	Alexandra McGee, Manager of Strategic Initiatives
RE:	Draft Electric Schedule VPPT - Virtual Power Plant Tariff (Agenda Item #07)
ATTACHMENTS:	A. Draft Electric Schedule VPPT – Virtual Power Plant Tariff B. Commercial & Industrial Brochure C. Residential Brochure for ZNCR Homebuyers D. Residential Brochure for Richmond Homeowners

Dear Technical Committee Members:

BACKGROUND:

On May 26th 2022, MCE was approved to join the implementation of a $4,998,555 Electric Program Investment Charge (EPIC) grant from the California Energy Commission (CEC) to develop an Advanced Energy Community (AEC).[1] With MCE's participation, the scope of work has been augmented to develop a pilot Virtual Power Plant (VPP) within the City of Richmond. This grant was initially awarded in 2020 to a network of partners including the Zero Net Energy Alliance (ZNEA), the City of Richmond, the Richmond Community Foundation, EcoShift Consulting, and Energy Solutions.

The grant partners will install a suite of privately-owned distributed energy resources (DERs) to be dispatched into the VPP- such as rooftop solar, heat pump water heaters, smart thermostats, smart plugs, electric vehicles, and energy storage. These will send data directly to MCE and can be remotely controlled and operated together to pull power to and from the grid at strategic times, creating pockets of power to support and decarbonize the grid.

The goal of Richmond Advanced Energy Community is to connect 120 sites to the VPP including 10 rehabilitated homes, 90 homes occupied by low-to-middle income residents (which have already received solar systems from GRID Alternatives), 18 commercial sites, and 2 industrial sites. Combined, the 120 sites are expected to contribute 1MW of solar, 2MWh of energy storage, and 1.5MW of flexible load by December 2024.

A social impact bond is being used to buy, rehabilitate, and modernize 10 abandoned houses to become zero-net carbon ready (ZNCR) with modern DERs installed on-site. The homes will be sold at below market rates to first-time low-to-medium income homeowners without resale restrictions, making this effort a powerful tool in building more equitable communities. To date four homes have already been purchased, and on average, these homes have sold $100,000 below market.

[1] The CEC uses the term, "Advanced Energy Community" (AEC) to describe communities that meet all 9 criteria outlined on page 17 of the following source. These are broadly categorized as those that can strengthen local grid resiliency while benefiting residents and reducing greenhouse gasses. https://www.energy.ca.gov/sites/default/files/2021-05/CEC-500-2019-010.pdf

To minimize or eliminate the upfront costs of installing customer-owned DERs, Richmond Advanced Community Energy will leverage CEC funds, MCE's existing program incentives, California's Self-Generation Incentive Program (SGIP), and low-to-no interest financing options through MCE's partnership with the National Energy Improvement Fund (NEIF).

The VPP will allow MCE to aggregate and dispatch DERs to manage critical peak loads, minimize procurement costs, and - as market opportunities evolve - generate value in wholesale markets. The VPP will also:

- Increase the deployment of DERs to align with local energy management plans,
- Relieve local grid congestion,
- Reduce load,
- Mitigate the need for future gas-fired peaker plants and other non-renewable generation
- Provide direct device-level data to evaluate effectiveness of automated versus behavioral solutions
- Increase demand-side management,
- Increase efficiency through envelope measures (e.g. enhanced home insulation and solar) coupled with high performance equipment and appliances,
- Increase clean backup power and resiliency that enables local grid management
- Provide valuable services to MCE such as flexible ramping and peak shifting, and
  Lower costs for participating VPP customers through automated load shaping, minimizing the grid's dependency on behavioral change.

The buildout and operation of MCE's Virtual Power Plant will take place in three phases.

1. Phase 1: The first two years of the pilot will build and test the structure necessary for energy data from customer-owned DERs to move through the grant partners MCE to our scheduling coordinators. With assistance from forecasting models and artificial intelligence, MCE could then automate or send dispatch signals that shape on-site load to save the customer money by shifting load to off-peak hours, proactively reduce local grid strain, and reduce carbon intensity of the grid. **The proposed Draft Electric Schedule VPPT is specific to this phase of the program implementation.**

2. Phase 2: Determined by the success of the first phase, the Tariff would be updated to allow MCE to bid the aggregated load into the California Independent System Operator (CAISO) marketplace. Financial benefits of this participation would be shared with the customer. The second phase of this tariff will require approval from the Board or a Committee.

3. Phase 3: Determined by the success of the second phase, the VPP would expand outside of Richmond to include MCE's full service area, opening up participation to the existing suite of DERs including roughly 55,000 solar systems and 7,000 battery energy storage systems.

The Technical Committee approved implementation of an energy storage tariff, Electric Schedule PBST (Pilot Battery Storage Tariff) in late 2016 which was then superseded by the approved Electric Schedule EST (Energy Storage Tariff) in late 2020. The proposed Draft Electric Schedule VPPT - Virtual Power Plant Tariff (Attachment A) would build upon these tariffs to provide VPP participants with monthly bill credits in exchange for remote control and dispatch capability.

<u>SUMMARY:</u>

Participating customers would be billed in accordance with their otherwise-applicable MCE rate schedule. DER equipment would be required to maintain a connection to the VPP so that MCE can remotely monitor, manage, and dispatch the technologies according to the Tariff. Participants may not be enrolled in other DER aggregation or demand response programs.

In addition, participants served under this Tariff would receive a monthly credit on their billing statement determined as follows.

Residential Credits
Monthly credits will vary depending on the number and type of DERs installed, as outlined in the Residential Monthly Advanced Payment (RMAP) Product Menu – ranging from $2 to $20 per device per month. This is capped at either $40 or $50 monthly credits, depending on whether or not customers are enrolled in the California Alternate Rates for Energy (CARE) or Family Electric Rate Assistance (FERA) discount programs.

Commercial and Industrial (C&I) Credits
Commercial Monthly Advanced Payment (CMAP) bill credits would be calculated with the Load Reduction Calculation methodology described in the Tariff and capped at $300 for commercial customers and $750 for industrial customers.

The CMAP calculation was developed to protect against overpayment until actual data is received and reconciled, providing more certainty in the reliability of DER dispatchability.

If participating C&I customers generate more credit during the program year than has been paid through the monthly CMAP credits, they can receive an annual true-up bill credit of the balance owed, measured by the total kWh of flexible load delivered over the course of the previous year. There is no penalty if participants generate less credit than has been paid in the CMAP.

The proposed Draft Electric Schedule VPPT includes three special conditions in which MCE would modify operations in response to outages and loss of connectivity. These conditions are inherited from Electric Schedule EST.

FISCAL IMPACTS: The maximum cost of bill credits provided by this Tariff would be approximately $240,000 annually in the two years of phase one. Billing system development and testing costs would be a one-time cost estimated to be no more than $10,000.

RECOMMENDATION: Approve Electric Schedule VTTP – Virtual Power Plant Tariff.

Initial Electric Schedule for Pilot Virtual Power Plant Tariff (VPPT)

APPLICABILITY: The Virtual Power Plant Tariff (VPPT) is available only to City of Richmond MCE customers that have executed the MCE Virtual Power Plant Agreement (VPPA), and that have installed one or more qualified and fully operational distributed energy resource (DER) using an MCE-authorized Designee, with remote monitoring and dispatchable direct load control capabilities, behind the customer's utility electric meter, as verified by MCE. Customers that participate in MCE's Virtual Power Plant (VPP) Pilot can reduce their annual electricity costs, increase their resiliency, contribute to improving the health of their local grid conditions, support the advancement of cutting-edge innovative energy technology, while also earning valuable monthly bill credits for participation through this pilot tariff.

SERVICE AREA: This schedule is available to MCE customers in the City of Richmond.

SUBSCRIPTION LIMIT: Subscription to this schedule is limited to 200 customers.

ELIGIBILITY: This optional schedule is available to MCE customers that meet the conditions detailed below.

To be eligible for the VPPT, a customer must meet and maintain the following requirements:

1. Customers must have an active MCE residential, commercial, or industrial account with a Richmond service address, that is in good standing.

2. The customer account may not be enrolled in utility or third-party demand response programs or other behind-the-meter DER aggregations, including MCE's programs like Peak FLEXmarket. Accounts that are enrolled in a utility or other third-party demand response program or aggregation must disenroll in the third-party program prior to enrolling in the Pilot. Enrollment can be determined using a standard form, the Customer Information Service Request (CISR) form.

3. Customers participating in the Pilot must comply with the terms and conditions described in their governing VPPA, and have installed a qualified and fully operational DER compatible for monitoring and dispatchability by MCE pursuant to this tariff.

4. Customer DER installations must be compliant with the rules, stipulations, and restrictions of all manufacturer warranties and state and local codes and regulations, including applicable interconnection requirements. By enrolling in the Pilot, customers warrant that they have all necessary authorizations and authority to enroll, and have provided any necessary notices to property owners, managers, or other stakeholders.

5. Customers must be enrolled in one of the following rate schedules:
    a. Residential: E-TOU-A, E-TOU-B, E-TOU-C, E-TOU-D, EV2, E-6 and EM-TOU.
    b. Commercial: B-1, B1-ST, B-6, B-10, B-19, B-20, BEV and SB.

   Other rate schedules as determined by MCE will be noted at www.mcecleanenergy.org/rates

6. Customers who change onto an ineligible rate schedule will be removed from the Pilot and VPPT, and monthly bill credits will be discontinued immediately.

7. Customers must have an installed revenue grade meter, such as an AMI Meter (aka- "Smart Meter"), MV-90 Meter, or equivalent load meter capable of providing 15-minute interval data.

8. Customers must provide any information reasonably requested by MCE or its authorized designees that is necessary for MCE to administer this VPPT, such as specifications for pre-existing DER installations.

9. If a participating customer opts-out of MCE service, the customer will be immediately removed from the VPPT on the effective date of the optout and will be ineligible for further bill credits, as well as any applicable Program Year True-Up Payment, as defined below.

10. All customers taking service under the VPPT must have their DER located behind the utility electric meter and the enrolled DERs must be fully operational for as long as they remain on the VPPT. If the customer anticipates that the DER will become non-operational for any reason for a period longer than 30-days, the customer must notify MCE at least 30-days prior to the start of the period of non-operation and provide MCE with the expected start and end dates of the non-operation. In such instances, and subject to MCE's verification and approval, MCE may suspend bill credits for up to 90-days. If the DER becomes non-operational for longer than 30-days, and the customer has not received approval for a temporary suspension of the bill credits, the customer may be removed from this VPPT and the bill credits will be discontinued immediately. If a DER unexpectedly becomes unresponsive, the customer may receive a notice via email from MCE or an MCE-authorized designee alerting them to the malfunction. Notified customers will have 30 days from the date of their notice to reconnect the unresponsive DER before MCE may disenroll the customer from the Pilot and terminate future bill credits.

11. Customers participating in the Pilot and who have completed a VPPA, agree to allow MCE and its authorized designees, to operate the DER consistent with this tariff and the Pilot rules and guidelines contained in the VPPA. A participating customer shall allow MCE to operate the DER at MCE's discretion, subject to the following limitations:

    a. MCE may, at its discretion, dispatch the DERs (i.e., charge, discharge, load shift, load shed, load shape, load shimmy, and/or otherwise affect asset behavior), no more than recommended by the applicable DER vendor and/or manufacturer's warranty, except as outlined in the Special Conditions a and b below.

    b. MCE and partners intend to program the DERs to shift customer load to non-peak hours to reduce cost and reliance on fossil fuel, except as described in Special Condition a below.

    c. If connectivity to MCE's VPP is lost (including due to unplanned outages, emergencies, or other instance), DERs will be preprogrammed to go into an autonomous, self-operating mode until the situation is resolved and connectivity is resumed; see Special Conditions a, b, and c below.

16. MCE reserves the right to withhold incentives for any participating customers determined to be violating the rules of the Pilot and/or the terms and conditions of the governing VPPA.

17. Customers may elect to disenroll from the Pilot and stop participation in VPPT at any time by contacting MCE at: virtualpowerplant@mcecleanenergy.org. All applicable terms and conditions of the governing VPPA will apply to any withdrawal. Termination of participation in VPPT, and the credits for participation, will be effective at the end of the customer's current billing cycle.

18. All customers participating in the Pilot may elect to continue service under the VPPT upon expiration of their existing VPPA, through execution of a new VPPA.

Special Conditions for Customers Participating in the Pilot:

a) Public Safety Power Shutoffs. In the event that PG&E calls a pending Public Safety Power Shutoff event (PSPS) in the vicinity of a customer, MCE will attempt to charge the participating energy storage system (ESS) that are expected to be impacted by the outage to full capacity in advance of the PSPS event. If necessary, MCE may charge the ESS to full capacity during any time of day, including "peak" periods, to maximize resiliency benefits for customers. Once the PSPS event has been resolved, and power has been restored, MCE will resume its normal dispatching of all DERs.

b) Unplanned Grid Outages. MCE will instruct the participating DERs to operate independently in the event of an unplanned outage of the electric grid. If the DER is an ESS, it will be charged using on-site generation resources if available, and only discharged to provide power for on-site usage. Once grid power has been restored, MCE will resume its normal dispatching of the DER.

c) Loss of Connectivity. It is the customer's responsibility to ensure continued connectivity of the DERs to the MCE VPP. If MCE loses connectivity to a DER, such as due to interruption of internet or cellular connection, the DER will revert to autonomous control until connectivity is restored.

RATES AND INCENTIVES:

Rate Schedule: All usage billed under this schedule will be in accordance with the customer's otherwise-applicable MCE rate schedule.

Monthly Bill Credits: In addition, customers served under this schedule will receive a performance payment in the form of a monthly bill credit. The monthly bill credit amount will be determined as follows:

Residential MCE VPP Customer

Residential customers are compensated for participation in the MCE VPP Pilot based upon the number and type of DER devices enrolled by the customer in the Pilot, as detailed below. Equipment specifications (including make, model, etc.) will be detailed in the customer agreement. This Residential Monthly Advanced Payment (RMAP) will be paid monthly, subject to the maximum credit amount listed below, in the form of a bill credit. The monthly bill credit amount will be based on the RMAP Product Menu below.

RMAP Product Menu:

- $2/month per enrolled smart major appliance (limited to eligible washers, dryers, dishwashers, refrigerators, freezers, and smart outlets with ≥ 1kW load)

- $5/month per enrolled eligible HAN/Smart Gateway
- $5/month per enrolled eligible smart thermostat (limited to all-electric HVAC systems)
- $5/month per enrolled eligible Mini-split air conditioner
- $5/month per enrolled eligible heat pump hot water heater
- $10/month per enrolled eligible Level 2 EV charger
- $20/month per enrolled eligible bi-directional (i.e., V2B, V2G, V2X) Level 2 electric vehicle charger
- $10/month per enrolled eligible battery energy storage system under 20 kWh
- $20/month per enrolled eligible battery energy storage system over 20 kWh

The maximum RMAP bill credit for an eligible Residential California Alternate Rates for Energy (CARE) or Family Electric Rate Assistance (FERA) customers is $50. The maximum RMAP bill credit for all other eligible Residential customers (i.e., who are <u>not</u> on a CARE or FERA rate schedule) is $40.

<u>Commercial or Industrial MCE VPP Customer</u>

Commercial and Industrial customers are paid a Commercial Monthly Advanced Payment (CMAP) in the form of a bill credit as well as an annual performance payment of $0.11 per kWh of measured load flexibility shift that is delivered to MCE's VPP annually. The monthly bill credit amount will be based on the CMAP Load Shift Calculation methodology and subject to the maximum credit amount. CMAP will be calculated for the Program Year (January 1st through December 31st) in which a customer is enrolled in the Pilot.

At the end of a Program Year, if the customer has generated more credit during the Program Year than has been paid to the customer through their CMAP for that Program Year, the customer is eligible to receive the balance owed, subject to the maximum bill credit amounts listed below (Program Year True-Up Payment). The Program Year True-Up Payment will be paid out as an additional bill credit prior to March 31st of the following Program Year. The calculation, as detailed below, is based on the total kWh of flexible load delivered to MCE's VPP, using MCE's Measurement and Verification (M&V) method and independently validated through third-party audit (as detailed in the VPPA).

CMAP Load Shift Calculation:

A. FIRST PROGRAM YEAR: In the First Program Year that the customer enrolls in the Pilot, MCE and/or MCE Authorized Designee will provide an Estimated Annual kWh of Load Shift for the proposed installations. Customer will receive a monthly bill credit valued at 33% of the Estimated Annual kWh Shift multiplied by $0.11, then divided by 12, subject to the maximum bill credit listed below.

B. AFTER THE FIRST PROGRAM YEAR: For each Program Year thereafter, the previous Program Year's actual verified kWh of Load Shift, as validated annually through MCE's M&V method, will be used to set the Delivered kWh of Load Shift Amount. Customer will receive a monthly bill credit valued at 50% of the DKRA multiplied by $0.11, then divided by 12, subject to the maximum bill credit listed below.

The maximum CMAP bill credit for an eligible commercial customer to receive is $300. The maximum CMAP bill credit for an eligible industrial customer to receive is $750.

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX D: Virtual Power Plant Agreement

May 2026 | CEC-500-2026-013

Appendix D:
Virtual Power Plant Agreement

MCE Internal Use Only: Group 1 ☐	Group 2 ☐	Group 3 ☐

Marin Clean Energy (MCE) Virtual Power Plant Agreement (VPPA) Cover Page

A. Participant Information

Participant Name		Contact Name (if Participant is an entity)
Title (if applicable)	Phone	e-mail

B. Project Developer (MCE Authorized Designee)

Company Name	Contact Name	Phone & e-mail

C. Project Installer (Subcontractor to Project Developer and is an MCE Authorized Designee, if applicable)

Company Name		
Contact Name	Phone	e-mail

D. Project Site Information

Site Address	City	State	Zip
Last 4 digits for each of the PG&E Service Account ID (SAID) Number(s) for the building(s) where equipment will be installed. ___ ___ ___ ___ // ___ ___ ___ ___ // ___ ___ ___ ___ Eligible electric Rate Schedule per Virtual Power Plant Tariff *(as of date of agreement)*: ____________ Attachments: ☐ Proof of change to a rate schedule eligible for the Virtual Power Plant Tariff (if applicable)			

E. MCE Battery Energy Storage System (BESS) Gap Funding

$ ***Total Cost of BESS***	BESS Installer:
$ ***MCE BESS Rebate Amount***	Payee*:

F. Richmond Advanced Energy Community Grant Funding Allocation

$ ***Total Grant Funding Allocated***	Payee*:

G. Monthly Bill Credit for Distributed Energy Resource (DER) Management and Control

(Residential Participants, insert Total Monthly RMAP from Worksheet A; Non-Residential Participants, insert 1st Year CMAP Amount in Worksheet B, Line c)

$ /month	Last four digits of SAID Number*: ________________ **Payee*:** ________________________

**If Payee is someone other than the Participant, then Participant must assign the funding, bill credit, and/or true-up payment to the third-party Payee via executing the Virtual Power Plant Funding Assignment Agreement attached hereto as part of this Agreement. ☐Virtual Power Plant Funding Assignment*

H. Term

Term Duration (years from Commercial Operation Date):	Estimated Commercial Online Date:

I. Installation Deadline

All work related to this Agreement must be installed and Fully Operational no later than ________. Failure to meet this deadline due to withdrawal or delay due to actions and/or inaction by Participant may result in adjustment or forfeiture of MCE Agreement Funding hereunder.

J. Participant Agreement and Signature

This Agreement is made and entered into by and between Marin Clean Energy ("MCE") and Participant as of the date of execution of the agreement. By my signature below, Participant represents to MCE that (i) Participant has read, understands, and agrees to be bound by the terms, conditions and requirements of this contract between MCE and Participant (including this Cover Page, the Virtual Power Plant Agreement Terms, and all attachments hereto) ("Agreement") and the Conditions and Requirements of the Virtual Power Plant Tariff, (ii) if Participant is an entity rather than an individual, its authorized representative listed below ("Authorized Representative") has the authority to sign this Agreement on behalf of the Participant, and (iii) all accompanying Project documentation is complete, true, and accurate to the best of my knowledge.

Consent to Electronic Disclosure and Contracting. By signing below, Participant consents and agrees to receive electronically all communications, agreements, documents, notices, records, legal disclosures, and other information (collectively, "Electronic Records") that MCE provides in connection with this Agreement. Participant further agrees and consents to the use of electronic signatures (such as clicking, checking, signing using a digital pen, or otherwise manifesting assent) in the processing of Electronic Records. Participant has the right to withdraw this consent at any time by calling 1 (888) 632-3674 or emailing info@mcecleanenergy.org. Participant must notify MCE of any change in Participant's e-mail address by using the contact information above.

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Consent to Sharing Agreement with MCE Authorized Financer (Only Applicable for Residential Customer Participants). By signing below, Participant hereby consents and agrees to the provision of this Agreement and/or data contained in this Agreement to the National Energy Improvement Fund ("NEIF") for evaluation of your eligibility for financing of the Project. Any such financing arrangements shall be negotiated and subject to a further agreement between Participant and NEIF. If you are approved, financing will be provided by NEIF.		
Authorized Representative of Participant *(if Participant is an entity, please print)*	Title	Date
Signature of Participant or Authorized Representative of Participant *(if Participant is an entity)*		

Virtual Power Plant Agreement Terms, Conditions and Requirements

1. **Overview.** MCE's Virtual Power Plant Pilot (VPP Pilot) provides certain payments and funding options to MCE customers installing behind-the-meter Distributed Energy Resources in exchange for MCE to have the ability to monitor and dispatch the Distributed Energy Resource to reduce local peak demand, reduce overall cost of service to eligible customers, reduce greenhouse gas emissions, and provide resiliency benefits for eligible customers during grid outages.
2. **Definitions.**
   a. "**Agreement**" refers to this Virtual Power Plant Agreement, including the Cover Page, the Virtual Power Plant Agreement Terms, Conditions and Requirements and all attachments hereto
   b. "**CPUC**" refers to the California Public Utilities Commission
   c. "**DERMS**" refers to MCE's distributed energy resources management system
   d. "**DER**" refers to one or more behind-the-meter Distributed Energy Resources installed within the Project
   e. "**Fully Operational**" refers to all the following occurring: (1) the DER has been completely installed at the Site; and (2) the Participant has received utility's permission to operate the DER; and (3) MCE has verified that the participating DERs are successfully connected to MCE's VPP.
   f. "**MCE**" refers to Marin Clean Energy or its contractors, subcontractors or agents
   g. "**MCE Agreement Funding**" has the meaning set forth in Section 12.b
   h. "**MCE Authorized Designee**" refers to a vendor that has been approved by MCE or its VPP Pilot Implementer to work in the VPP Pilot and is identified on the Cover Page
   i. "**M&V**" refers to measurement and verification
   j. "**Participant**" has the meaning set forth on the Cover Page
   k. "**Party**" (individually) or "**Parties**" (collectively) refers to MCE and Participant
   l. "**Personally Identifiable Information**" refers to any information that relates to an identified or identifiable individual, including, but not limited to, an individual's name, address, telephone number, email address, or as otherwise recognized as "personal information," "personal data," or "personally identifiable information" in accordance with applicable laws and regulations
   m. "**Project**" refers to the design, engineering and installation of the DER pursuant to the terms of this Agreement as described in Section E. of the Cover Page
   n. "**Project Developer**" refers to an MCE-authorized installer of the DER and can be an MCE Authorized Designee
   o. "**Qualifying DER**" refers to a DER supplied by an MCE Authorized Designee that is capable of being controlled by MCE's DERMS
   p. "**Site**" refers to the site (or sites) where the DER will be located
   q. "**Tariff**" or "VPPT" refers to the MCE Virtual Power Plant Tariff (VPPT) applicable to Participants of the Virtual Power Plant Pilot
3. **Agreement Eligibility.** Participants must, for the Term of the Agreement: (i) be and remain an active MCE customer and (ii) meet and maintain all Agreement requirements herein and those listed in the Virtual Power Plant Tariff.
4. **Authorization.** Participant must be authorized to approve the installation of a DER, including any necessary modifications to the electrical system, either: (i) as the legal Site owner; (ii) as the duly authorized representative of the Site owner; or (iii) with prior, written authorization and approval from the legal owner of the Site.
5. **Ownership.** Participant must be the owner and title holder to the DER during the Term of the Agreement, unless agreed to otherwise in writing by MCE. If the site has a solar panel system owned by a person or entity other than the Participant, MCE must be notified immediately. MCE does not anticipate that its control of the DER will interfere with the operation of the solar panel system or impact the terms of any agreement with the third-party owner of the solar panel system (i.e., a lease, prepaid lease, or power purchase agreement), however MCE does not guarantee that this Agreement does not conflict with any agreement with a third-party owner of the solar panel system and takes no responsibility or liability for any such conflict. Participant is solely responsible for confirming the terms of any agreement with the third-party owner of the solar panel system does not conflict with this Agreement and obtaining any required consent to this Agreement of the third-party owner of the solar panel system.
6. **DER Requirements.** Participant agrees to: (i) install a Fully Operational Qualifying DER with equipment and/or software using an MCE Authorized Designee (ii) provide the DER with continuous access to a functioning broadband internet connection with a speed of at least 1 Mbps with one (1) wired Ethernet port (preferred), a wireless Internet connection and standard electrical outlet, or its own mobile data connection.
7. **DER Operations.** Participant agrees to operate and maintain the DER and all associated equipment in accordance with the rules, stipulations and restrictions of all manufacturer requirements and warranties as well as all State and local codes and regulations.

Participant is responsible for operation and maintenance of the DER and therefore must provide for or arrange for the provision of operations and maintenance services on the DER. Except for any required shutdowns for safety or maintenance, Participant further agrees to ensure that the solar panel system is operated and maintained such that it is generating at its expected capacity (as per manufacturer's projections) during the Term.

8. **No Modification of DER.** Participant may not modify, disconnect, or uninstall the DER equipment and/or software during the Term, unless required for maintenance, repair, or safety reasons and Participant has provided advance notice to MCE (if possible, due to safety considerations), after which the DER must be restored to original condition, connection, and specifications. Participant must notify MCE immediately if there have been any modifications to the DER equipment and/or software by any person or entity, or if there has been any damage to or removal of the DER. Notwithstanding the foregoing, manufacturer-recommended software upgrades are permitted without needing to notify MCE, so long as such upgrades do not impact MCE's ability to monitor and control the DER.
9. **Site Access and Inspections.** Participant agrees to allow MCE, and/or MCE Authorized Designee, access to the Site during reasonable hours and upon reasonable notice during the Term to: (i) specify, install, operate, maintain, repair and remove equipment used to measure Project-related kW Usage; (ii) perform Agreement related audits; and (iii) perform Agreement-related inspections. MCE Authorized Designee may conduct a Site inspection during installation or after installation is complete. If the MCE Authorized Designee determines that the DER was not installed in a manner consistent with the approved Project or within the provisions of this Agreement, or Participant has taken measures that counter the Agreement's goals such as going off-grid or removing the DER from Site, MCE may, at its sole discretion, require immediate repayment of the MCE Agreement Funding and/or eliminate future MCE Agreement Funding. MCE Authorized Designees may perform up to two (2) inspections per year during the Term.
10. **Measurement and Verification Equipment.** MCE Authorized Designee will develop an M&V plan for the purpose of measuring DER performance and subsequent energy savings from deployed use cases subject to the limitations of the Tariff, on an ongoing basis for the Term of this Agreement. Participant agrees: (i) to allow MCE and/or MCE Authorized Designee to install M&V equipment; and (ii) to allow for such equipment to remain in place and functional for the entire Term of this Agreement; and (iii) not to remove, modify, or tamper with installed M&V equipment. MCE may modify the M&V conditions in the Tariff from time to time in its sole discretion.
11. **Project Installation.** The Project must be developed and installed by an MCE Authorized Designees. Participant is responsible for negotiating an installation contract with the Project Developer or MCE Authorized Designee, monitoring the work, and managing and resolving any disputes that may arise between Participant and Project Developer or MCE Authorized Designee with respect to the contract or the work performed under the contract. Participant shall require its Project Developer or MCE Authorized Designee to install the DER in accordance with all applicable federal, California State and local law. MCE does not guarantee or warranty, and is not responsible for, any acts or omissions of any Project Developer or MCE Authorized Designee.
12. **Available Funding.**
    a. SGIP Incentives. Eligible Participants or Project Developer may apply for incentives from PG&E's Self-Generation Incentive Program (SGIP). SGIP is a CA State-funded Program that provides financial incentives for installing on-site electrical generation and storage systems. Eligibility and receipt of SGIP incentives is solely determined by the SGIP program administrator.
    b. MCE Agreement Funding. Participant understands and agrees that their eligibility to receive any MCE Agreement Funding, if applicable, or the eligibility of MCE Authorized Designee or its Subcontractor to receive any MCE Agreement Funding, if applicable, requires compliance with the terms and conditions of this Agreement for the full Term. MCE Agreement Funding includes all amounts provided to Participant from this Section 12 b. pursuant to this Agreement. Pursuant to Section 14, MCE may require repayment of DER Gap funding, PV Gap funding, and/or Richmond Advanced Energy Community Grant Funding on a pro-rated basis:
        i. DER Gap Funding as set forth on the Cover Page to cover some of the DER costs not covered by SGIP and other incentives, depending on SGIP eligibility rules and final award of funds and determined on a case-by-case basis. Gap Funding is provided in return for integration with the MCE DERMS.
        ii. Solar Photovoltaic (PV) Gap Funding Participants may be eligible for additional MCE Agreement Funding as indicated on the Cover Page for installing a Solar PV with GRID Alternatives, or other MCE Authorized Designee.
        iii. Richmond Advanced Energy Community Grant Funding as set forth on the Cover Page to cover a portion of the DER costs not covered by SGIP, MCE Gap Funding and other applicable incentives, depending on SGIP eligibility rules and final award of funds, and determined on a case-by-case basis.
        iv. DER Management & Control Payments: Participants are eligible to receive a monthly bill credit as defined in the Tariff and pursuant to the applicable Worksheet A or B, attached. Non-Residential Participants are eligible for an additional Program Year True-Up Payment as defined in the Tariff and Worksheet B paid annually once Fully Operational. MCE reserves the right to change the Tariff at any time for any reason.
    c. Cap on Total Funding. The combined total of MCE Agreement Funding and any other incentives (including, but not limited to SGIP incentives and Investment Tax Credit, if applicable) received for the Project shall not exceed the Total Eligible Project Costs, as defined in the current SGIP Handbook. If Participant is not receiving SGIP Incentives, the total of MCE Agreement Funding and any other incentives cannot exceed 100% of the DER costs.

13. **Term.** Standard terms are 5 years for residential sites and 7 years for non-residential sites. Term end date will be 5 or 7 years, as indicated based on the Cover Page, from the latter of (1) Participant receives utility's permission to operate the DER, if applicable and (2) DERMS software platform is installed and enabling MCE to monitor and control the DER. For clarity, the Term Start Date is the date Participant signs this Agreement.
14. **Early Termination.** If MCE terminates this Agreement pursuant to the terms set forth in Section 15, or if Participant terminates this Agreement prior to the end of the Term, MCE may, at its sole discretion, require immediate repayment of the MCE Agreement Funding. Upon termination, all monthly bill credits and any applicable Program True-Up Payment will terminate.
15. **Breach of the Agreement.** If Participant does any of the following, it shall constitute a material breach of this Agreement by Participant ("Breach"): (a) Participant opts out of MCE service; (b) Participant abandons the Site, or for any reason other than selling, leasing or renting the Site to another MCE customer, terminates service with MCE; (c) Participant modifies, removes, disconnects, decommissions, fails to properly maintain or operate the DER or has the DER interconnection agreement revoked for any reason; (d) the DER is destroyed or damaged other than as a result of the negligence of MCE; or (e) the DER is not installed by the Installation Deadline set forth on the Cover Page. In the event of a Breach that has not been resolved by Participant within ten (10) days of such Breach, MCE shall have the right to terminate this Agreement and MCE may, at its sole discretion, require immediate repayment of the MCE Agreement Funding and/or eliminate future MCE Agreement Funding.
16. **Command and Control of the DER.** As a condition of participating in the Agreement and receiving any Agreement Funding, Participants must allow MCE to monitor and control the DER for the Term of this Agreement.
    a. MCE Control. Participant agrees MCE will be the sole entity controlling and dispatching the DER for the Term and agrees not to allow any other person or entity to control DERs interconnected at this Site.
    b. Dispatching DER. MCE will dispatch the DER at its discretion subject to the limitations defined in the Tariff and as applicable, the requirements of the California Independent System Operator ("CAISO") Open Access Transmission Tariff ("OATT").
    c. Access to DER Data. Participants agree to provide access to the DER telemetry and usage data for the Term of this Agreement. Such data includes, but is not be limited to information regarding how frequently the DER operates, charges and discharges, the timing and amount of such operation, and may include data relating to the solar panel system production or Site's energy usage (hereinafter, collectively referred to as the "Data"). Participants consent to MCE's collection, processing, use, and retention for its own purposes of any Data in de-identified and aggregated form, including Data collected under this Agreement, or derived from participation in this Agreement. Participants acknowledge, agree and, to the extent necessary or appropriate as determined in MCE's sole discretion, provide consent to MCE for MCE to obtain such Data in de-identified and aggregated form. Without limiting the generality of the foregoing, MCE will not disclose Data without the consent of Participant, except in the following circumstances: (1) to MCE's agents, independent contractors and subcontractors as necessary in connection with MCE's performance under the Agreement; (2) where the Data does not contain Personally Identifiable Information (including where Data has been de-identified or aggregated); (3) if MCE is required to do so by any law or regulation or in the good-faith belief that such action is necessary to comply with any law, regulation, order or other legal process; (4) if MCE believes, in good faith, disclosure is appropriate or necessary to (A) take precautions against liability, (B) protect MCE or others from fraudulent, abusive, or unlawful uses or activity, (C) investigate or defend against any third-party claims or allegations or (D) protect the security or integrity of MCE's services and any facilities or equipment used to make MCE's service available.
    d. CAISO Participation. MCE, at its sole discretion and without requiring any additional approvals from or notice to Participant, may enroll or disenroll the DER in any program, product, or market (including any distributed energy resource aggregation) under the CAISO OATT. MCE shall be entitled to all revenue received from the DER's participation in such program, product, or market.
17. **Indemnification.** MCE shall have no liability for any claims arising from work performed by Project Developer or MCE Authorized Designee, including, but not limited to, damage to the Site, the DER or any persons or property at or about the Site, or the performance of the DER. MCE shall have no liability for any claims or damages caused by the DER, including, but not limited to, any defects therein. Participant hereby releases MCE from any claims or liabilities relating to the installation of the Project. To the fullest extent permitted by applicable law, Participant shall indemnify, defend, and hold MCE and its employees, officers, directors, authorized designees, and agents, harmless from and against any and all actions, claims, liabilities, losses, costs, damages, and expenses (including, but not limited to, litigation costs, attorney's fees and costs, physical damage to or loss of tangible property, and injury or death of any person) arising out of, resulting from, or in connection with the Agreement by any actual or alleged act or omission of Participant, Project Developer, MCE Authorized Designee, or any subcontractor, agent, or third party, or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.
18. **LIMIT OF LIABILITY.** MCE AND PARTICIPANT WAIVE ANY AND ALL CLAIMS AGAINST EACH OTHER FOR INCIDENTAL, CONSEQUENTIAL, SPECIAL, MULTIPLE, AND PUNITIVE DAMAGES ARISING OUT OF OR RELATING TO THIS AGREEMENT, REGARDLESS OF WHETHER SUCH DAMAGES WERE FORESEEABLE AND WHETHER OR NOT THE CULPABLE PARTY WAS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. MCE'S TOTAL AGGREGATE LIABILITY TO PARTICIPANT UNDER THIS AGREEMENT ON ALL CLAIMS OF ANY KIND ARISING OUT OF OR IN ANY WAY RELATED TO THIS AGREEMENT, INCLUDING, BUT NOT LIMITED TO, NEGLIGENCE, ERRORS, OMISSIONS, STRICT LIABILITY, INDEMNITY, OR BREACH OF CONTRACT, IS LIMITED TO THE MCE AGREEMENT FUNDING PAID TO PARTICIPANT UNDER THIS AGREEMENT.

19. **No Warranty.** MCE DOES NOT WARRANT OR GUARANTEE (1) THE AMOUNT OF ENERGY PRODUCED BY THE DER FOR ANY PERIOD, (2) ANY COST SAVINGS, OR (3) THE EXISTENCE OF OR PRICING ASSOCIATED WITH ANY NET METERING AGREEMENT, OR UTILITY OR GOVERNMENT INCENTIVE AGREEMENT. CUSTOMER LOAD, ELECTRICITY RATES AND RATE STRUCTURES ARE SUBJECT TO CHANGE. PROJECTED SAVINGS FROM THE DER ARE THEREFORE SUBJECT TO CHANGE. TAX INCENTIVES ARE SUBJECT TO CHANGE OR TERMINATION BY EXECUTIVE, LEGISLATIVE OR REGULATORY ACTION.
20. **Removal of Equipment.** Participant agrees to remove and dispose of any batteries and/or equipment being replaced by the DER in accordance with all laws, rules, codes and regulations. Participant agrees not to reinstall the DER anywhere in California or transfer it to any other party for installation in California for the Term of the Agreement.
21. **Miscellaneous.**
    a. Agreement/Terms and Conditions Changes. The VPP Pilot may be modified, suspended or terminated by MCE at any time, without prior notice. In the event of termination of this VPP Pilot, MCE or its Authorized Designees shall be granted immediate access to the Site in order to remove M&V Equipment.
    b. Taxes. Participant shall be responsible for the payment of any and all taxes associated with the Project or incurred as a result of the SGIP incentives, Monthly Bill Credits, Program Year True-Up Payment, or any MCE Agreement Funding.
    c. Insurance. Participant has and agrees to maintain during the entire Term customary property and liability insurance with respect to the Site, including sufficient coverage for any damage to the Solar Panel System and/or the DER.
    d. Use of Non-Usage Data. Participant agrees to allow MCE and its authorized contractors and agents to use Participant's name, Site location, size of DER installed, and any other information gathered as part of participating in the Agreement ("Non-Usage Data") for use in regulatory and grant reporting, ordinary business use, industry forums, case studies or other activities deemed necessary to MCE.
    e. Acknowledgment. Participant agrees to have MCE designed stickers containing MCE's logo and/or the generation service (i.e., Light Green, Deep Green, Local Sol) placed on the installed DER. The applicable stickers will be provided by MCE and Participant authorizes MCE and/or its MCE Authorized Designee to place such stickers on the installed DER.
    f. Amendment. This Agreement may not be amended without the mutual, written agreement of both Parties.
    g. Assignment. This Agreement may not be assigned by either MCE or Participant without the prior written consent of the other party, not to be unreasonably withheld, conditioned, or delayed. Subject to ten (10) days prior written notice, Participant may assign this Agreement if the new Site owner or lessee enters into a written assignment and assumption agreement assuming all the obligations of Participant prior to the transfer of Site ownership or control.
    h. Jurisdiction and Venue. This Agreement shall be construed in accordance with the laws of the State of California and the Parties hereto agree that venue shall be in Marin County, California.
    i. Survival. The following sections will survive the termination of this Agreement: 11, 15, 17-20.
    j. Severability. In the event any provision in this Agreement is found to be legally invalid or unenforceable, that provision will be revised to the degree allowed by law to give it the maximum effect allowed by law, or, if revision is not possible, will be severed and the remaining provisions of this Agreement will remain in full force and effect.

Worksheet A

Residential MCE VPP Customer

This Worksheet is to be completed by a Project Developer or MCE Authorized Designee who is authorized to provide services relating to MCE's Virtual Power Plant Pilot.

Residential Monthly Advance Payment (RMAP)					
DER Classification	**Make and Model**	**Quantity**	**Monthly Bill Credit per unit**	**kW Capacity**	**Line-Item Bill Credit**
Smart Refrigerator			$2		
Smart Freezer			$2		
Smart Outlet* *(*with 1 kW minimum peak load)*			$2		
Smart Thermostat			$5		
HAN/Smart Gateway			$5		
Mini-split			$5		
Heat-Pump Water Heater			$5		
Level 2 EV Charger			$10		
Bi-directions Level 2 EV Charger			$20		
ESS under 20kWh			$10		
ESS larger than 20kWh			$20		
			Total kW Capacity:		
TOTAL MONTHLY RMAP:** *(**Maximum monthly RMAP is $50 for CARE and FERA customers. Maximum monthly RMAP is $40 for non-CARE and non-FERA customers)*					$

Worksheet B

Commercial MCE VPP Customer

This Worksheet is only to be completed by a Project Developer or MCE Authorized Designee who is authorized to provide services relating to MCE's Virtual Power Plant Pilot.

First Year CMAP and Program Year True-up Payment	
Estimated Total Annual kWh of Load Shift:	a.
Estimated Total Annual Performance Payment - multiply Line a. by 0.11:	b.
First year's CMAP* - multiply Line b. by 0.33 and divide by twelve:	c.
Program Year True-Up Payment - Calculation Below	
Program Year Verified Total Annual kWh of Load Shift:**	d.
First Year Annual Performance Payment - multiply Line d. by $0.11:	e.
Number of program participation months this program year (Jan.1st to Dec. 31st):	f.
Total annual CMAP - multiply Line c. by line f.:	g.
Program Year True-Up Payment - subtract line g. from Line e:	h.

**Maximum monthly CMAP $300 for customers on a commercial rate schedule. Maximum monthly CMAP $750 for customers on an industrial rate schedule.*
***Total kWh of measured load shift delivered to the MCE VPP during each Program Year (January 1st to December 31st) will be verified by MCE and its program partners at the conclusion of each program year using the MCE approved Measurement and Verification methodology, which will be independently validated through third-party audit. The Program Year True-Up Payment will be delivered to participating customers no later than March 31st of each applicable program year.*

After First Year CMAP and Program Year Annual Performance Payments	
Total Delivered Annual kWh of Load Shift in previous year (verified kWh from Line d.):	i.
Estimated Annual Performance Payment - multiply Line i. by 0.11:	j.
After First Year CMAP* - multiply Line j. by 0.5 and divide by twelve:	k.
Program Year True-Up Payment - Calculation Below	
Program Year verified total annual kWh of Load Shift:**	l.
After First Year Annual performance payment - multiply Line l. by $0.11:	m.
Number of program participation months this year (Jan.1st to Dec. 31st):	n.
Total annual CMAP - multiply Line k. by line n.:	o.
Program Year True-up Performance Payment - subtract Line o. from Line m.:	p.

**Maximum monthly CMAP $300 for customers on a commercial rate schedule. Maximum monthly CMAP $750 for customers on an industrial rate schedule.*
***Total kWh of measured load shift delivered to the MCE VPP during each Program Year (January 1st to December 31st) will be verified by MCE and its program partners at the conclusion of each program year using the MCE approved Measurement and Verification methodology, which will be independently validated through third-party audit. The End of Program Year True-Up Payment will be delivered to participating customers no later than March 31st of each applicable program year.*

****All calculations are done pursuant to MCE's M&V plan for the VPP Pilot, which may be updated from time to time by MCE.*

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX E: Zero Net Carbon Ready Homes Program Case Study

May 2026 | CEC-500-2026-013

Appendix E:
Zero Net Carbon Ready Homes Program Case Study

Richmond Advanced Energy Community Project

case study

From Distressed and Abandoned to Smart and Climate-Friendly

This home needed all-over repair and was a great candidate for a makeover to a new all-electric, carbon-free home. It originally had gas appliances for heating and water heating, and there was no cooling or ductwork—but that would all soon change.

Before and after shots of a refurbished home in Richmond, CA

A neglected, abandoned home just got a new climate-friendly life thanks to the groundbreaking Richmond Advanced Energy Community (AEC) Project. This project combines innovative affordable housing and low-income support strategies with clean energy technology to modernize existing housing stock while saving households money.

With an ecology of partners, including MCE, this ambitious project aims to tackle a combination of challenges—including poor air quality, a strained power grid, displacement caused by gentrification, blighted neighborhoods, and a critical lack of affordable housing. This project can be an example for other communities in California with similar difficulties.

During WWII, Richmond's four shipyards built over 747 ships—more than anywhere else in the world—and launched as many as three ships in one day. Workers came from all over the country, and the population increased from 20,000 to over 100,000 in three years. Much of the housing erected for this workforce was intended to be temporary but remains today.

Like many other communities, Richmond has been affected by decades of unfair housing policies that excluded people of color. Today, Richmond has homes that have fallen into disrepair, becoming blighted and abandoned and raising public health and safety concerns. This, along with environmental challenges, has contributed to portions of Richmond being designated as a Disadvantaged Community by the state's CalEnviroScreen 4.0.

The house on 17th is a part of this all-too-familiar story of urban blight. This 3-bedroom/1-bath home has 1,147 sq. ft and a 1-car garage. Built in 1955, it suffered neglect and was nearly forgotten until it was spotted by RCF Connects (formerly known as the Richmond Community Foundation), who recognized its potential.

CalEnviroScreen Rankings for Richmond

The CalEnviroScreen tool identifies communities disproportionately burdened by pollution and with characteristics that make them more sensitive to pollution.

Some census tracts in the City of Richmond score above the 90th percentile for metrics that measure housing burden for low-income residents in the State of California

RCF Connects leverages funds from a social impact bond – established in 2015 by the City of Richmond – for the purchase and rehabilitation of abandoned properties.

Since its inception, RCF has facilitated the repair and sale of dozens of affordable homes for first-time home buyers, given a boost to local spending, and attracted new investments to continue their housing work. With additional support from EPA Brownfields Assessment and Cleanup grants, RCF has been able to address some of the city's most challenging blighted properties and help Richmond residents overcome barriers to local homeownership.

Once RCF purchased the property, a team of partners got to work. TLC Construction provided a general remodel, including structural updates, new plumbing, a new 200-amp electrical panel, and a mini-split system for both heating and cooling. GRID Alternatives designed and installed the solar system and provided an EV charger. Alco Building Solutions installed the battery, washer, dryer, refrigerator, dishwasher, induction range, and a heat pump water heater.

Electrification technologies installed in a VPP home

What's Inside?

- Smart, high-efficiency washer & dryer
- Smart, high-efficiency dishwasher
- Smart, high-efficiency refrigerator
- Induction range
- Smart heat pump water heater
- Smart mini-split HVAC system
- Smart plugs
- 7.15 kW (DC) solar system
- Battery with 5.2kWh storage
- Level-2 electric vehicle charger

The house has been transformed into an all-electric home of the future. It can generate and store its own solar energy, which power the home's high-efficiency appliances to reduce emissions even further. In addition, its key appliances and battery are connected to MCE's Virtual Power Plant (VPP)—a network of devices throughout Richmond—and can be synchronized by MCE to shift energy usage (or "load") during high-use times to help residents avoid outages.

Serious Controls connected the relevant appliances to the VPP through a dedicated wireless modem, allowing the VPP to implement load shifting without depending on the homeowner's Wi-Fi. Since the typical first-time home buyer in the Richmond AEC Project has likely never experienced features such as solar battery systems, induction ranges, or load shifting, training is extremely important.

Alco Building Solutions led a two-hour walkthrough with the new homeowners and provided resources for later questions. They also explained how the VPP would shift load during critical times for the grid and made sure the homeowners understood how their batteries could provide backup power during an outage.

The Richmond AEC Project is proud to celebrate the success of its first all-electric home. It plans to rebuild nine more and install new clean energy technologies in 90 other currently occupied Richmond homes. In doing so, the initiative can become a model for other projects in communities that have been historically excluded from equitable housing and clean energy.

Homeowners will not only enjoy cleaner, safer homes, they'll also save money on their electric bill and get paid up to $50 per month for connecting their batteries and smart appliances to the VPP.

The goals for the VPP are to connect enough load shifting equipment in homes, commercial buildings, and industrial sites to provide 1.5 MW of load that can be used flexibly, and to connect enough batteries to get 2 MWh of dispatchable electricity. That's about enough energy to run 4,000 average refrigerators for one hour.

This will help reduce carbon emissions, improve grid reliability, and provide more equitable access to the latest green technology for participants.

About the Richmond Advanced Energy Community Project:

The Richmond Advanced Energy Community Project is an invitation-only project for homes and businesses led by the ZNE Alliance and MCE. It provides low to no-cost energy efficiency and electrification equipment to participants so they can save money on their energy bills and reduce impacts on the environment. The participants agree to allow their devices to be part of MCE's Virtual Power Plant (VPP) to reduce grid load during critical times. This helps make Richmond's energy cleaner and more reliable for everyone, while reducing costs for the homeowner. The program is supported by a $5 million grant from the California Energy Commission and up to $2.8 million in match funding from various partners including the City of Richmond and MCE.

ZNE/Alliance MCE SERIOUS CONTROLS CEER RESOURCES Richmond RCF

Project made possible in part by the California Energy Commission

Learn more: mceCleanEnergy.org/virtual-power-plant
Questions? virtualpowerplant@mceCleanEnergy.org

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX F: Homeowner Customer Journey

May 2026 | CEC-500-2026-013

Appendix F:
Homeowner Customer Journey

Home Smart Home...

Your home could be more comfortable and efficient, even if you already have solar. Through the Richmond Advanced Energy program, you could be eligible to receive new, smart appliances such as for water heating, EV charging, or storing backup energy in batteries at low or no cost. Let MCE connect these clean energy upgrades to its Virtual Power Plant (VPP) and receive bill credits for helping make the electric grid more efficient, benefiting the environment and reducing the risk of outages.

Here's how it works:

PHASE 1:

Enrollment

Estimated duration: 2–3 weeks

Apply: Receive your invitation to participate and apply by contacting MCE at (415) 464-6010, ext. 300, or virtualpowerplant@mceCleanEnergy.org.

Site Visit:

1. Project team reaches out to schedule a home visit.
2. Project team reviews existing equipment, recommends upgrades, and answers questions.
3. Receive and sign documents for project team to develop a customized home proposal.

Review and Decide:

1. Review the options in your proposal and choose the one right for you.
2. Sign the agreement forms to get the project started.

PHASE 2:

Approvals & Installation

Estimated duration: 5–12 months

Permits and Approvals: Project team applies for any permits as needed.

Installation and Connection:

1. Project team schedules and completes the installation of your new equipment.
2. Local officials complete all needed inspections.

PHASE 3:

Operations

Estimated duration: 2–6 weeks

Get Ready to Start Earning:

1. Receive a Welcome Packet with informational materials, equipment warranties, and relevant documents.
2. Project team completes a walk-through to explain how the equipment works and answer questions.
3. Start receiving monthly bill credits.

Questions?
Contact virtualpowerplant@mceCleanEnergy.org or (415) 464-6010, ext. 300.

Projects are available for a limited time while funding lasts.

Project made possible in part by:

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX G: Homeowner Outreach Brochure

May 2026 | CEC-500-2026-013

Appendix G:
Homeowner Outreach Brochure

The Richmond Advanced Energy Community

The Richmond Advanced Energy Community is a group of homes and buildings that have teamed up to lower pollution and the risk of power outages through small and automated energy-saving actions. It's powered by **MCE's Virtual Power Plant** (VPP), a program that coordinates the community's smart devices so they can work together. This allows electricity to be distributed more efficiently, which can help the environment and reduce the risk of grid outages.

By participating, you'll get bill credits for every eligible device you connect. MCE's VPP will make automatic, slight shifts to your home's energy usage, allowing you to take advantage of lower-cost electricity prices throughout the day—without sacrificing convenience or comfort.

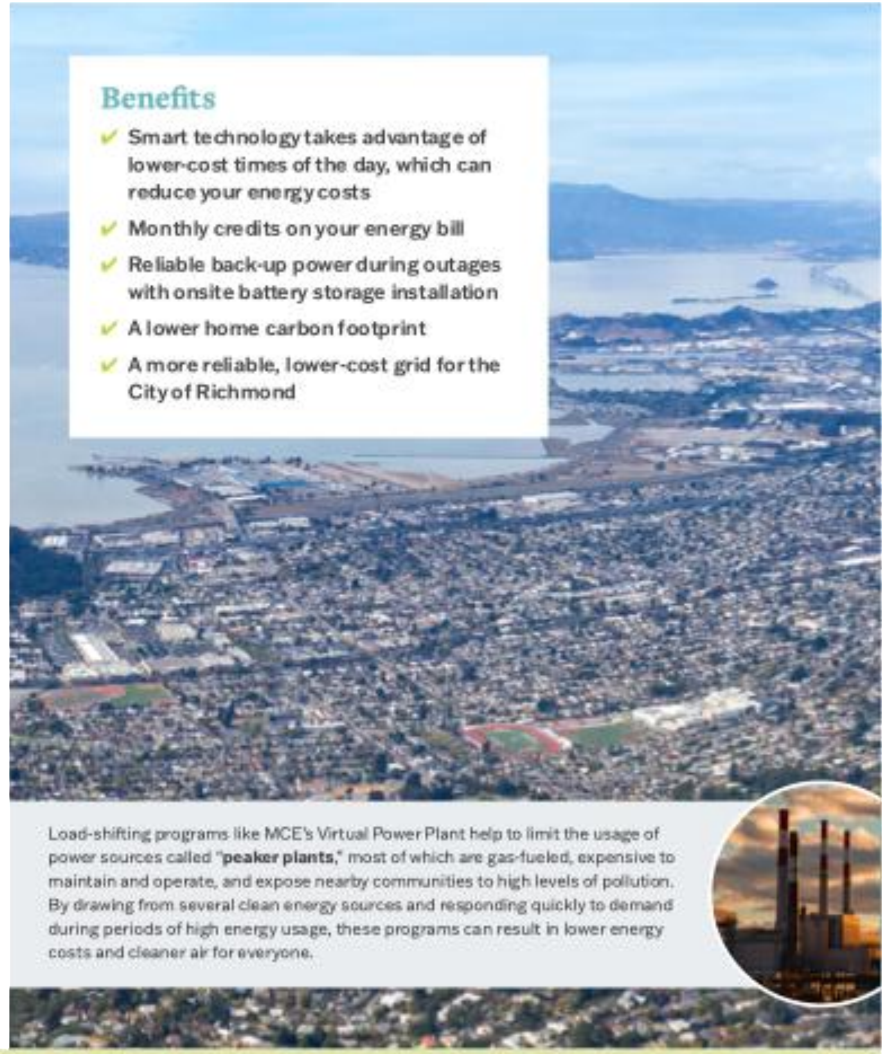
A Solution Tailored to You

We provide financial and technical support to design a solution that fits your needs—from identifying and securing the right technologies for your home, to contracting and installing them. We'll work with you to create a custom **no-** or **low-cost** package. These packages can range from self-installed devices to full electrification with solar panels, heat pump appliances, and more.



Packages may include:

- Smart home energy monitor
- Smart plugs
- Smart thermostat
- Heat pump water heater
- Heat pump space conditioner
- Electrical panel upgrades
- Rooftop solar panels
- Battery storage system
- Electric vehicle charger
- Gas capping for home electrification



Benefits

- ✓ Smart technology takes advantage of lower-cost times of the day, which can reduce your energy costs
- ✓ Monthly credits on your energy bill
- ✓ Reliable back-up power during outages with onsite battery storage installation
- ✓ A lower home carbon footprint
- ✓ A more reliable, lower-cost grid for the City of Richmond

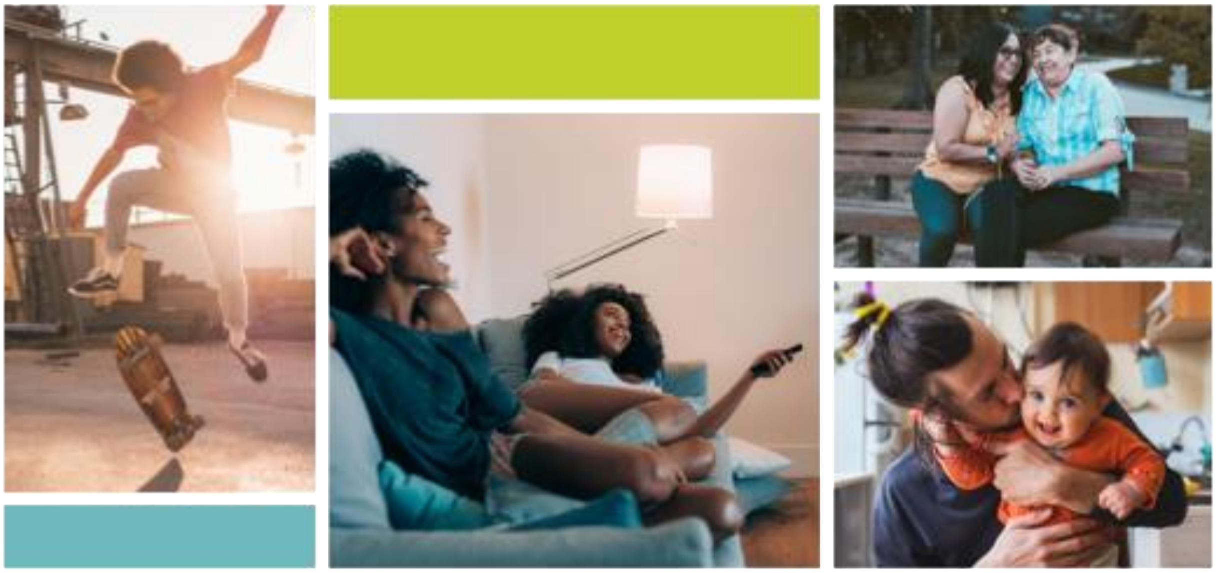
Load-shifting programs like MCE's Virtual Power Plant help to limit the usage of power sources called "**peaker plants**," most of which are gas-fueled, expensive to maintain and operate, and expose nearby communities to high levels of pollution. By drawing from several clean energy sources and responding quickly to demand during periods of high energy usage, these programs can result in lower energy costs and cleaner air for everyone.

How It Works

step 1
Schedule a home visit to discuss your custom no-/low-cost equipment package

step 2
We'll help secure and install your equipment and connect you to MCE's Virtual Power Plant

step 3
Get bill credits for helping to strengthen your local energy grid and reduce carbon emissions



It's easy to get started:

Contact virtualpowerplant@mceCleanEnergy.org to learn more and schedule a site visit. During our consultation, we'll discuss which equipment best suits your needs.

Projects are available for a limited time while funding lasts. The first phase of this roll-out is limited to 100 homes. Preference will be given to income-qualified households that have worked with GRID Alternatives to install solar panels.

MCE Empowering Our Clean Energy Future
CONTRA COSTA | MARIN | NAPA | SOLANO

City of Richmond California

GRID Alternatives

Project made possible in part by the California Energy Commission

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX H: Contractor Guidelines

May 2026 | CEC-500-2026-013

Appendix H:
Contractor Guidelines

SERIOUS CONTROLS

Richmond Contractor Guidelines

Contractor Scope of Work and Building Standards (Revision E)

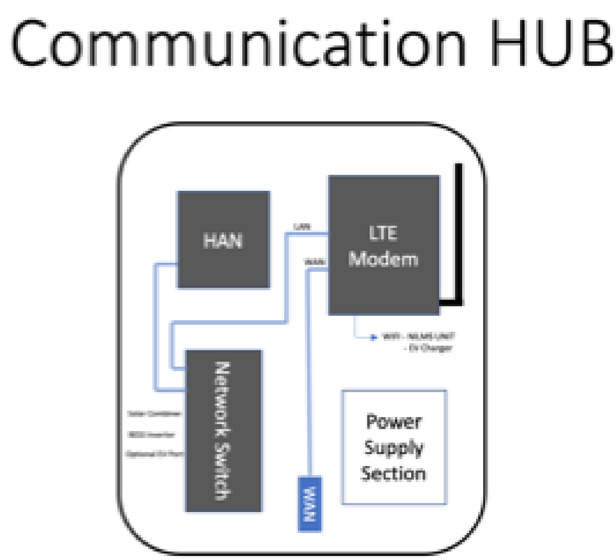
Overview
Richmond ZNCR homes will replace natural gas with a fully electric home, powered from solar and supplemented with a battery energy storage system (BESS), resulting in a low carbon footprint home. Residential electrical contractors will prepare each home for the installation of the solar panels and battery storage and smart appliances.

Section 1: TLC Construction	
Intent: Below are items that will need to be installed in preparation for the installation of the solar, BESS, EV charger and smart appliances.	
Item	**Building Standards**
1.0 Critical Load Panel	Contractor will install one 50-amp sub-panel at the main electrical panel and power the panel with one 50-amp breaker from the main. Contractor will land designated critical loads circuits in the critical load panel. Exact circuits will be determined during the site walk-through. However, by default critical circuits will include, lighting, refrigerator/freezer, plug in the bathroom, plug in the living room, two kitchen plugs and one bedroom plug.
1.1 BESS Preparations	From the critical load panel to BESS location, electrician will need to install 2" conduit suitable for outdoor applications to an outdoor junction box at BESS location. Install 100-amp service wire between critical load panel and BESS location. Cable to be terminated by BESS installing contractor, Alco.
1.2 Solar Panel Preparations	From roof solar panel location, electrician will need to install 1" conduit and 2 conductor #10 AWG THWN-3 wire (Black, Red, White) with #10 green ground wire to BESS location. Cable to be terminated by solar panel by Grid Alternatives.
1.3 Electrical Vehicle Preparations	Homes with Garage or Driveway: From main electrical panel install 240vac outlet in garage or car park location. If installed in the garage, outlet to be installed close to the garage door, to allow the EV charge cable to reach a car parked in the driveway. Homes with Curbside Parking only: From main electrical panel install 240vac outlet on the front of the home, at ground level in a lockable NEMA3R or better outdoor rated enclosure.
1.4 Electric Range	From main electrical panel install 240vac outlet in kitchen at range location. Range to be installed by Alco.
1.5 Heat-Pump Hot Water Heater	From main electrical panel install 240vac outlet at hot water location. Heat-pump hot water heater to be supplied by Alco to TLC. TLC to install hot water heater.

1.6 Electric Washer and Dryer	From main electrical panel install 240vac outlet at dryer location and a 120vac outlet at washer location.
1.7 Heat-pump HVAC System	TLC to install a multi-head split heat-pump HVAC system, supplied by Alco.
1.8 Refrigerator and Dishwashers	TLC to provide all standard connections need, electrical, water and drain as needed. Alco to install appliance.

Section 2: Alco Building Solutions	
Intent: The scope of work below is for Alco in the ZNCR homes, which include the BESS, Appliances and HAN & NILMS installation. All products are fully electric.	
Item	**Building Standards**
2.0 Critical Load Panel	Contractor to verify and correct installation of critical load circuits, in the critical load panel.
2.1 BESS Installation	Contractor to install pre-approved BESS from the Serious Controls DER picklist. Contractor to submit permit package for Solar and BESS.
2.2 Solar Panel AC Coupling	Contractor to make final connection from solar panel micro inverters to the BESS inverter. Solar panel to BESS inverter will be an AC coupled connection.
2.3 Appliance Installation	Contractor to install all appliances, including electric range (and vent hood), dishwasher, clothes dryer and washer and refrigerator. Installation include water, drain and electrical connections.
2.4 Equipment Delivery	Alco to deliver to TLC the following equipment for installation: a) HVAC split system heat-pump with agreed upon number of heads based in initial site walk-through b) Heat-Pump hot water heater
2.5 NILMS Units	Contractor to purchase and install NILMS units. Note: NILMS interface to the Critical Load Panel Circuits, extra conduit for CT leads.
2.6 CAT5e or CAT6 Cable	Contractor to run (orange or yellow) CAT5e or CAT6 cable from Serious Controls Communication HUB (section 4.0) to customer's ISP router location and label cable "Plug into Highspeed Internet Router". Contractor to install (orange or yellow) CAT5e or CAT6 cable from the Communication HUB to the PV gateway combiner, the BESS Inverter, and the EV Charger.
2.7 Communication HUB	Contractor to install and power the Serious Control Communication HUB. Communication HUB to be powered from BESS during power outages.
2.8 PV and BESS Permitting	Contractor to use provided drawings from Grid Alternative along with Alco engineering to file for solar and BESS permit.
2.9 EV Close-Out	Home with curbside parking, where the 240vac outlet is installed on the front of the home, contract to install lock on NEMA3R box, verify breaker is in the OFF position and label and leave keys in or around the electrical panel for homeowner.

Section 3: Grid Alternatives	
Intent: To install solar panels and micro inverters, plus EV charger where applicable	
Item	**Building Standards**
3.0 Solar Panel Design	Contractor design solar panel system based on site walk-through that maximizes roof space and supply Alco all single line drawing necessary for permit package.
3.1 Solar Panel Installation	Prior to installation of the BESS, Contractor to install solar panels and micro inverter and verify or install electrical wiring from panels to BESS location.
3.2 EV Charger	Contractor supply, mount, connect to existing 240VAC plug and verify communication of EV charger where applicable. 240VAC plug to be permitted by TLC in Section 1.3 above. Approved EV Charger is EverCharge unit.

Section 4: Serious Controls	
Intent: Provide the Communication HUB and On-Site IT Support	
Item	**Building Standards**
4.0 Communication HUB	Contractor to build the Communication HUB panel that contains: 1. LTE Modem with homeowner WAN connection 2. HAN Device 3. Network switch for ethernet connections to the HAN, the Solar gateway/combiner, and the BESS inverter. (extra port for EV charger, if needed). 4. LTE modem to provide WIFI connection for the NILMS and EV Charger 

4.1 On-Site IT Support	Contractor to support Alco in connecting all DERs and Smart Devices to the Communication HUB
4.2 DERMS Connectivity	Contractor to verify with THG connection to DERs

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX I: Commercial and Industrial Customer Journey

May 2026 | CEC-500-2026-013

Appendix I: Commercial and Industrial Customer Journey

Good for your business.
Good for your community.

Your business could get more resilient during power outages and more efficient to operate. With the Richmond Advanced Energy Community program, you may be eligible to receive **low-cost** or even **no-cost** energy storage and EV chargers, plus other equipment to allow you to reduce and/or shift electric load. You'll also get up to $750/month in bill credits for being part of MCE's Virtual Power Plant (VPP) Pilot that will reduce strain on the grid during critical times, helping keep the energy supply cleaner, safer, and more reliable for your community.

Here's how it works:

PHASE 1:

Site Visit and Proposal Review

Estimated duration: 4–6 weeks

Site Visit:

1. A program partner will contact you for authorization to send you information and to schedule a site visit.
2. During the site visit, the partner will assess your existing equipment, explore options for new or additional equipment, and answer any questions.
3. With your authorization, the program partner will develop an equipment proposal for you.

Review and Enroll:

1. Review the Draft VPP Agreement and choose the equipment package option that is right for you.
2. You will receive a VPP Agreement, Installation Agreement, and any applicable Incentive Application Form(s) to sign.

PHASE 2:

Installation and Utility Approvals

Estimated duration: 4–12 months

Permits and Approvals:

The project team applies for any required permits.

Installation and Connection:

1. The project team schedules and completes the installation of your new equipment
2. Local officials inspect the installed equipment for building permit sign-off.
3. Utility technician completes inspection required for interconnection permit.

PHASE 3:

Operations

Estimated duration: 2–6 weeks

Commissioning, Testing, & Bill Credits:

1. You receive a Welcome Packet with equipment warranties, contact information, and other important documents.
2. We confirm your equipment is connected and working properly and provide on-site training for you and your staff.

Annual True-up Payments (as applicable)

1. At the end of each calendar year, MCE will conduct a transparent Measurement and Verification process to determine the total value delivered by your equipment during the proceeding calendar year.
2. At the end of each calendar year, MCE will calculate the total value of the savings it received from your equipment and issue a true-up payment if needed.

Questions?
Contact virtualpowerplant@mceCleanEnergy.org or (415) 464-6010, ext. 300.
Projects are available for a limited time while funding lasts.

MCE Empowering Our Clean Energy Future
Richmond
Project made possible in part by:

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX J: Commercial and Industrial Outreach Brochure

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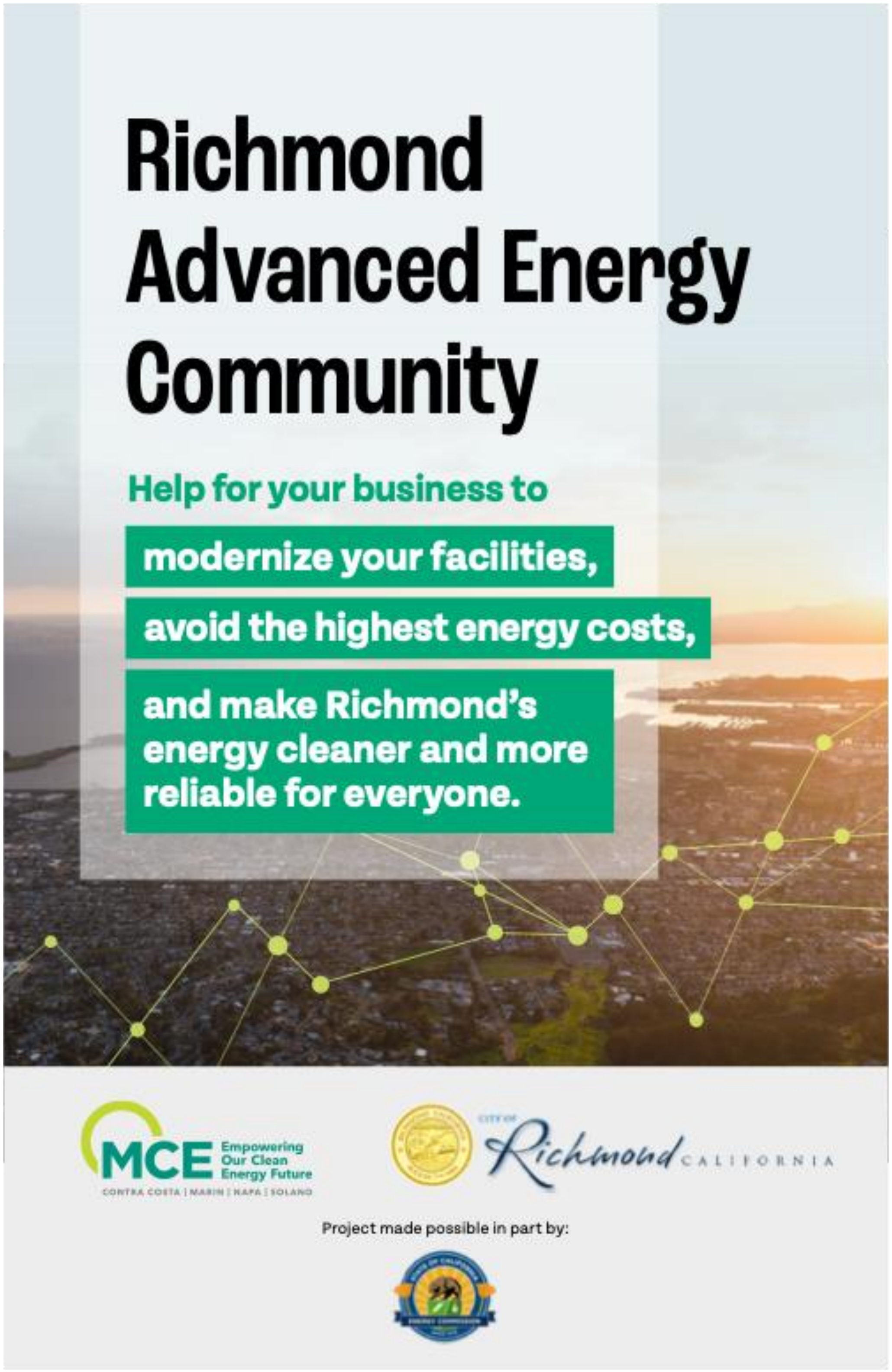
Appendix J: Commercial and Industrial Outreach Brochure



Taking advantage of available energy programs doesn't have to be a chore. The Richmond Advanced Energy Community can help you get **low-cost** or even **no-cost** equipment for your business that helps you reduce and manage your energy use.

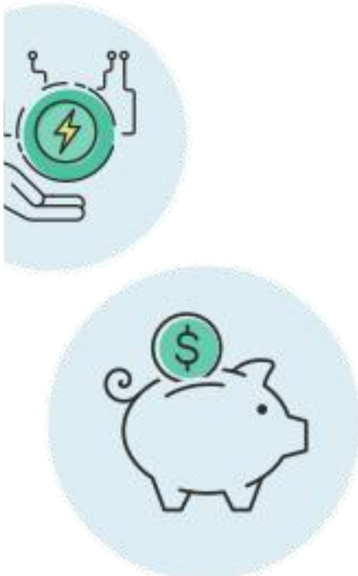
We provide end-to-end financial and technical support to design a solution that fits your needs—from identifying and securing all available incentives, to contracting, installing, and commissioning your equipment. As part of MCE's Virtual Power Plant, you can not only save on your energy costs but also earn bill credits and revenue for optimizing your energy use.

MCE's Virtual Power Plant

The Richmond Advanced Energy Community is powered by MCE's Virtual Power Plant (VPP), a program that connects buildings equipped with smart devices to manage and balance grid operations, resulting in cleaner and more reliable energy for the community. MCE's VPP also provides cost savings for customers by making slight shifts to energy use. This allows customers to take advantage of lower-cost electricity prices throughout the day—without sacrificing productivity or comfort.

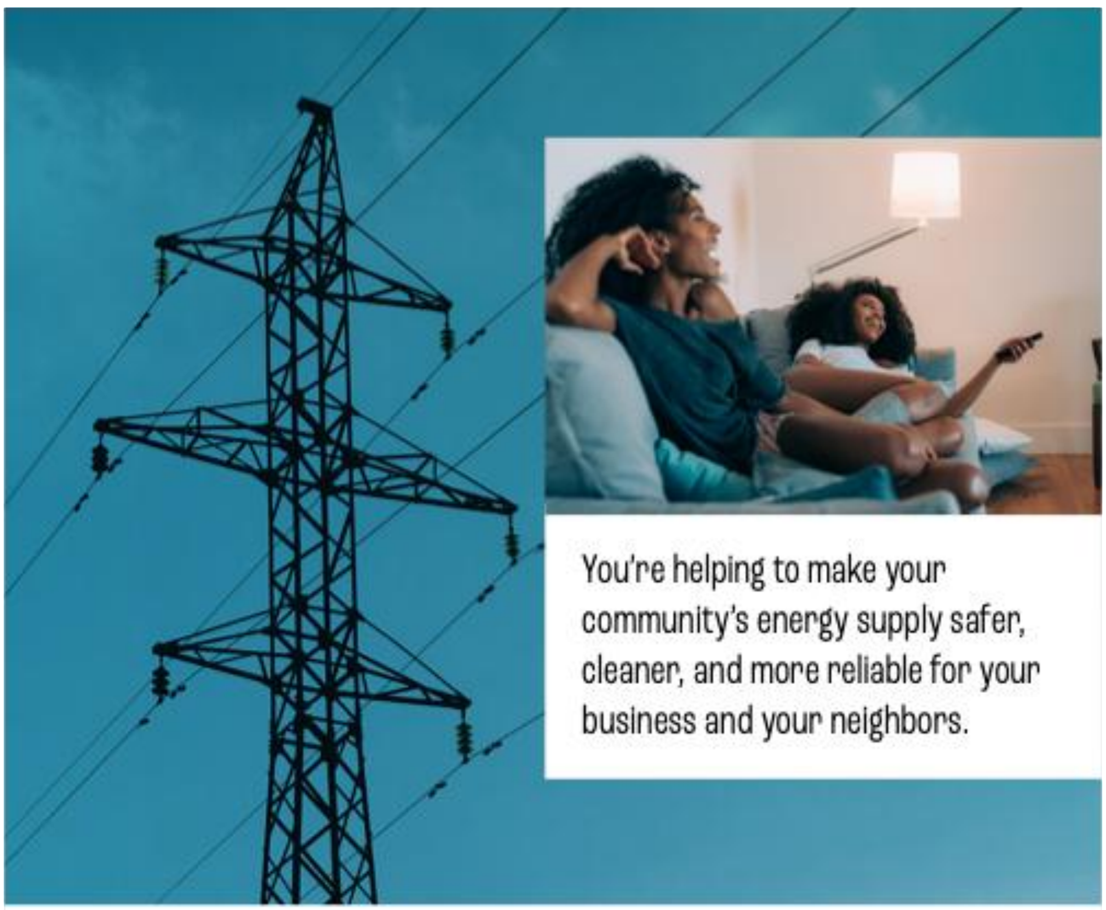
- **Reduce your energy costs** by automatically taking advantage of lower-cost times of the day
- **Earn credits** on your energy bill
- **Get paid** for reducing your energy use during peak demand times
- **Enhance resiliency** during power outages with onsite battery storage
- **Lower your business's carbon footprint** and **make your community healthier and safer**
- **Support a more reliable, lower-cost grid** for the City of Richmond

virtualpowerplant@mceCleanEnergy.org



The Richmond Advanced Energy Community Project combines with other program incentives to minimize your equipment costs and maximize your energy savings. We'll leverage all available programs to bring your costs down:

- MCE Rebate & Energy Programs
- PG&E Business and Industry Rebate Programs
- BayREN
- And other utility, non-profit, and state programs



virtualpowerplant@mceCleanEnergy.org

Your Exclusive Invitation

Your business has been hand-picked to be a part of the Richmond Advanced Energy Community, because—based on your typical energy usage—you are poised to receive the most dramatic financial benefits from participating in the program. We will create a package tailored to the needs of your business and help you find cost-saving incentives on equipment that is right for you.

Equipment may include:

- Battery storage system
- Electric vehicle charger
- Gateway interface
- Universal controller
- Smart thermostat
- Load monitoring equipment
- Additional equipment as needed

It's easy to get started:

Contact virtualpowerplant@mceCleanEnergy.org to schedule a consultation.

Projects are available for a limited time, while funding lasts.

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX K: Multifamily Residential Customer Case Study

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Appendix K:
Multifamily Residential Customer Case Study

Richmond Advanced Energy Community Project

case study

Solar, Batteries, and Electric Vehicles — they're Better Together

When existing rooftop solar is paired with new batteries and EV chargers at commercial multifamily properties, they can be a real force multiplier. By uniting these assets and enrolling them through MCE's Virtual Power Plant, multifamily properties avoid fees associated with the new Net Billing Tariff program and even increase their margins on EV chargers. The grid just got smarter.

Left: Workers install rooftop solar panels
Right: The local property owner's multifamily residence in Richmond, CA

MCE's service territory is teeming with legacy solar assets. With help from their Advanced Energy Community (AEC) Grant, MCE is helping customers navigate new regulatory challenges and make that initial investment pay off for years to come. The trick is bringing those panels together with the next generation of energy technologies and integrating them through a Virtual Power Plant (VPP). With MCE's help, a local multifamily property owner with affordable housing facilities throughout the City of Richmond will be able to avoid the highest energy costs, modernize their facilities, and make Richmond's energy cleaner and more reliable for everyone.

When this multifamily property owner installed their first rooftop solar panels, the going theory in Net Energy Metering (NEM) design was, 'the more solar, the better.' Under favorable NEM 2.0 rates, many customers leapt at the opportunity to earn new revenue and save by embracing this new technology. In recent years, however, California has learned that rooftop solar can cause grid imbalances: panels tend to produce too much power during the middle of the day when people aren't using it, but not enough in the afternoon and evening when energy demand picks up.

Net Billing Tariff (NBT) rates, the new approach to net energy metering, are designed to reflect those lessons. Customers will now be compensated according to avoided grid costs rather than retail generation rates, reducing credits by up to 75%, and mandatory Time-of-Use rates include a $15/month participation charge.

Together, these changes negatively affect rooftop solar financing, in some cases turning what was once an asset into a liability. To ease the transition from NEM 2.0 to NBT and preserve the value of customers' initial solar investments, the path forward is clear: customers need a smart way to manage their solar generation.

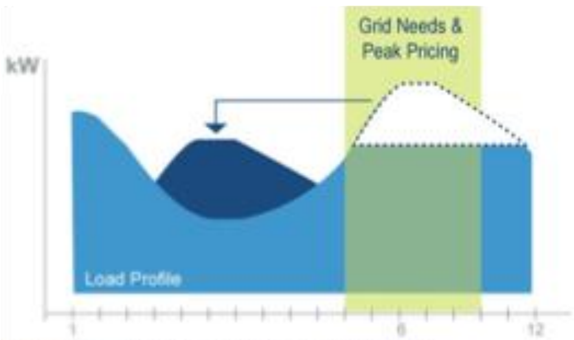
Rate Changes with Net Billing Tariff

Export Compensation	↓ 75%	
Import Charge	↓ Off-Peak	↑ On-Peak
Base Services Charge	$15/month	

That's where MCE's Virtual Power Plant comes in. VPPs are digital networks that use software, sometimes described as "virtual wires," to connect and coordinate distributed energy assets across communities. By linking together resources such as rooftop solar panels, battery storage systems, and flexible technologies like electric vehicle (EV) chargers, VPPs create clean, resilient, and reliable local energy systems. When these assets operate in unison, they can intelligently manage energy flows, smoothing out the imbalances that have historically challenged rooftop solar integration.

MCE leveraged funds from the AEC Grant to help this local property owner install new battery storage systems and EV chargers at their Richmond multifamily residences to bring smart energy management capabilities together with their existing rooftop solar assets to create a local energy powerhouse. Through stacked incentives of up to $316,000 plus tax credits, these assets come at minimum up-front cost and start delivering savings in the first year of operation.

The VPP can dispatch the residential facility's new assets to optimize how they use energy. During the day, when their rooftop solar panels generate more energy than is being consumed on-site, the VPP directs the new energy storage systems and charging stations to store the excess energy. This way, the property owner can generate revenue by providing EV charging capacity to its residents. Because the energy that powers these EV chargers comes from on-site generation assets rather than the grid, the margins on EV charging revenues are much more attractive. Even at 15% utilization, the systems provide a net present value of $1.13 million.



The VPP shifts energy demand to reduce peak demand

MCE also shares value directly with participating customers through an innovative tariff. Over its seven-year contract, this multifamily property owner is projected to earn up to $10,841 in monthly bill credits, helping build a more cost-effective, resilient community energy future.


Battery storage installed at a local multifamily development

When the sun sets, the VPP directs the batteries to release stored energy. By using that on-site power, the customer avoids the higher time-of-use (TOU) rates charged for on-peak electricity imports. Any excess energy can be exported back to the grid during these same peak hours, maximizing the customer's compensation under NBT.

At the same time, the VPP delivers broader value to MCE and the community it serves. By coordinating this customer's assets with others across Richmond, MCE can lower its overall procurement costs and generate additional revenue through participation in state energy markets. Those savings don't stop at MCE; they help stabilize costs system-wide, enabling MCE to pass benefits along to residents through affordable, predictable rates.

As customers with big footprints, multifamily properties have the potential to lead the way in the clean energy transition. Until now, these customers have been hard to reach because it can be difficult to find energy solutions that are attractive to both management companies and residents.

By helping companies navigate regulatory challenges and make the most of their investments, the VPP aligns incentives behind climate action and responsible grid stewardship. With over 100 properties in its portfolio, this local multifamily property owner can be a key partner in championing the benefits of VPP in Richmond and beyond.

About the Richmond Advanced Energy Community Project:

The Richmond Advanced Energy Community Project is an invitation-only project for homes and businesses led by the ZNE Alliance and MCE. It provides low to no-cost energy efficiency and electrification equipment to participants so they can save money on their energy bills and reduce impacts on the environment. The participants agree to allow their devices to be part of MCE's Virtual Power Plant (VPP) to reduce grid load during critical times. This helps make Richmond's energy cleaner and more reliable for everyone, while reducing costs for the homeowner. The program is supported by a $5 million grant from the California Energy Commission and up to $2.8 million in match funding from various partners including the City of Richmond and MCE.

ZNE/Alliance MCE SERIOUS CONTROLS CEER

Project made possible in part by the California Energy Commission

Learn more: mceCleanEnergy.org/virtual-power-plant
Questions? virtualpowerplant@mceCleanEnergy.org

ENERGY RESEARCH AND DEVELOPMENT DIVISION

APPENDIX L: Technology Vendor Participation Requirements

May 2026 | CEC-500-2026-013

Appendix L: Technology Vendor Participation Requirements

The technology vendor is a VPP partner that has the ability to control the DER assets that comprise the VPP using an electronic interface associated with the asset. This interface must be able to be configured to meet the technical requirements for participation in the VPP. Two key sets of requirements are described below: Day-Head Market Integration requirements and OpenADR Requirements.

Day-Head Market Integration Requirements

Technology vendors must ensure that DER assets are capable of responding to dispatch instructions. For participation in day-ahead markets, assets with less than 10MW of curtailment potential do not require sophisticated communications or controls. Because day-ahead markets must be submitted before 10AM on the day prior to the event day, the MCE VPP will use asset availability information to plan its day-ahead bids. The California Independent System Operator will generally publish its awarded bids by 1PM on the day prior to the event day; subsequently, the MCE VPP will allocate awards to participants and send event notifications to assets.

OpenADR Requirements

As the Richmond VPP scales up to cover MCE's entire service territory, MCE is requiring standardization around OpenADR communication protocols. To ensure an open, fair, and competitive advanced energy solution marketplace, MCE will assist grid edge partners in gaining OpenADR certification.

Configuration of New VENs and DERs in eDERMS

The DERMS OpenADR Guidelines, available at https://tinyurl.com/DERMSOpenADR, provide guidance on how virtual end nodes (VEN) and distributed energy resources can integrate with the purpose-built enterprise-level DERMS (eDERMS) created by Serious Controls. Supported VEN or DER types include battery energy storage systems, building management systems, non-intrusive load monitoring system units, electric vehicles, lighting controls, wireless thermostats, PV solar panels, and home area network units. When new VEN or distributed energy resources are installed, the eDERMS will require certain attributes in order to control and monitor the VEN, and these attributes must be entered manually through the eDERMS graphical user interface. Attribute fields may also be found in the DERMS OpenADR Guidelines.

OpenADR Payload Conventions

The DERMS OpenADR Guidelines provide predefined and custom OpenADR payloads and describes the payload flow, including registration sequences, default event sequences, and default reporting sequences. The resource also specifies three types of report requests: one shot, historical, and periodic. One shot reports request the most recent SINGLE interval; historical reports request prior data intervals captured over some time frame in the past; periodic reports request internals to be uploaded periodically, *e.g.,* every 5 minutes. The resource also outlines the two types of event signals used for dispatching: simple levels and storage specific resources.

OpenADR VEN Specific Payloads

In addition to these payload conventions, the DERMS OpenADR Guidelines also list OpenADR payloads specified for various DER types. Three types of reports are sent between the VEN and the virtual top node (VTN). The "Register Report" is a metadata report generated by the VEN that informs the VTN about the data points the VEN is willing to send. A data point description (rID) is required for the VTN to send a request for that particular data. Next, "Create Report" is a follow-up request sent by the VTN for the VEN to send a report for a certain set of rIDs. Finally, the "Update Report" contains the actual data points sent by the VEN. The rIDs and amount of intervals will match the settings from the associated "Create Report." These report payload parameters may be stacked into a single report.