Energy Research and Development Division

FINAL PROJECT REPORT

Peninsula Advanced Energy Community

California Energy Commission

Gavin Newsom, Governor

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PREFACE

The California Energy Commission's 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, energy transmission and distribution and transportation.

In 2012, 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 solution, foster regional innovation and bring ideas from the lab to the marketplace. The California Energy Commission and the state's three largest investor-owned 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 Energy Commission is committed to ensuring public participation in its research and development programs that promote greater reliability, lower costs, and increase safety for the California electric ratepayer and include:

- Providing societal benefits.
- Reducing greenhouse gas emission 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), and finally with clean, conventional electricity supply.
- Supporting low-emission vehicles and transportation.
- Providing economic development.
- Using ratepayer funds efficiently.

Peninsula Advanced Energy Communities is the final report for Peninsula Advanced Energy Communities (PAEC) project (Agreement Number EPC-15-056) conducted by Natural Capitalism Solutions, dba Clean Coalition. The information from this project contributes to Energy Research and Development Division's EPIC Program.

For more information about the Energy Research and Development Division, please visit the Energy Commission's website at www.energy.ca.gov/research/ or contact the Energy Commission at 916-327-1551.

ABSTRACT

How does California move to a vision for the clean, local energy future necessary from where the state is today? The Peninsula Advanced Energy Community initiative explored ways to close this gap and accelerate advanced energy communities in southern San Mateo County.

Advanced energy communities strive to meet zero-net energy (ZNE) standards for the built environment and take full advantage of local renewable energy, demand response, Solar Emergency Microgrids, and electric vehicle charging infrastructure. Accelerating the pace of advanced energy community development will help California realize its clean energy and climate policy goals.

Over 21 months and 31 reports, the Peninsula Advanced Energy Community team developed recommendations to accelerate advanced energy project development. Peninsula Advanced Energy Community uncovered key challenges, studied best practices, developed findings, enumerated benefits, and created tools. The goals of the Peninsula Advanced Energy Community initiative facilitated adopting clean energy and energy efficiency solutions, lowering the costs of and barriers to implement these solutions, increasing the reliability and resilience of the advanced energy communities, and providing replicable and scalable models for other communities throughout California and beyond.

Keywords: advanced energy communities (AEC), Peninsula Advanced Energy Community (PAEC), electric vehicle charging infrastructure (EVCI), solar emergency microgrid (SEM), solar siting survey (SSS), energy storage, energy efficiency, microgrid, solar PV, renewable energy, zero-net energy (ZNE).

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Introduction

There is a wide gap between California's clean local energy future and where the state is today. For the past 21 months, the Peninsula Advanced Energy Community Initiative, with grant support from the California Energy Commission, researched and studied how to bridge this gap and accelerate use of clean and efficient energy technology. Advanced energy communities facilitate this, combining various technologies that use clean, renewable energy sources, improve overall energy efficiency, and increase energy reliability in a localized area.

Fortunately, the state of California has already laid the foundation for clean energy project success. California has ambitious policy goals for greenhouse gas reductions and renewable portfolio standards, and a rigorous regulatory structure. What impedes progress are primarily economic and policy barriers.

The Peninsula Advanced Energy Community team was led by the Clean Coalition (a nonprofit organization) and partnered with subcontractors, jurisdictional collaborators (including the Town of Atherton, East Palo Alto, City of Menlo Park, City of Redwood City, and San Mateo County) and utility provider Pacific Gas and Electric. The Peninsula Advanced Energy Community Initiative uncovered key challenges, studied best practices, developed findings, enumerated benefits, and created tools to accelerate advanced energy communities. This final report presents the highlights of Peninsula Advanced Energy Community's program work to demonstrate accelerated development of cleaner, more affordable, efficient, and reliable local energy services in southern San Mateo County and throughout California.

Project Purpose

Advanced energy communities are one way to bring clean energy technologies to market and contribute to meeting California's goal of 100 percent clean energy by 2045. The primary goal of the Peninsula Advanced Energy Community Initiative was to provide models for advanced energy communities that are replicable and scalable so that other communities can benefit from the Initiative's findings and effectively navigate around any barriers to develop similar projects.

Advanced energy communities strive to meet zero net energy standards for the built environment. These communities take full advantage of local renewable energy, demand response, solar emergency microgrids, and electric vehicle charging infrastructure. More than the sum of their components, advanced energy communities provide numerous co-benefits, including:

- Minimizing the need for new energy infrastructure.
- Providing energy savings through zero-net energy.
- Improving grid reliability and resilience.
- Offering easier grid integration.

- Providing affordable access through distributed energy resources and energy efficiency for all electricity ratepayers

Key Challenges

Advanced energy communities face economic, policy, and technical barriers. Foremost among them are the economic challenges of accounting barriers and limited funding sources. Some of the specific economic challenges include the following:

- The preference of building owners to make decisions based on initial costs instead of life cycle costs.
- Budgeting conflicts between capital costs and operating costs.
- Split incentives between the building owner and tenant.
- Limited financing options.
- The question of who should fund and who should own advanced energy community components.

As the component technologies for advanced energy communities continue to mature and economies of scale give rise to lower per-unit costs, the Peninsula Advanced Energy Community expects some of these barriers to fall away.

Policy challenges mainly revolve around a regulatory structure that advantages outdated building practices, inconsistent and opaque permitting processes, interconnection to electric grid barriers for Wholesale Distributed Generation projects (six months to 2.25 years with high electric grid infrastructure costs), as well as insufficient permitting staff to handle the increasing volume of permitting requests for Advanced Energy Communities projects.

In general, technical limitations are not a binding constraint, although technical innovations continue to decrease the costs associated with advanced energy components and bring to market more advanced energy alternatives.

Project Process

To better understand how to overcome some of the challenges facing advanced energy communities, the Peninsula Advanced Energy Community studied programs at local jurisdictions focused on encouraging renewable energy, energy efficiency, zero-net energy, and electric vehicle charging infrastructure projects. The Peninsula Advanced Energy Community team collated exemplary economic best practices including:

- Incentives and rebates.
- Purchasing aggregation strategy.
- Property Assessed Clean Energy loans.
- Pay As You Save funding.
- Community Choice Aggregation (CCA).
- Revolving loan funds.
- Climate impact fees.

Best policy practices the Peninsula Advanced Energy Community studied include:

- Zero Net Energy reach codes and plans.
- District approaches.
- Required renewable energy goals.
- Feed-in-tariffs.
- Residential energy conservation ordinance /commercial energy conservation ordinances.

Innovative jurisdictions and organizations have done the hard work of developing these tools and practices. Other jurisdictions and organizations can save time by borrowing the economic tools and policy practices that best address the challenges they face.

Project Results

Through dozens of reports, the Peninsula Advanced Energy Community team developed key economic, policy, and technical findings that will accelerate the pace and broaden the scope of advanced energy community development.

The tools the Peninsula Advanced Energy Community applied or developed to overcome barriers are sorted into three buckets: economic, policy, and technical. Economic tools sought to leap beyond the limitations of first cost concerns and unlock the value of life cycle and resilience benefits. Readily available economic tools, such as benefit-cost analyses and scenario modeling demonstrate the financial viability of alternative energy measures.

Policy tools, developed through numerous workshops with key stakeholders, yielded streamlined permitting checklists, model ordinances, and green lease language. Technical tools include a solar siting survey, *Electric Vehicle Charging Infrastructure Master Plan*, solar emergency microgrid scenario modeling, and community microgrid design.

Economic Findings:

- Thirty-four financing options exist to contribute funding to the advanced energy community in southern San Mateo County. While there are plentiful options available, there is room to expand some of the financial tools to provide wider coverage. For example, on-bill financing would be useful to the residential sector for energy efficiency retrofits, and using public-private partnerships to finance electric vehicle charging infrastructure should be expanded.
- Energy storage projects finally have become financially viable because of a dramatic reduction in the price of batteries over the past few years. However, energy storage projects usually have positive net present value when doing double duty through some combination of renewable energy power storage, backup power, peak shaving, power conditioning, spinning reserves, or load shifting. The Peninsula Advanced Energy Community expects prices of energy storage to continue to fall, improving the economics and broadening the number of viable energy storage installations.
- Building owners often cherry pick the top one or two energy efficiency measures to implement when they could be implementing several at a time with synergistic savings. the Peninsula Advanced Energy Community studied a prototypical office building and found an 18 percent internal rate of return for a bundle of energy efficiency measures.

This return is higher than most other potential non-advanced energy community investment options.

- The Peninsula Advanced Energy Community studied eight model ordinances to determine if they would pay for themselves over the life of the project. Four of the eight model ordinances were net present value positive: upgrading the heating system, installing insulation, replacing windows, and installing LEDs. The analysis found that the availability of cheap natural gas limits fuel switching as an economically competitive option.

Policy Findings:

- The Wholesale Distributed Generation Fast Track Permitting Program must be streamlined to provide transparency and consistency. The Peninsula Advanced Energy Community team studied 209 applications for wholesale distributed generation interconnection approval and found that 82 percent failed to secure permits or dropped out. The applications approved took six months to 2.25 years.
- Municipalities also must provide more transparency and consistency in the permitting process for costs, timelines, and documentation requirements.

Technical Findings:

- The Peninsula Advanced Energy Community's solar siting survey discovered 65 MW of commercial technical PV solar siting potential -- enough to satisfy peak usage of over 65,000 homes -- in southern San Mateo County, a highly developed area with a dense tree canopy. The three types of locations with the potential for solar PV installations of 100 kW or more are school rooftops, parking lots, and parking garages.
- The Peninsula Advanced Energy Community's *Electric Vehicle Charging Infrastructure Master Plan* recommended locations for new Level 2 chargers at multi-unit dwellings and workplaces, and DC Fast Chargers at retail and transit corridors. The Master Plan also underscores the public education value of installing electric vehicle charging station signage visible from roadways to encourage demand for electric vehicles.

Case Studies

A few exciting Peninsula Advanced Energy Community projects in the planning stages that incorporate multiple advanced energy community components are described in more detail in the report. These include:

- Stanford University Redwood City Community Microgrid.
- Hoover School Solar Emergency Microgrid (three scenarios).
- Town of Atherton's new zero net energy Civic Center.

Accomplishments

Several key accomplishments included:

- Identified 65 MW of technical solar PV potential within the core the Peninsula Advanced Energy Community region

- Recommended four fully vetted clean energy ordinances to cities throughout San Mateo County
- Identified and began developing preliminary engineering design on the Peninsula Advanced Energy Community Redwood City Community Microgrid
- The distributed energy resources interconnection streamlining pilot is being developed in cooperation with PG&E as the distribution system operator, and will support meeting the demand from the regional Community Choice Aggregation for local renewable resource development under California Public Utilities Commission jurisdiction.
- A multi-unit dwelling electric vehicle charging infrastructure draft model ordinance was vetted through the California Electric Vehicle Accelerator Charrette as one of only three infrastructure concepts to be recommended for implementation.
- Evaluated expanding the C-46 California Contractors license to include electric vehicle supply equipment installation and found that it will accelerate electric vehicle charging infrastructure use.
- Identified relevant information regarding 34 currently available government incentives and lending strategies/programs related to advanced energy communities in and around San Mateo County, California.

Technology/Knowledge Transfer/Market Adoption (Advancing the Research to Market)

One of the goals was to ensure that the knowledge gained and lessons learned from the Peninsula Advanced Energy Community initiative was available to the public and key decision makers. The team disseminated results from the analyses, reports, and the Case Study through educational webinars, outreach to media and stakeholders, speaking engagements, published press releases, and interviews. Additionally, the Clean Coalition published monthly blog articles on their website and promoted them via social media and email marketing.

Benefits to California

By accelerating the planning, approval, financing and deployment of Advanced Energy Communities, the Peninsula Advanced Energy Community initiative has resulted in environmental, economic and other benefits for the ratepayers of California's investor-owned electric utilities. Specific outcomes have or will include the following.

- The Peninsula Advanced Energy Community Solar Siting Survey, identified more than 65 megawatts (MW) of technical solar photovoltaic (PV) siting potential in the southern portion of San Mateo County —enough clean local energy to satisfy peak use from more than 65,000 homes. Notably, more than 54 MW of the solar potential identified is sited on sections of PG&E's grid where interconnection should be quick and cost-effective.

- Increasing the efficiency of the permitting process reduces time for agency and applicant staff by at least 10 percent and potentially up to 50 percent, typically saving $2,000 per commercial application.
- Reduced costs of clean local energy. The tools, data, and expected policy adoption will reduce the time, uncertainty, and other soft costs, associated with siting, financing, permitting, and interconnecting, which will result in roughly 20 percent lower prices for clean local energy where these practices are employed.
- Improved interconnection policies would facilitate development of local renewables at locations on the grid that would not result in expensive interconnection costs.
- Each 25 MW of new local solar that is built from the Peninsula Advanced Energy Community's improved tools and policies are estimated to result in 20-year benefits such as:
    - Ratepayer savings: Energy consumers will save $12 million in PG&E peak capacity costs, $6 million in avoided transmission losses, and $9 million in avoided transmission proportional capacity related costs.
    - Economic stimulation: Investment equal to 25 MW of new solar PV use is estimated to generate $116 million in total added regional economic output and create $35 million in local wages from construction and installation.
    - Environmental benefits: Each year, the Peninsula Advanced Energy Community is projected to reduce GHG emissions by nearly 40 million pounds and save 7 million gallons of water.
    - Avoided loss costs from outages, plus improved reliability: Medium and large commercial facilities, small commercial enterprises, and residential customers (per 100) will be on track to save $83,600, $14,160, and $9,500 in avoided loss costs, respectively.

Considering all of the potential benefits resulting from application of the PAEC Initiative's findings, tools, and plans, the Peninsula Advanced Energy Community project will help the California Energy Commission, utilities, building and planning departments, developers, building owners, and elected municipal officials determine where to focus future efforts for advanced energy community development. Consumers, ratepayers, and communities will benefit from the consequential resilient, decarbonized energy system.

CHAPTER 1: Introduction

Purpose

The Peninsula Advanced Energy Community (PAEC) Initiative is designed to overcome existing barriers to clean energy projects and establish a replicable model that can be used by other communities across California and beyond. Supported by numerous local governments and PG&E, Clean Coalition's PAEC initiative will accelerate the planning, approval, and deployment of an advanced energy community (AEC) within a diverse region of southern San Mateo County.

This report describes the results of the studies funded under this solicitation (Grant Award Number: EPC-15-056).

Background

The core PAEC region encompasses the Town of Atherton, East Palo Alto, City of Menlo Park, and City of Redwood City, as well as surrounding unincorporated areas. The core PAEC region, which is largely developed but also experiencing enormous commercial and residential growth pressure, is representative of similar regions throughout California — ensuring that the PAEC's successes can be replicated statewide.

Objectives

The PAEC team investigated how renewable energy, energy efficiency, electric vehicle charging infrastructure (EVCI), and energy storage were used within the PAEC region and documented key challenges to adopting these advanced energy solutions. This informs Clean Coalition's close work with municipal partners including the Town of Atherton, East Palo Alto, City of Menlo Park, City of Redwood City, San Mateo County, and PG&E to distill leading policies related to permitting, building codes, ordinances, and utility interconnection. Specific project plans are being developed for:

- Community microgrids and solar emergency microgrids (SEM) that strengthen the grid and provide ongoing power to key facilities during an outage
- High-performance and zero-net energy (ZNE) buildings.
- Charging infrastructure to support the rapid growth of electric vehicles (EVs).

The results of the PAEC project will guide future action by policymakers, governmental agencies, utility executives, and other key decision makers. Figure 1 below summarizes the PAEC project goals.

Figure 1: PAEC Project Goals

Source: Clean Coalition

Challenges

To meet California's bold energy and environmental goals, significant improvements are necessary in how the state generates, transmits, and uses electricity. Increasing the amount of power generated from local renewables and using energy more efficiently will help realize those goals. However, enabling the widespread adoption of key technological solutions — such as local renewables, ZNE buildings, SEMs, and EV chargers — will require fundamental changes to the way these projects are planned, financed, approved, and deployed.

Findings and Recommendations

The PAEC team identified and documented key challenges, developed findings, and recommended solutions for the adoption of advanced energy technologies. Overarching take-always from the PAEC initiative include the following:

- AECs are achievable with current proven technologies working together.
- Deep energy efficiency (EE) retrofits are needed to help the state of California meet GHG reduction goals. California has 9 million single family homes, 3.1 million multi-unit dwellings, and 600,000 commercial buildings. Most of these are not ZNE.
- Stacking energy efficiency measures creates synergies. In the Town of Atherton Civic Center project, passive ventilation and other energy efficiency measures allowed building project engineers to downsize HVAC systems and size a solar PV system that can meet ZNE objectives.
- Expand use of feed-in-tariffs to support development of the 65 MW of technical solar PV potential in southern San Mateo County identified by the PAEC Solar Siting Survey.
- Municipal and utility permitting should be streamlined to speed advanced energy (AE) project development.
- Fuel switching for buildings and transportation, away from burning fossil fuels and toward electrification, will require expansion of distributed energy resources.
- Surplus funds from CCA programs, like Peninsula Clean Energy in San Mateo County, should be invested in local renewable energy.

- Climate impact fees like the City of Watsonville's encourage ZNE multi-family dwellings and their use should be expanded.
- ZNE reach goals, such as those implemented by the City of Santa Monica and Santa Clara County, should be expanded in other jurisdictions.
- Renewable energy goals, such as the Menlo Park General Plan update for the Bayfront commercial district, should be required by other jurisdictions.
- Community microgrids and SEMs will benefit communities by providing uninterruptible power in the event of a natural disaster or power outage. Having microgrids at hospitals, police stations and fire stations will provide power to critical loads and allow emergency responders to serve their community indefinitely.
- Local stakeholder engagement is vitally important to tailor AECs to the specific climate, economic, and political context of the community. Doing so will make it easier to attract development investment and meet climate action plan goals.

Accomplishments

The PAEC initiative focused on how to use local renewables – and other technologies like energy storage – to provide cleaner, more affordable, and more reliable power throughout California. By streamlining the process to permit, finance, build and connect AEC projects, the PAEC initiative will drive down the costs of building these resources. In addition, the PAEC will save money for California energy consumers, provide economic stimulation, and demonstrate how to enhance grid resilience by leveraging renewable-based, back-up power at critical facilities.

Several key accomplishments during the PAEC performance period include:

- Identified 65 MW of technical solar potential siting within the core PAEC region;
- Recommended four fully vetted clean energy ordinances to cities throughout San Mateo County;
- Identified and developed the conceptual engineering design on the PAEC Redwood City Community Microgrid;
- The distributed energy resource (DER) DC fast charger (DCFC) interconnection streamlining pilot is being developed in cooperation with PG&E as the distribution system operator, and will support meeting the demand from the regional CCA for local renewable resource development under CPUC jurisdiction;
- A multi-unit dwelling (MUD) EVCI draft model ordinance was vetted through the California EV Accelerator Charrette as one of three infrastructure concepts to be recommended for implementation;
- Evaluated expanding the C-46 California Contractors license to include EVSE installation and found that it will accelerate EVCI deployment; and
- Identified relevant information regarding 34 currently available government incentives and lending strategies/programs related to AECs in and around San Mateo County, California.

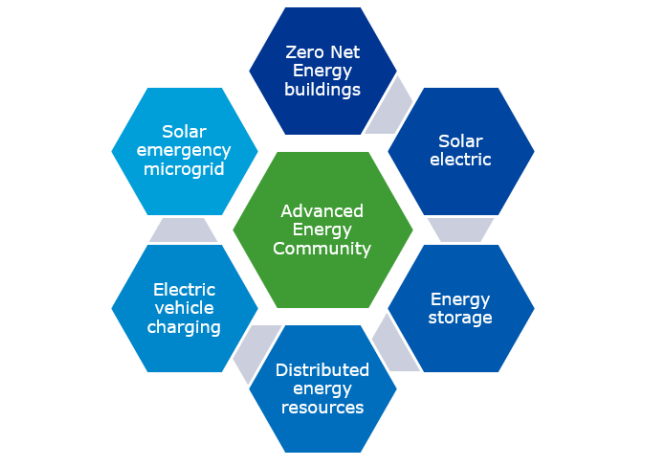
As a society it is essential to invest in upgrading buildings and energy system. The benefits of clean local energy including reduced costs, enhanced grid security, job creation and a stable climate will accrue to building owners, the community and future generations.

CHAPTER 2:
Peninsula Advanced Energy Community Overview

PAEC is a groundbreaking initiative focused on streamlining policies and showcasing projects that accelerate using advanced energy communities (AECs). Building and integrating the AEC components of EE, renewable energy (RE), ZNE, energy storage (ES), and EVCI will create the clean local energy future necessary.

Throughout the 21-month project, the PAEC team defined the ideal of an advanced energy

Figure 2: Advanced Energy Community



Source: DNV GL

community, identified challenges to implementing AECs, studied best practices, developed key findings, and created tools to overcome the challenges. This final report presents highlights from PAEC project work and explains what it takes to close the gap between the ideal AEC and where California is now.

Advanced Energy Communities

For the PAEC initiative, AECs have buildings, whether new or undergoing major renovations, that meet ZNE standards, including enough on-site RE generation to be grid positive, with Solar Emergency Microgrids (SEM) on all large campuses (such as schools, hospitals, shopping centers, office parks, civic centers >250,000 sq. ft.), reduced fossil fuel use in buildings, and electric vehicle (EV) charging available at all buildings. Additionally, all new city vehicles will be electric or zero carbon, where feasible (Figure 2).

In addition to these requirements for new buildings and transportation, the AEC will actively promote deep energy retrofits. The initial focus will prioritize retrofitting the most inefficient existing buildings serving low-income tenants through subsidies, rebates, and on-bill financing to ensure zero upfront costs. The AEC will similarly promote RE, EE, and ZNE retrofits with a combination of incentives and low-cost financing. The AEC will assist businesses with the installation of EV chargers on existing parking facilities, with the charger count based on site specific information and funding availability.

The California Energy Commission, which has funded the PAEC project, defines AECs as those which:

- Minimize the need for new energy infrastructure costs such as transmission and distribution upgrades.
- Provide energy savings by achieving and maintaining ZNE 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's (CPUC) Long-Term Procurement Plan, and the California Independent System Operator's (California ISO) local capacity requirements process.
- Can be replicated and scaled up to further drive down costs.
- Are financially attractive from a market standpoint for developers, home buyers, and renters.
- Provide affordable access to RE generation, EE 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 such as the Sustainable Communities and Environmental Protection Act (Senate Bill 375 (Steinberg, Chapter 728, Statutes of 2008) and Governor Brown's Executive Order B-29-15 for the drought.

Many components of AECs already exist. The key to filling in the gaps and integrating the components so they work seamlessly lies in overcoming economic and policy barriers.

Project Tasks

The PAEC team worked on the following tasks for the PAEC project.

- Streamlining of Local Government Planning and Permitting.
- Finance and Business Models for Advanced Energy Communities.
- Streamlining the Interconnection for Advanced Energy Communities.
- Solar Emergency Microgrid Design.
- Electric Vehicle Charging Infrastructure Master Plan.
- Atherton Civic Center Feasibility Features.

- Solar Siting Survey.
- PAEC Master Case Study.
- PAEC Master Community Design.

Streamlining Local Government Planning & Permitting

Local government permitting and planning departments are the gatekeepers to a clean local energy future. They face two major challenges in service of this role: how to realize the goals of their jurisdiction's climate action plan with limited resources, and how to manage the workload of an increasing number of advanced energy project permit applications.

Climate action plans are comprehensive roadmaps that outline the specific activities that an agency will undertake to reduce greenhouse gas (GHG) emissions. By supporting development of advanced energy projects, the team is helping municipalities realize their climate action plan goals.

In PAEC's research about streamlining permitting processes, the PAEC team:

- studied innovative best practices,
- conducted gap analyses,
- developed model ordinances, and
- created policy recommendations to streamline permitting and planning work.

The value of the streamlining recommendations are two-fold: making the permitting process less onerous for project developers, and shortening each municipality's learning curve about adopting policies and programs that encourage advanced energy projects. PAEC's work in this area offers replicable and scalable models that save time and money.

Best Practices for Adopting Advanced Energy Communities

The PAEC initiative surveyed best practices within California, the United States, and across the globe to identify the most effective clean energy ordinances, reach codes, zoning, building and energy codes, policies, initiatives, permitting processes, and advanced energy technology programs.[1] The results are summarized in Figure 3.

The *Best Practices Report* examined in detail measures relevant for the PAEC region in the following categories:

- RE
- EE
- ZNE
- EVCI
- Additional Clean Energy Measures

[1] Menlo Spark, Task 2.2 - Best Practices report

Several dozen innovative ordinances and additional measures offer proven approaches that will accelerate deployment of AECs.

Figure 3: Summary of AEC Best Practices

Renewable Energy (RE)	Energy Efficiency (EE)	Zero Net Energy (ZNE)	Electric Vehicle Charging Infrastructure (EVCI)	Additional Clean Energy Measures
Model Municipal Ordinance Options				
Solar Rooftops [RE1] (mandatory ordinances) could also include solar water heaters, cool roofs, or other alternatives, e.g., San Mateo **Solar Carports [RE2]** over parking, could be coupled with energy storage and/or EV charging, e.g., Palo Alto or Green Charge **Zoning or Building Codes [RE3]** requiring 100% Renewable Energy, e.g., Menlo Park, covering electricity & gas **Solar or Zero Carbon Water Heaters [RE4]** requiring new or replacement water heaters to be solar (e.g., Hawaii) or a non-fossil fuel alternative such as heat pumps	**Reach Codes for New Construction [EE1]** Palo Alto & Santa Monica (e.g., 15% efficiency improvement over title 24) **Point of Sale [EE2]** energy audits and disclosure, e.g., Berkeley and Austin **ECBO: Existing Commercial Building Benchmarking Ordinance [EE3]**, e.g., San Francisco Buildings report energy use + audit each year ***or*** retro-commissioning every 5 years **Other Mandatory Requirements** Higher efficiency equipment, etc.	**Reach Codes [ZNE1]** for CA ZNE, e.g., Santa Monica **Financial Incentives [Fees2]:** New Climate Impact Fee, fully refunded for ZNE, e.g., Watsonville	**City Ordinance & Zoning [EVCI1]:** Minimum parking spaces required with pre-wiring or EV Chargers for **new** homes, multi-family, commercial or parking, e.g., City of San Francisco	**Fees [Fees1]** for Fossil Fuel Use or Carbon, e.g., Palo Alto Natural Gas offset fees
Additional Measures				
Financing: Rebates, PACE, on-bill financing, etc. **New technology** – in-pipe hydro, Pressure Relieving Valve (PRV)/Turbine technology, e.g., Portland – Lucid project **Permitting** improvements	**Audit programs** – NYC Retrofit Accelerator, Green @ Home, Green House Calls, PG&E audits **Incentives**, e.g., Energy Upgrade CA **Permitting**, e.g., fees waived and/or expedited, e.g. Encinitas **Building Electrification** / Natural Gas Replacement, Boulder	**District Approaches** (e.g., 2030 Districts, Fort ZED, Cambridge) **RFP & Lease Language** **Existing Building Retrofits** Energiesprong, ZNE overhauls with modular components	**City Charging Stations** (for city fleets and public use) **Incentives** (preferred parking, free charging or low/no cost charging) **Streamlined Permitting** **City EV "First" purchasing policy,** Palo Alto	**Innovations through CCEs** (aggregated solar, EV deployment) **Solar Emergency Microgrids** **Energy Storage**

Source: Menlo Spark, Best Practices report

Gap Analysis

The *Gap Analysis Report*[2] determined an important hole must be filled when building out AECs in southern San Mateo County. For this densely developed area, the *Gap Analysis Report* identifies a particular opportunity to drive down building energy use in the existing building stock. PAEC recommends implementing a bundle of EE measures with the greatest impact and widespread fuel-switching from natural gas to electric. Findings in the report describe specific opportunities at each jurisdiction in southern San Mateo County.

- Town of Atherton – Most homes were built before the California Title 24 building codes were adopted . Given that residences in Atherton use three times more energy than the average household in San Mateo County, comprehensive EE upgrades and fuel switching from natural gas to electricity could reduce residential energy use by 30-40 percent. The jurisdiction could focus on voluntary assistance programs, and mandatory upgrades at the point of sale or during major renovations.
- East Palo Alto – Energy bills in East Palo Alto generally range from 17-23 percent of a household's monthly earnings after taxes. As such, the focus in this town should be to help single-family and multi-family residents complete deep residential EE retrofits.
- Menlo Park – Menlo Park is planning for growth around the Bayfront area, which must meet 100% RE and energy benchmarking requirements, and also should encourage existing homes and businesses to retrofit to be more sustainable in the areas of EE, RE, ZNE and EVCI.
- Redwood City – Given how much development has happened recently and will happen in the near future, Redwood City should focus on helping buildings become ZNE and developing reach codes for sustainable building energy standards.

The four cities currently exceed minimum state requirements for EE.

Benefits-Cost Analysis Report of Potential Ordinances

Local governments could pass a number of different ordinances to require implementation of AEC components. For each jurisdiction to conduct several benefit cost analysis (BCA) to determine which ordinances would pay for themselves over the life of the project would be time consuming and costly. To save each jurisdiction time and money, PAEC analyzed eight measures[3] to determine which ones were cost effective.

PAEC team members worked with San Mateo County and 20 municipalities that are part of the Regionally Integrated Climate Action Planning Suite (RICAPS) group for input on the model ordinances. DNV GL calculated energy savings, payback, and GHG emission reductions for the eight potential ordinances. Table 1 shows highlights of the study.

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[2] Menlo Spark, Task 2.4 - Gap Analysis

[3] DNV GL, Task 2.14, AEC Regulatory and Permitting Recommendations

Table 1: Payback Analysis for Eight AEC Model Ordinances

Model Ordinance	Total Annual Energy Savings	Annual Profit and/or Cost Savings ($/yr)	Payback (years)	Annual GHG Reduction (MT CO2)
1. Electric vehicle chargers in multifamily buildings	630 gallons of gasoline	$1,028	2.5	5
2. Electric vehicle fast chargers for new retail buildings	10,005 gallons of gasoline	$5,713	5.7	87
3. Solar carports for new commercial buildings	143,052 kWh	$33,811	7.0	15
4. Electric heat pumps for space heating in multifamily buildings	4,920 kWh*	$(1,159)	No payback	1
4. Electric heat pumps for water heating in multifamily buildings	15,010 kWh*	$(515)	No payback	2
5. Electric heat pumps for space heating in new commercial buildings	9,592 kWh*	$(286)	No payback	1
5. Electric heat pumps for water heating in new commercial buildings	4,939 kWh*	$(167)	No payback	1
6. Time of sale energy audits and energy efficiency recommendations for existing multifamily buildings	21,701 kWh*	No cost savings for seller	No payback	2
7. Time of sale energy audits and energy efficiency recommendations for existing commercial buildings	54,626 kWh*	No cost savings for seller5	No payback	6
8. Energy efficiency measurement and verification for new commercial buildings	29,300 kWh*	$6,925	15.9	3

*** Denotes net energy savings (based on h therms of gas and electricity)**

Source: DNV GL, Benefit-Cost Analysis Report of Potential Ordinances

According to this analysis, EV chargers in multi-family complexes, electric fast chargers for new retail, solar carports for new commercial, and EE measurement and verification for new commercial buildings are cost effective measures. Electric heat pumps for space and water heating, as well as time of sale energy audits are not currently cost effective because of the low cost of natural gas. Having detailed benefit cost analyses like these helps jurisdictions with limited personnel and funding resources determine where to focus future efforts.

Model Ordinances for San Mateo County

DNV GL worked with key stakeholders in San Mateo County to identify and develop AEC ordinances that can be used by other cities in the County and state. The final ordinances presented below were developed through a stakeholder-driven process that included a focus group of jurisdictions across the southern part of San Mateo County, including the cities of Redwood City, East Palo Alto, and Menlo Park, and the unincorporated County. A set of draft ordinances were vetted during a stakeholder workshop held on May 23, 2017, and attended by eight cities, the County of San Mateo, Peninsula Clean Energy and numerous local stakeholders including neighboring jurisdictions and Build It Green.

The final deliverable included model ordinance language for four policies.

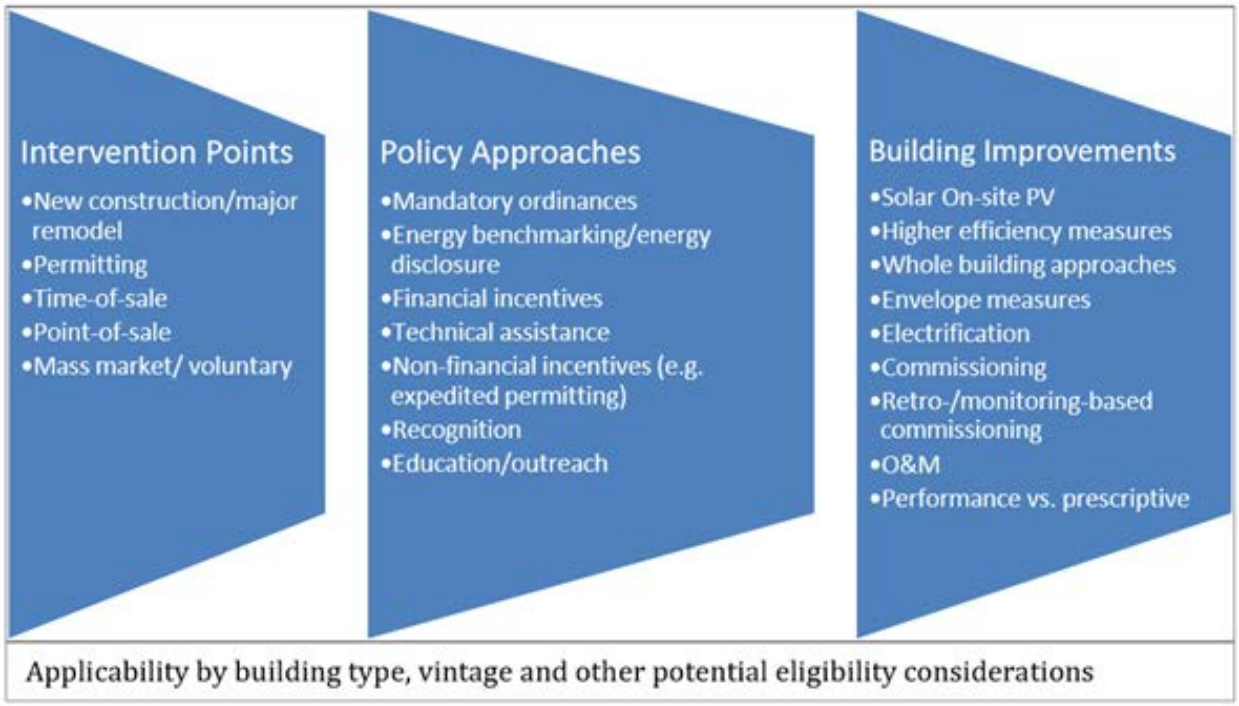
- Policy 1-EV-MF. Electric Vehicle Charging Station Ordinance for Cost-Share in Leased Buildings
- Policy 2-EV-NC. Electric Vehicle Fast Charger Ordinance for New Large Retail Buildings
- Policy 3-PV. Ordinance for Solar Photovoltaic Carports on New Parking
- Policy 4-HP. Ordinance for Renewable Space and Water Heating

The full text for all four model ordinances are included in Appendix B. Jurisdictions simply need to customize each ordinance, perform their own legal review, and undergo a public stakeholder process including review by relevant commissions and committees before formally adopting the code. Some ordinances may also require an application to California Energy Commission for approval to go beyond what is currently required in the State Title 24 Energy Code.

AEC Regulatory and Permitting Recommendations

This report studied building improvements, policy approaches, and intervention points to accelerate permitting of advanced energy community components. Figure 4 provides examples of each.

Figure 4: Framework for Considering a Range of AEC Regulatory and Policy Changes



Source: DNV GL, Task 2.14 - AEC Regulatory and Permitting Recommendations

PAEC was interested in exploring specific intervention points for streamlining the permitting process at the utility and municipal level. The reasons for doing so in these two sectors include:

- Utilities – provide consistency and transparency in the permitting process with respect to costs, timelines, documentation and reviews; and
- Municipalities – provide consistency between municipalities in the permitting process with respect to costs, timelines, documentation, inspections, and permitting requirements.

This report also studied potential mandatory ordinances. DNV GL's scoring system[4] evaluated the relative efficacy of each potential ordinance. Criteria were weighted for importance and scored via a low, medium, and high scale (1-3 points), as detailed (Table 2):

- Indicators were weighted equally for the initial analysis (5).
- A policy with a negative or no payback scored low (1), a short payback (<2 years) scored high (3), and a high payback of (>2 years) scored medium (2.).

[4] DNV GL, Task 2.14: AEC Regulatory and Permitting Recommendations

- Annual GHG emissions of 1–4 MT CO2 scored low (1), emissions of 5–15 MT CO2 scored medium (2), and >15 MT CO2 scored high (3).
- For fossil fuel use, innovation in technology or deployment, regulatory ease, and community benefits, scores were assigned as low (1), medium (2), or high (3).

Table 2: Summary of Scoring of Potential Mandatory Ordinances

Policy	Payback	Payback score	GHG Reduction Score	Fossil Fuel Use Score	Innovation Score	Regulatory Ease Score	Community Benefits Score	OVERALL SCORE
Weighting		5	5	5	5	5	5	
1-Electric Vehicle – Multi-Families	1.97	3	2	3	1	1	1	55
2-Electric Vehicles – New Commercial Buildings	5.69	2	3	3	3	1	2	70
3-Solar PV	7.01	2	2	1	2	3	2	60
4-Heat Pump-Multi-families (space heating)	No payback	1	1	3	3	1	1	50
4-Heat Pump-Multi-families (water heating)	No payback	1	1	3	3	1	1	50
5-Heat Pump-New Construction (space heating)	No payback	1	1	3	3	1	1	50
5-Heat Pump-New Construction (water heating)	No payback	1	1	3	3	1	1	50
6-Energy Efficiency – Multi-families	No payback	1	1	1	2	2	2	45

Policy	Payback	Payback score	GHG Reduction Score	Fossil Fuel Use Score	Innovation Score	Regulatory Ease Score	Community Benefits Score	OVERALL SCORE
7-Energy Efficiency – Commercial buildings	No payback	1	2	1	2	2	2	50
8-Energy Efficiency – New Construction	15.88	2	1	1	1	2	2	45

Source: DNV GL, Task 2.14: AEC Regulatory and Permitting Recommendations

This report presents a methodology for prioritizing a set of model ordinances for further development, and associated recommendations for local government interventions in both existing buildings and new construction. The report also recommends steps that PAEC communities should take to update and streamline regulations, ordinances, and other laws and procedures relating to AEC projects, including permit approvals. Streamlining will facilitate the approval of AEC projects and reduce the time, cost, and uncertainty in planning, financing, and deploying them.

Interviews with Public Agencies, Installers, and Vendors for Permitting Energy Storage

Sovereign Energy Storage conducted interviews with building and fire departments in seven California counties to understand the process, costs, and timelines for permitting lithium ion energy storage projects. This report found that there is currently no standardized process in or between jurisdictions, and that projects are generally evaluated on a one-off basis.

Standardizing required documentation, timelines, inspections, and costs would provide transparency and certainty that the regulated community would like to see from local building and fire departments. Creating a 'behind the meter energy storage permitting tool kit' will save local jurisdictions time and allow them to implement streamlined processes more rapidly.

Policy Recommendations and Guidelines for Permitting Energy Storage

The state of California's Expedited Solar Permitting Act (AB2188) required California cities and counties to adopt an ordinance to create a streamlined, expedited permitting process for small residential rooftop solar energy systems. The energy storage industry would benefit from similar legislation. Standardizing the permitting process across California county and municipal agencies would decrease the time required for permitting activities for project developers and agency staff.

Finance and Business Models for Advanced Energy Communities

While the cost of AEC components has fallen precipitously in the past few years, first cost prices for some of the components have not fallen far enough yet to justify widespread adoption. This task evaluated financial and business models for AECs that looked at the life-cycle costs for AE components such as energy storage, building EE retrofits, and EV charging infrastructure, and found these systems were attractive when viewed through a more holistic lens.

Backup Power Valuation Methodology

Sovereign Energy reviewed research literature to develop a methodology to value backup power. At its most basic level, the value of resilience to a site is equal to the cost the site incurs during a power outage. That site-specific cost depends on multiple factors including frequency of service outage, duration of outage, timing of outages (off-peak vs on-peak), type of use specific to the facility, and availability of backup power systems.

This report made the following conclusions:

1. Resilient solar+storage systems can be NPV positive with and without a resilience value stream evaluated.
2. For New York Power Authority customers, the economics of resilient PV are greater than stand-alone solar PV, due to the battery's ability to reduce facility demand charges.
3. Project economics for all modeled systems are greatly improved for radial customers when a resilience value is included due to a higher frequency of outages on radial vs. network grids.
4. Level of resilience depends on when the outage occurs, the state of battery charge, and the load size.
5. Resilient PV sized for cost-savings only will have limited resilience benefits.
6. In some cases, inclusion of a value for avoiding utility power outages can more than offset the additional costs incurred by sizing resilient PV for resilience rather than utility cost savings alone.
7. Generators as a resilience solution are not NPV-positive, except when resilience is valued for long outages.

Lending, Customer Compensation, and Government Incentive Report: Strategies and Incentives Available to Advanced Energy Communities In and Around San Mateo County, California

This report provides relevant information regarding 34 currently available government incentives and lending strategies/programs related to AECs in and around San Mateo County, California. The primary purpose is to provide information on the following topics:

- Government incentives (and disincentives) for RE, ES, EE, EVCI, and deployment, and also how they relate to and support AECs, particularly ones under the following jurisdictions:
    - Federal;
    - State of California; and
    - San Mateo County, CA (within zip code 94002).
- Local lending enhancement strategies/programs and how they relate to and support AECs, particularly:
    - Loan collateral and repayment support risk reduction strategies such as the Property Assessed Clean Energy (PACE) program;
    - Public capitalization and financing cost reduction strategies (green bonds); and
    - Customer aggregation for reduced cost and simplified loan qualification.

In summary, there are many opportunities for Advanced Energy Communities in and around San Mateo County to receive free or reduced technical assistance, assessments, grants, rebates, and low-cost financing. Oftentimes, the know-how and funding from these opportunities can positively affect the decision of whether or not to deploy renewables, electric vehicle charging, and other desirable components to an Advanced Energy Community.

Financial Pro-forma, Delineating the Cost of Capital, Tenor, and Risk/Return Profile of Each Financing Arrangement

Sovereign Energy produced two reports for PAEC regarding the value of energy storage. Each assessment performs a scenario analysis from a different perspective – user-driven versus end-use driven.

Sovereign Energy has developed an Excel-based financial model to analyze behind-the-meter energy storage,[5] which includes an integrated financial pro-forma to model the revenue and expenses for both behind-the-meter energy storage and in-front-of-the-meter energy storage projects. Dynamic and interactive, the tool allows the user to change inputs to determine the financial performance of each unique project scenario. The user may save and compare an unlimited number of scenarios. The project has more than fifty inputs which calculate the risk adjusted project internal rate of return (IRR) unlevered, levered, and after tax, including for the following inputs and outputs.

- Inputs - capital expenditures (equipment, permitting, and installation costs), operation and maintenance costs, and incentives (e.g., Self-Generation Incentive Program, SGIP)

[5] Task 3.4 and 3.10: Summary of Financial Pro-Forma, Delineating the Cost of Capital, Tenor, Risk/Return Profile, and Value Streams for Behind the Meter Energy Storage.

- Output - annualized revenue and expenses for the project, including depreciation schedule

In addition, the model output includes a summary of sources to finance the project (equity, debt, and incentives).

An important co-benefit to energy storage is its capacity to increase community resilience, especially when combined with a local PV energy supply. Sovereign Energy reports on the cost-effectiveness of PV and energy storage across four scenarios to evaluate the robustness of the arrangement across policy objectives:

- without resilience criteria
- critical back-up load provided by energy storage
- critical back-up provided by diesel generators
- a hybrid scenario

The value of scenario analysis affords the user a better understanding of how the particular analyses match individual needs.

Dispatch Model for Energy Storage System

Using the Electric Power Research Institute's (EPRI) Energy Storage Valuation Tool (ESVT) as the analytical engine to evaluate multiple ES revenue and dispatch modeling tools for behind the meter applications in the California market, Sovereign Energy found that the dispatch model results were able to validate Sovereign Energy Solution's initial assumptions around financial viability of various use cases in the California Independent System Operator (California ISO) market. Demand charge management on its own is a high value use case that can support battery storage (if the SGIP rebate is obtained); however, it is also risky to perform because the battery control system has to forecast individual site load.

Successful Energy Storage Financing Program

This report provides an overview of the revenue streams that support distributed ES projects and financing mechanisms that end-customers can utilize to get projects built. Sovereign Energy Storage has worked with active financiers and developers of distributed ES projects to collect this research and analysis data. The vast majority of systems installed to date have been financed based on incentive programs such as California's SGIP or in places that have rolled back net metering tariffs, such as Hawaii. The business case for stand-alone storage has been thin at best, but as equipment and installation prices decline rapidly (10 – 20 percent annually) the market for stand-alone ES is expected to grow rapidly in the 2018 – 2020 time-frame.

Third-party financing is key to moving the market forward. Integrators of behind-the-meter systems should have a third-party ownership structure in place to get early customers comfortable with projects that otherwise would have long payback periods. Most current financing mechanisms are shared savings agreements, under which the system owner must bill the host customer for demand charge savings created by the battery. A more viable market that

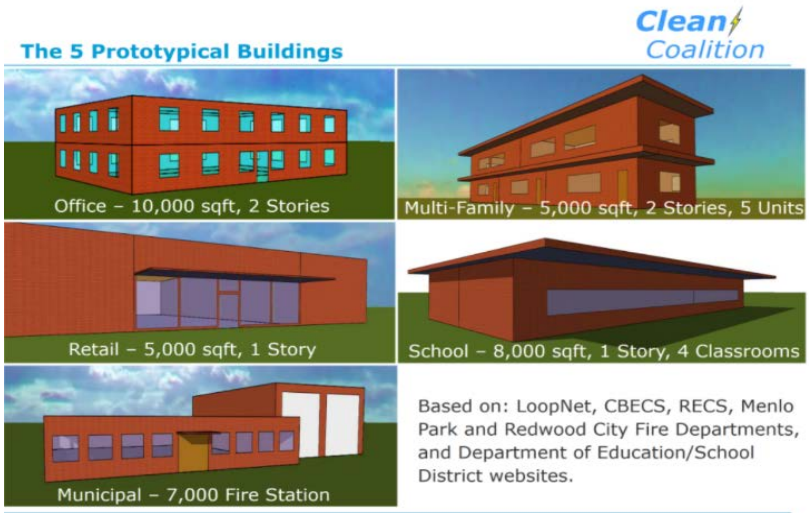
is currently emerging in California under Southern California Edison's (SCE) Resource Adequacy contracts, is for the projects to earn long-term utility capacity payments.

Economic Benefit-Cost Analysis of Energy Efficiency and Fuel Switching Measures: Prototypical Buildings -- Residential Multifamily, Municipal Building (Fire Station), Office, Retail, and School

Return on investment calculations provide a key metric that signals the financial viability of potential projects. If a project can stand on its own and is net present value positive, meaning it pays for itself before the end of the expected lifetime, the project will more likely be funded. Projects with an attractive return on investment of one or two years are even more likely to be funded.

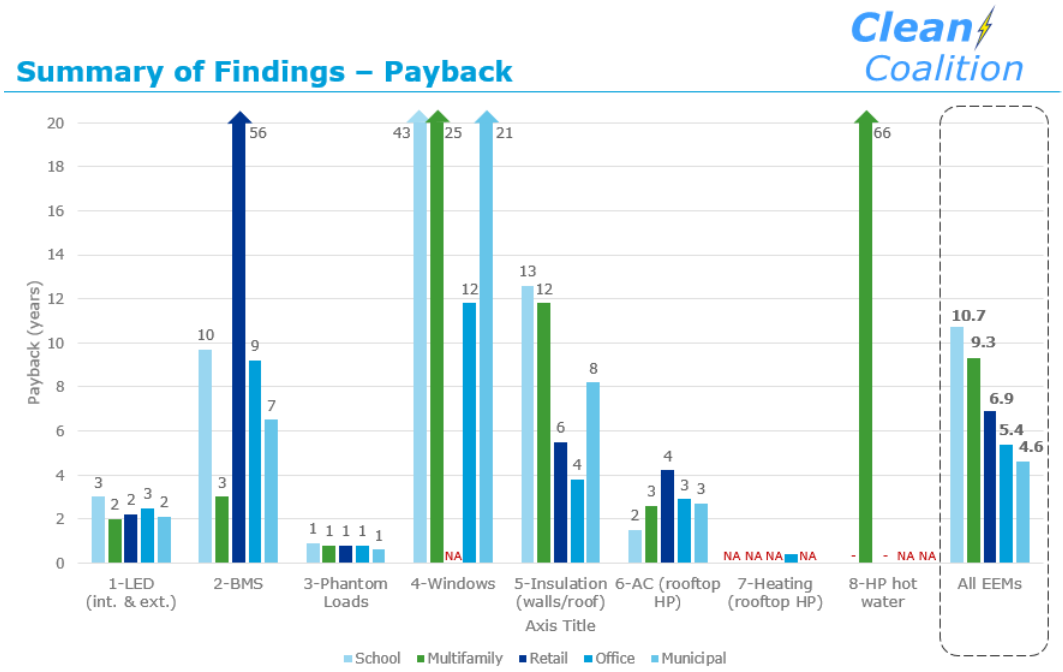
With this in mind, PAEC conducted economic analyses for bundles of EE measures. The PAEC report *Benefit-Cost Analysis of Energy Efficiency and Fuel Switching Measures* includes BCAs for five different building types: office, multi-family, retail, municipal (fire station), and school (Figure 5). Figure 6 shows that bundling seven or eight EE measures still resulted in attractive paybacks for each of the five building types: 10.7 years (school), 9.3 years (multi-family), 6.9 years (retail), 5.4 years (office) and 4.6 years (municipal).

Figure 5: Five Building Types Analyzed for Energy Efficiency



Source: DNV GL, Task 3.14 – Economic Benefit-Cost Analysis of Energy Efficiency and Fuel Switching Measures

Figure 6: Economic Analysis of Energy Efficiency Measures for Five Building Types



Source: DNV GL, Task 3.14 – Economic Benefit-Cost Analysis of Energy Efficiency and Fuel Switching Measures

Prototypical building configurations were analyzed to see how various EE measures stacked up against each other. This report found that the internal rate of return for these eight measures together in a prototypical office building would be 18 percent -- a higher return than a commercial building owner would receive from most other investments.

These five studies make the case for building owners to implement several EE measures together rather than just cherry picking the two or three with the best paybacks.

Economic Benefit-Cost Analysis of Electric Vehicle Charging Infrastructure

The payback for the installation of EVCI during new construction as compared to retrofitting is significantly shorter. To enable this savings for their citizens, local governments should implement ordinances requiring EVCI installation at the time of new construction and major remodels.

Furthermore, if a municipality is considering an ordinance requiring EVCI installation at existing dwellings, the municipality should put a cap on expenditures per unit as there will be some dwellings (particularly in the multi-family dwelling stock) that may be extremely expensive to retrofit.

Finally, given the changing landscape of EV adoption due to the introduction of long range EVs, municipalities are encouraged to use existing funding programs when installing Level 1 and Level 2 charging infrastructure in the workplace or public space, and encourage third party providers to install public Direct Current Fast Chargers.

Energy Tracking/Benchmarking Tool Report – Building Energy Management Systems: An Advanced Energy Solution for Commercial Buildings

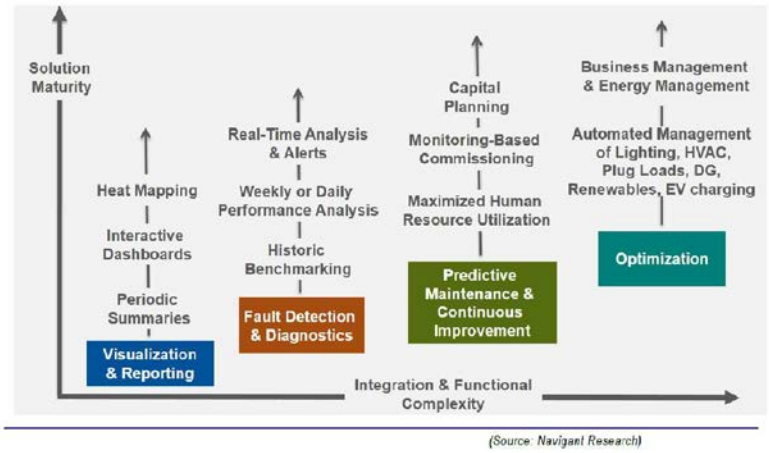
Building Energy Management System (BEMS) are used by 60 percent of large commercial properties in California, whereas 22 percent of medium-sized commercial properties utilize BEMS, and two percent of small buildings have an active system in place (Figure 7). There is a correlation between having a BEMS and participating in utility Demand Response (DR) programs that support energy conservation and grid harmonization. From the perspective of the utility, the success of a variety of energy conservation measures is reliant on the building manager being able to manage energy data from a centralized control point.

Figure 7: Building Automation System Segments

Source: Task 3.18, Energy Tracking/Benchmarking Tool Report – Building Energy Management Systems: An Advanced Energy Solution for Commercial Buildings, Office of Sustainability, County of San Mateo)

This report studied the functions that BEMS have the potential to perform, as shown in Figure 8, and listed several different BEMS currently available on the market.

Figure 8: Building Energy Management System Functionality by Complexity



Source: Task 3.18, Energy Tracking/Benchmarking Tool Report – Building Energy Management Systems: An Advanced Energy Solution for Commercial Buildings, Office of Sustainability, County of San Mateo

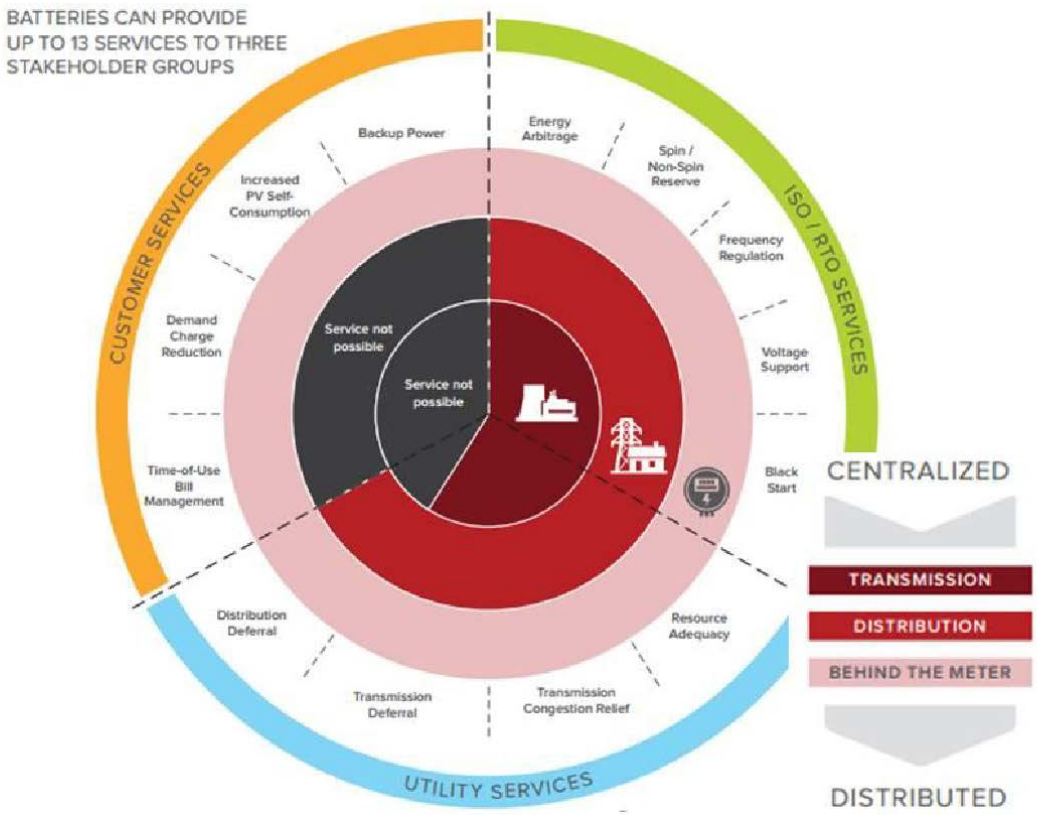
The ability of a BEMS to save on maintenance and energy costs depends on the type of system employed, how it is managed, the existing equipment, and demand charges, among other factors. According to the American Council for an Energy-Efficient Economy, BEMS with predictive capabilities as well as detection can save 13 to 66 percent on energy.

Report Summarizing Literature Review & ISO/RTO Tariff Analysis

The Independent System Operators (ISO) operate transmission systems in order to provide open access to the grid. Regional transmission organizations (RTOs) operate the transmission system in multi-state areas to advance the development of competitive wholesale power markets. This report studied how the California ISO, the New York Independent Systems Operator (NYISO), and PJM -- the RTO that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Washington D.C. -- are using ES to lower costs for customers.

Figure 9 shows the different ways that energy storage provides value during transmission, distribution and behind the meter to ISO/RTOs, utilities and customers.

Figure 9: Battery Storage Value Streams by Point of Interconnection



Source: Rocky Mountain Institute

Energy storage projects create revenue by providing products to retail customers and wholesale markets. Recent Federal and state level policies have been created to break down barriers to participation of ES resources, connected both in front of and behind the meter, in wholesale markets. The market is transitioning, and the full body of regulations required to account for all of the attributes of ES that can create value in wholesale markets will take years to be implemented at the state level.

California has been at the forefront of implementing policy to animate the ES market, followed by PJM and New York. Each ISO is moving towards a similar goal with different approaches. This report focuses on the California market, as it is both the most advanced market and the most pertinent to PAEC, but also examines PJM and NYISO as the processes of those ISOs could establish the value of ES in ways that will also benefit California.

The principles of ES projects are the same in each of the ISOs in that they stack value created at the retail level and wholesale level to satisfy site host requirements and attract investors to projects. At the wholesale level, the projects work within the specific market frameworks to sell capacity, energy, and ancillary services. Capacity is sold through either long-term bi-lateral agreements with utilities, or on a “merchant” basis, meaning they are cleared through auctions that result in short-term contracts directly to the market. Energy and ancillary services are generally bid into the market on a merchant basis, in both a day-ahead market in which the

majority of supply is settled, and also a real-time market in which the final marginal units of energy and ancillary services are bought and sold.

Distributed ES balances wholesale market obligations with retail services to end-customers. These retail services shift energy usage from off-peak times to on-peak times, thereby lowering demand charge and energy costs for host customers.

Streamlining the Interconnection of Advanced Energy Communities Model

Utilities are responsible to ensure low-cost, reliable energy for their customers. They have a rigorous approval process for any distributed energy resources project that would like to interconnect with the electric grid. This approval process has become increasingly complex to the point where society would benefit if the process were now streamlined. The following two reports contain PAEC's recommendations to accelerate the permitting process for advanced energy projects to connect to the electric grid.

Best Practices: Streamlining Interconnection for Local, Commercial-Scale Renewable Energy Projects

The approval process for wholesale distributed generation (WDG) projects is one example of a permitting process that should be simplified. PAEC studied PG&E's Fast Track permitting process that reviews 10 kW to 5 MW WDG projects, most of which are commercial-scale solar projects, that seek interconnection.

This report studied how well the PG&E permitting process works for WDG projects.[6] The study found that among 209 permit applications since 2012, only 18 percent received approval, 61 withdrew prior to either completing the application process or receiving the results of the Initial Review, and 138 projects failed Initial Review. In total, only 37 out of 209 projects signed a Generator Interconnection Agreement. Figure 10 shows how long the different stages of the approval process take.

[6] Clean Coalition, Task 4.2 – Best Practices: Interconnection for Local, Commercial-Scale, Renewable Energy Projects – Streamlining the Interconnection of Advanced Energy Communities to the Grid

Figure 10: Timeframe for Wholesale Distributed Generation Project Approval

WDG Rooftop 1 MW Fast Track Project Development (Project where ICA map indicates sufficient capacity)	Timeframe (business days) Max	Minimum	Typical
PRELIMINARY WORK AND SITE CONTROL	180	60	120
Site Selection	2	1	1
Preliminary site evaluation and project screening	2	1	2
Preliminary layouts and performance models	2	1	2
Site control (Lease Option Agreement)	180	60	90
Pre-application reports	60	30	45
Other site research and selection	120	30	75
INTERCONNECTION INITIAL REVIEW	160	55	110
Prepare and submit interconnection application	120	30	75
Utility deems application complete	10	10	10
Initial review results (if pass, go to GIA cost estimate or GIA)	15	15	15
Developer requests initial review results meeting or proceeds to supplemental review	10	0	5
Initial review results meeting (if successfully identified, go to GIA cost estimate or GIA)	5	0	5
INTERCONNECTION SUPPLEMENTAL REVIEW	55	35	45
Decide to proceed to Supplemental Review	10	0	5
Supplemental review results (if pass, go to GIA cost estimate or GIA)	20	20	20
Developer requests supplemental review results meeting	15	0	5
Supplemental review results meeting (if successfully identified, go to GIA cost estimate or GIA)	5	0	5
Provide GIA cost estimate	15	15	15
POWER SALE CONTRACT	180	60	120
Lease negotiation	180	60	90
Site due diligence (structural, roof condition, soils, electrical/services, etc.)	50	20	30
Negotiate GC/EPC and engineering contracts	30	10	20
Final system engineering, design and integration; performance modeling	20	5	10
Permits	80	40	60
Financing pre-commitment			
Review power sales options	90	30	60
Obtain Power Purchase Agreement	90	30	60
GENERATOR INTERCONNECTION AGREEMENT (GIA)	95	17	50
Request GIA	15	1	5
Utility provides GIA	15	15	15
GIA negotiations and signatures (90 Calendar Day max time allowed)	65	1	30
GRID UPGRADES CONSTRUCTION**	250	0	190
Grid upgrade costs			
O&M costs (Cost of Ownership or COO)***			
Coordinate upgrade construction with utility, deed transfers			
PTO			
COD			
Totals (accounting for overlapping times)	**830**	**197**	**575**

Source: Clean Coalition, Best Practices: Streamlining Interconnection for Local, Commercial-Scale Renewable Energy Projects

With a timeline that currently ranges between six months and 2.3 years for approved projects, there are opportunities to streamline the Fast Track process while continuing to ensure a safe, reliable electric grid. According to the PAEC team's analysis, the Fast Track permitting process should be more transparent, efficient, and cost-effective to serve applicants better.

Design Pilot for Testing Streamlined Interconnection Procedures

After studying 209 interconnection applications to PG&E for commercial-scale solar projects, the PAEC team developed the following model interconnection process checklist.[7]

a. Pre-Review
    i. Online Automation (Internal and External)
    ii. Hosting Capacity Maps
b. Fixed charge for eligible small WDG (commercial solar) interconnection processes and avoiding developer requirements to pay for and then deed such upgrades
    i. Eligibility requirements
    ii. Proposed methodology for determining the fixed charge (modeled after the process used by NEM)
c. Pre-Application Report for larger WDG projects
d. Fast Track for larger WDG projects
    i. Screens
    ii. Initial Review
    iii. Supplemental Review
e. Detailed Study for larger WDG projects
f. Additional Requirements for larger WDG projects
    i. Interconnection Agreement
    ii. Insurance
    iii. Dispute Resolution
    iv. Utility Reporting
    v. Cost Certainty
        1. Unit Cost Guide
        2. Cost Envelope
        3. Cost Averaging
    vi. Miscellaneous

Utilities that adopt these recommendations will yield more transparency and certainty for the applicants around costs, timelines, and dispute resolution.

Solar Emergency Microgrid (SEM) Site Design and Deployment Plan

PAEC created a SEM site design and deployment plan in a disadvantaged region within the core PAEC region. The SEM provides renewables-driven power backup for critical facilities: police and fire stations, emergency operations centers, emergency shelters, and other facilities prioritized by the jurisdiction. Boosting the environmental and resilience benefits for a site is the primary goal. A secondary goal is to provide economic benefits to the site through lower

[7] Clean Coalition - Task 4.2 – Best Practices: Interconnection for Local, Commercial-Scale, Renewable Energy Projects – Streamlining the Interconnection of Advanced Energy Communities to the Grid

long-term energy costs and reduced utility charges, including demand charges, made possible by using distributed energy resources.

PAEC chose Hoover Elementary as a site for a SEM and modeled three SEM configuration scenarios: 1) solar and storage, 2) solar and storage, plus EV charging, and 3) an emergency community shelter running at 21 percent of normal load (Figure 11). The school district leadership will decide which option best meets the district's and community's needs.

Figure 11: Hoover Elementary School Solar Emergency Microgrid Potential Site

Source: Clean Coalition

Electric Vehicle Charging Infrastructure Master Plan

California Governor Edmund G. Brown set a goal of five million electric vehicles (EV) on the roads by 2030. To achieve this goal, the state of California is planning for 250,000 EV chargers, including 10,000 fast chargers, by 2025. Having an extensive network of charging stations will reassure people considering purchase of an EV that charging will be available where and when needed. PAEC developed a Master Plan to expand the number of electric vehicle charging stations in southern San Mateo County to help the state move toward these ambitious goals.

Potential Locations for the Electric Vehicle Charging Infrastructure Master Plan

PAECs EVCI Master Plan[8] recommends the Staumbaugh-Heller area of Redwood City as the primary geographic location for additional chargers, and East Palo Alto as a secondary location. Both geographic locations currently have the least dense charging infrastructure in San Mateo County, the potential for 80 percent to 90+ percent EVCI funding via PG&E's Charge Network Program, and a large and growing number of workplace and multi-unit dwelling potential hosts. Figure 12 shows the eight EVCI spots PAEC recommends within the planned PAEC Redwood City Community Microgrid.

Figure 12: Potential EVCI Sites in Redwood City

Source: Sven Thesen & Associates, Potential Locations for the Electric Vehicle Charging Infrastructure Master Plan

EVCI Master Plan

EV experts have noted the sharp decline in the price of battery technology and steady increase in vehicle range by EV manufacturers. Currently, there are several EVs that can travel more than 200 miles on a charge (Tesla Model S, Tesla Model X, and Chevy Bolt) as well as several plug-in hybrid models.

The availability of long-range EVs has catalyzed a new development paradigm for EVCI. While the focus of EVCI development has been on short-range charging for commuters at home and work, with longer range EVs available and more coming onto the market each year, the focus is

[8] Sven Thesen & Associates, Task 6.2 – Potential Locations for the Electric Vehicle Charging Infrastructure Master Plan

now on developing Level 2 charging outlets at Multi-Unit Dwellings and workplaces, as well as Direct Current Fast Chargers at retail locations and in transit corridors near highways.

Fortunately, local government does not need to spend money on EVCI. There is grant money from regional agencies and utilities to pay for part or most of the installation costs. Public-private partnerships are also becoming more common as a way to share the costs and savings, and speed the rollout of EVCI.

Five key ways local government can help supercharge EVCI include the following:

1. Create stronger code requirements for EV Level 2 charging outlets at Multi-Unit Dwellings (MUD) and workplaces that are new construction or major renovations.
    - MUDs - one charging outlet for each unit; and
    - Workplaces - require a certain percentage of parking spaces to be EV ready.
2. Encourage Direct Current Fast Charging stations at transit corridors with ownership, installation, and operation by third parties.
3. Encourage building owners to take advantage of grants from public agencies and utilities that fund major costs of installing EV charging outlets at MUDs and workplaces.
4. Install or require installation of EV signage. EV drivers already know where chargers are because of apps like plugshare.com. Public signage visible from roadways serves to educate and reassure non-EV owners that there are plenty of places to plug in once they buy an EV.
5. Host or encourage “EV Ride & Drives” to educate people about the benefits of EVs.

Together these five activities will have a big impact at little cost for local governments.

PAEC has been facilitating many conversations about EVCI build-outs in southern San Mateo County. While conducting research for the EVCI Master Plan, the team talked to several property owners about the availability of public funding for EV charging stations. This outreach resulted in commitments to install $504,000 of EV chargers. One multi-family complex in Redwood City plans to install 10 Level 2 chargers, and a condominium complex in East Palo Alto plans to install 36 Level 2 chargers.

Atherton Civic Center Sustainability Features

Spread across five acres, Atherton’s Town Center is comprised of a cluster of buildings (some of which were built in the 1920s) and temporary trailers. This municipal campus is undergoing major renovations, and the new campus will include a new Library and renovated Town Hall, a new City Hall building with Town Administration and Community Development offices, a new Police Department including Council Chambers and an Emergency Operations Center, and a renovated Corporation Yard and Public Works building. In order to reach the town leaders’ goal of ZNE, Atherton’s Town Center is being designed to maximize energy and water efficiency, as well as accommodate onsite solar photovoltaic (PV) systems to meet its electricity demand.

Technical and Economic Feasibility of Sustainability Features for the Atherton Civic Center Report

Forging a pathway to ZNE for this project was not easy. Choosing non-fossil fuel heating and cooling technologies and maximizing solar energy in an area with heavy tree cover, all while keeping the project within budget, posed a few of the challenges. The design team also had to work within the confines of site setbacks, existing roadways, and existing utilities. All three constrained the geometry of the new Town Center buildings and the siting of the solar PV systems. Limited rooftop capacity for solar PV required extensive use of energy efficient technologies in order for onsite energy supply to meet energy demand.

The following list of sustainability features and aspects demonstrate why PAEC chose the new Atherton Civic Center as a showcase case study.

Energy reduction and building energy use intensity (EUI)

- Library has an EUI of 20 kBTU/sf/yr (assumed operating 57 hours/week)
- City Hall/Council Chambers has an EUI of 20 kBTU/sf/yr (assumed operating 45 hours/week)
- Police Station has an EUI of 35 kBTU/sf/yr (assumed operating 24/7 operation, 168 hours/week)

Water reduction

- Target of 50 percent reduction in water use

Maintenance and operations

- Capability to reduce maintenance cost over the life of the building
- Simple to maintain

Renewable energy

- Rooftop solar PV (367 kW)
- Heat pump with water thermal storage

Essential services

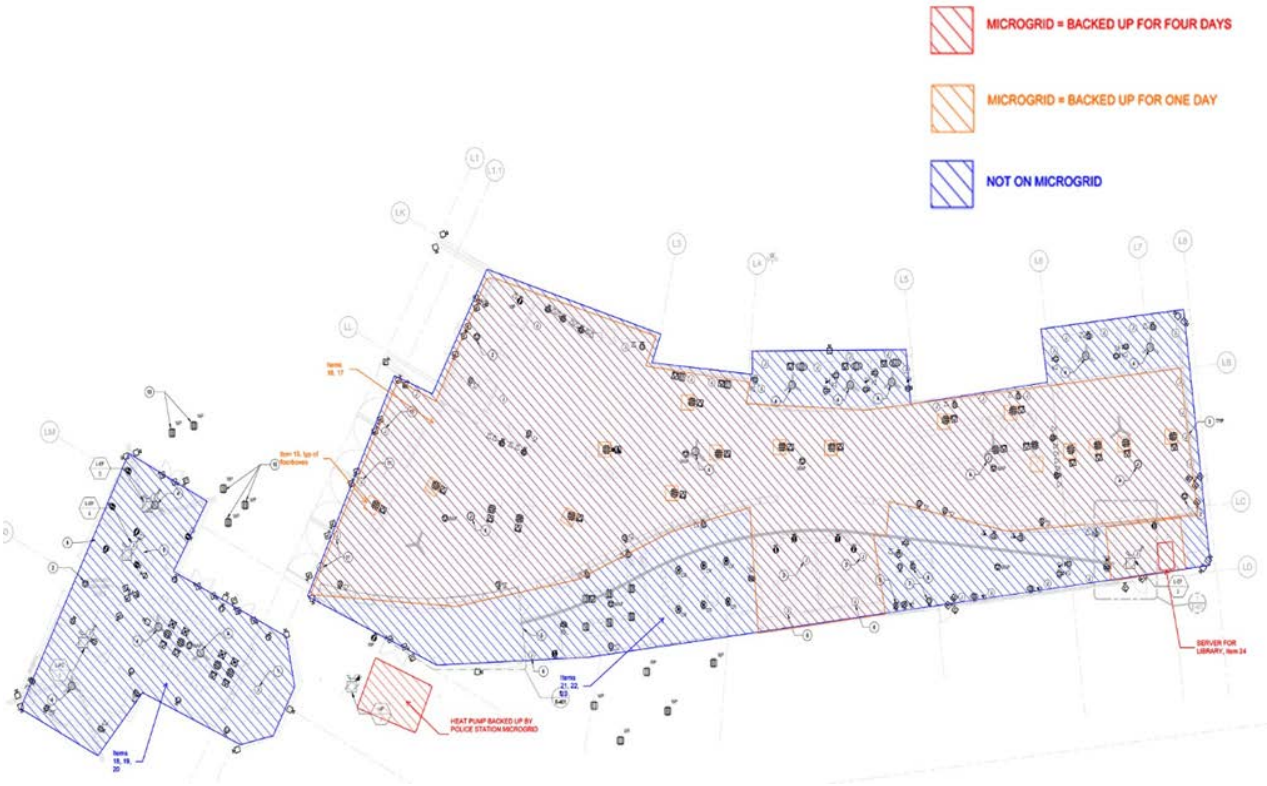
- The Police building must maintain up-time as an essential facility and will be designed with a seismic importance factor of 1.5

Combustion and CO2 emissions

- Reduce CO2 emissions drastically by not having on-site combustion

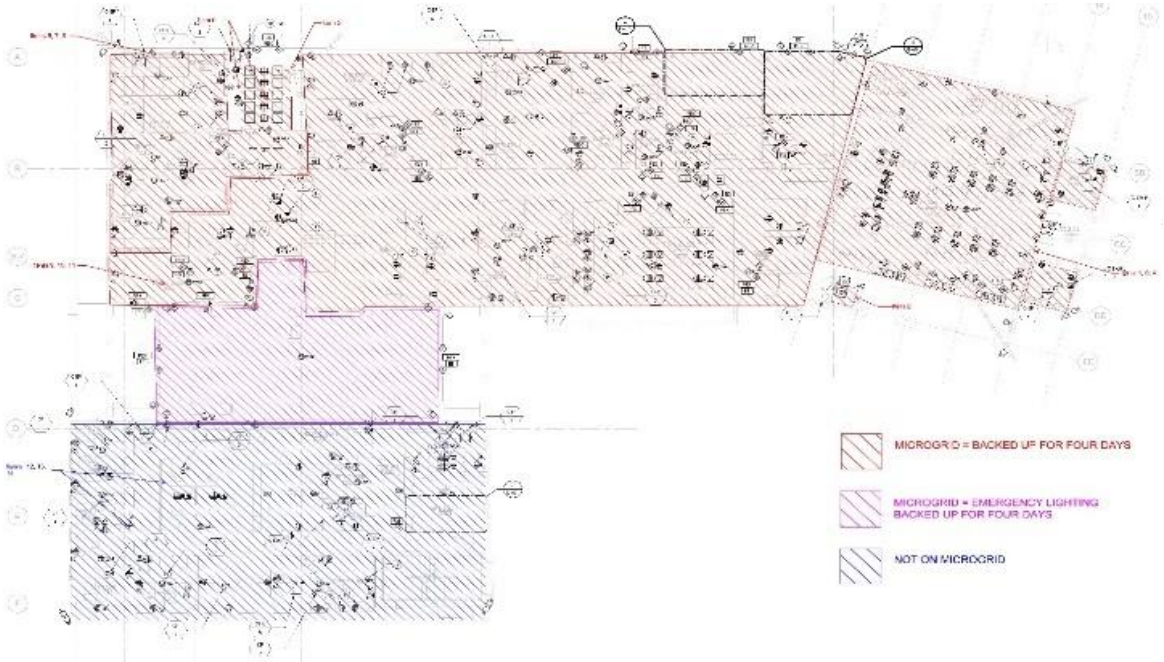
The SEM in the design was sized to provide backup power for critical emergency response services as shown in Figures 13 and 14.

Figure 13: Atherton Civic Center Microgrid (Part 1)



Source: Task 7.4: Technical and Economic Feasibility of Sustainability Features for the Atherton Civic Center Report

Figure 14: Atherton Civic Center Microgrid (Part 2)



Source: Task 7.4: Technical and Economic Feasibility of Sustainability Features for the Atherton Civic Center Report

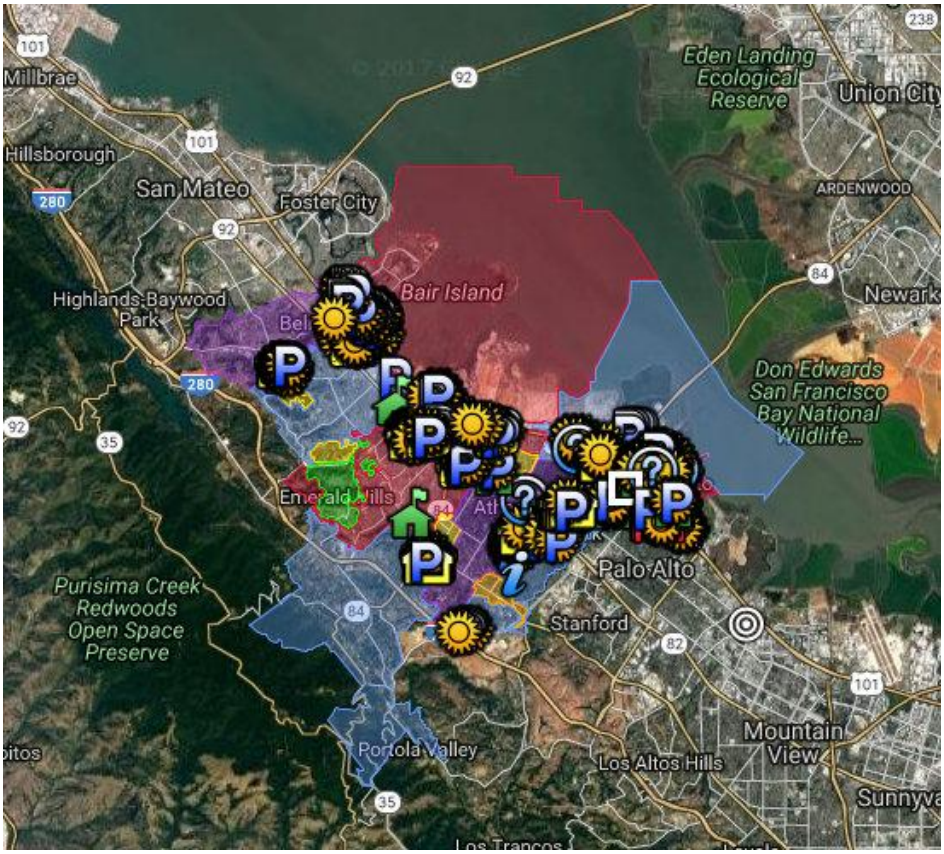
Overall the project will not only update the historic civic center buildings, it will figuratively catapult Atherton's town center to the leading edge of sustainable design.

Solar Siting Survey

PAEC's Solar Siting Survey reviewed satellite maps of southern San Mateo County to determine how much undeveloped commercial solar potential exists. Although the area has dense development and a thick canopy of trees, PAEC found 65 MW of commercial solar potential. Three main areas that offered opportunities for solar PV installations of at least 100 kW each were school rooftops, parking lots, and parking garages.

Information about each location with at least 100 kW of solar potential was loaded into a Google Map platform (Figure 15), which is searchable for details about each property.

Figure 15: Map from PAEC Solar Siting Survey Tool



Source: Clean Coalition, Solar Siting Survey

Each county in California would benefit from having a map of potential sites for commercial solar development with a backend database describing each potential site like the PAEC team created for southern San Mateo County. Other counties in California are now benefitting from the Clean Coalition Solar Siting Survey tool base including Alameda County, Santa Barbara County, Sonoma County, etc.

Master Case Study

Over 21 months, the PAEC team identified challenges, studied best practices, developed findings, and created tools to accelerate advanced energy communities. The Master Case Study synthesized highlights from all PAEC initiative reports. The following two-page infographic summarizes highlights of the greater than 100-page PAEC Master Case Study (Figure 16).

While the individual tasks and reports examine topical objectives and results, the Master Case Study organized these results according to their economic, policy, and technical components, which provides a comprehensive playbook for advancing AECs. In addition, the Master Case Study lays out a specific proposal for development of a new AEC with Southern San Mateo County (also see the next section on Master Community Design) and highlights areas for further exploration to continue the work of advancing AECs.

Figure 16: Master Case Study Infographic

PENINSULA ADVANCED ENERGY COMMUNITY

ADVANCED ENERGY COMMUNITY COMPONENTS

1. ENERGY EFFICIENCY
2. RENEWABLE ENERGY
3. ZERO NET ENERGY
4. ELECTRIC VEHICLE CHARGING INFRASTRUCTURE
5. ENERGY STORAGE

PLANNED ATHERTON CIVIC CENTER

BENEFITS

1. REDUCES NEED FOR NEW ENERGY TRANSMISSION + DISTRIBUTION INFRASTRUCTURE
2. PROMOTES GRID RELIABILITY + RESILIENCE
3. FINANCIALLY ATTRACTIVE
4. REPLICABLE + SCALABLE

PAEC REPORT HIGHLIGHTS

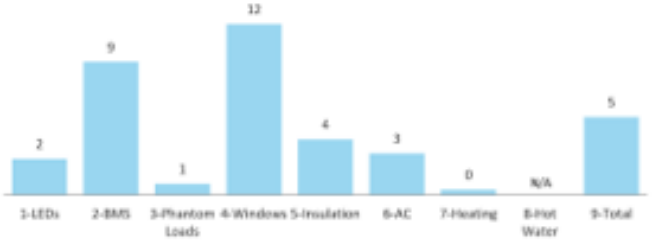
CHALLENGES

- INCONSISTENT PERMITTING PROCESSES (DOCUMENTATION REQUIREMENTS, COSTS, REVIEWS, TIMELINES) AT MUNICIPALITIES AND UTILITIES
- INCONSISTENT FINANCIAL INSTRUMENTS AVAILABLE TO FUND INVESTMENTS FOR AECS IN COMMERCIAL, RESIDENTIAL, AND PUBLIC SECTORS
- SPLIT INCENTIVES BETWEEN BUILDING OWNERS + TENANTS
- TENSION BETWEEN CAPITAL EXPENSES + OPERATING EXPENSES
- TENDENCY TO FAVOR INITIAL COST OVER LIFE CYCLE COSTS
- RANGE ANXIETY - LACK OF EV FAST CHARGERS

RECOMMENDATIONS

- IMPLEMENT BUNDLES OF ENERGY EFFICIENCY MEASURES. AVERAGE 5-YEAR PAYBACK = 18% RETURN, BETTER THAN RETURNS FROM MOST OTHER INVESTMENT OPTIONS.

ENERGY EFFICIENCY ROI FOR OFFICE BUILDING



- FOCUS ON THE FOLLOWING IN SOUTHERN SAN MATEO COUNTY:
  - DEEP ENERGY RETROFITS FOR RESIDENTIAL + COMMERCIAL PROPERTIES
  - FINANCIAL OPTIONS THAT ALLOW ENERGY SAVINGS TO FUND CAPITAL INVESTMENTS
  - ZERO NET ENERGY FOR NEW DEVELOPMENTS
  - INCREASING EV CHARGING INFRASTRUCTURE WITH BATTERY STORAGE
- MUNICIPALITIES SHOULD DEVELOP EV-READY CODES FOR MULTI-UNIT DWELLINGS
- CONTINUE SUBSIDIZING ENERGY STORAGE IN THE NEAR TERM AS THE MARKET BRINGS THE PRICE DOWN

TOOLS

- STREAMLINED PERMITTING
- MODEL INTERCONNECTION PROCESS CHECKLIST
- MODEL ORDINANCES
- GREEN LEASE LANGUAGE
- SOLAR SITING SURVEY
- ELECTRIC VEHICLE CHARGING INFRASTRUCTURE MASTER PLAN

Benefits of AEC Projects

Customers

- Implementing energy efficiency means:
  - Customers save on their energy bill
  - Improved comfort, health + worker productivity
- Installing solar PV allows customers to prepay their electricity bill for the next 25 years, a hedge against future price increases

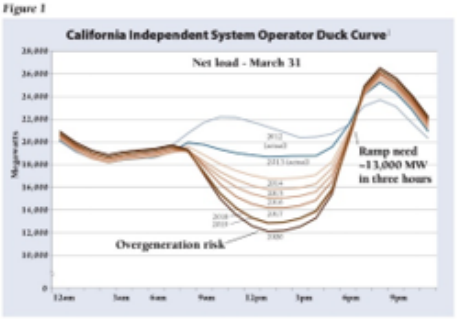
Community

- Provides clean local energy
- Creates clean energy jobs
- Obviates expense of new power plant construction
- Builds resilience
- Addresses climate change

Ratepayers

- Energy storage bridges the gap between overgeneration by solar PV during peak sunlight hours and peak energy demand later in the evening

Figure 1



AEC Leaders

Existing Projects with AEC Components

Palo Alto Bryant Street Garage
(Improving feed-in tariff)
- Solar PV
- EV charging
- Energy storage

Facebook
(Including water treatment in energy footprint)
- On-site black water treatment
- Energy efficiency
- Solar PV
- EV charging
- Energy storage

Jewish Community Center
(Maximizing existing technologies)
- Energy efficiency
- Air-source heat pump
- Solar PV
- EV charging

Kaiser Permanente
(Life-cycle cost solution to split incentive problem)
- Energy efficiency retrofits
- Solar PV power purchase agreement
- EV charging

Redwood City Corp Yard
(Solar emergency microgrid)
- Solar PV
- EV charging
- Energy storage

Stanford University
(District-level projects)
- Energy efficiency
- District-scale heat exchange system
- Solar PV
- EV charging

Master Community Design

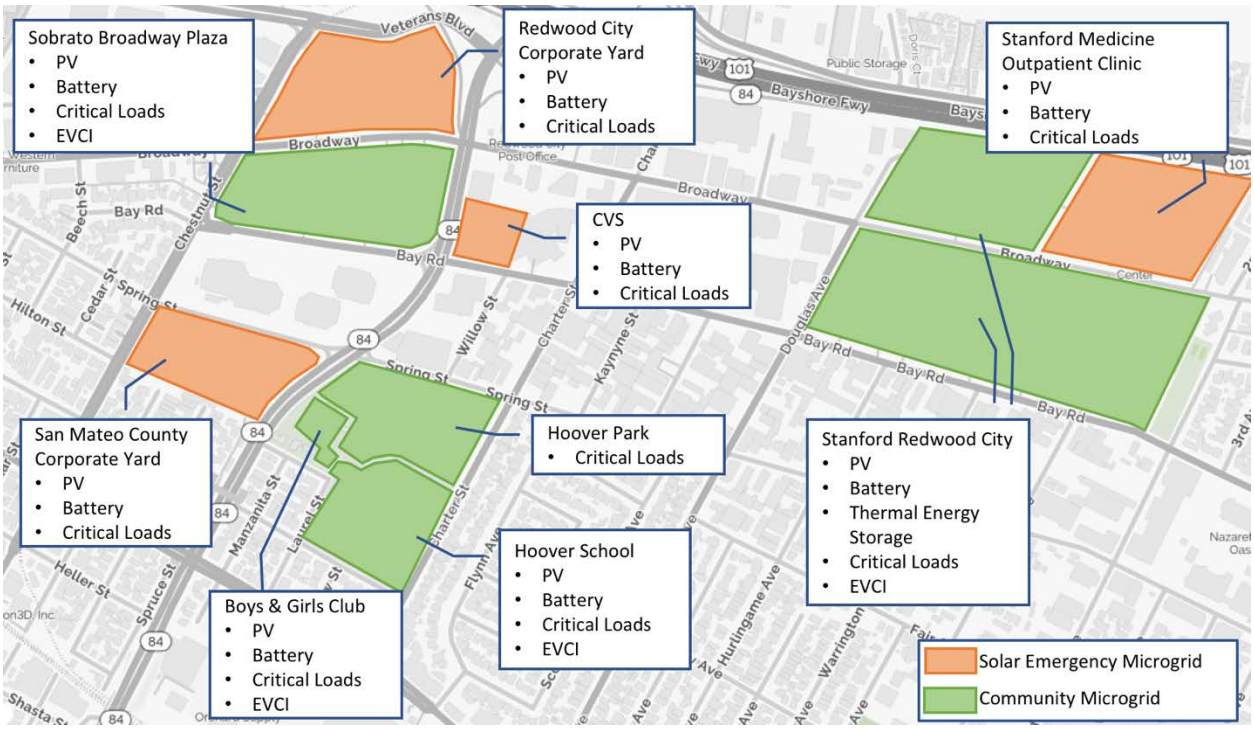
Community microgrids represent a new approach for designing and operating the electric grid, relying heavily on distributed energy resources to achieve a more sustainable, secure, and cost-effective energy system while generally providing renewables-driven power backup for prioritized loads over indefinite durations. The Redwood City Community Microgrid for PAEC will use a combination of solar, ES, and EVCI at five separate sites and 11 utility meters within a disadvantaged community.

The project showcases community microgrid deployments at four unique site types and demonstrates four unique use-cases and ownership models for community microgrids. The critical facilities that will receive indefinite, renewables-driven power backup include an emergency shelter facility at Hoover School and the Boys and Girls Club, Public Works services including road and public facility repair services at the two Corporate Yards, low-income housing and a pharmacy at the Sobrato Broadway Plaza, and Stanford Redwood City. Finally, all of the sites provide model microgrid deployment projects that can be replicated.

This project demonstrates how to incorporate advanced energy technology into existing public buildings, existing private buildings, as well as new private buildings owned by non-profit and for-profit entities. The deployment of this project will result in new learnings about the challenges and opportunities specific to each site type, and also how to structure asset ownership (solar, battery, EVCI, building management systems and microgrid controller) for each site type.

Figure 17 provides an overview of the AEC component pieces planned for each of the sites.

Figure 17: Redwood City Master Community Design Conceptual Drawing



Source: Clean Coalition

The next steps required to develop the Final Master Community Design into a shovel-ready project are to complete the engineering designs including single line diagrams and economic analysis, and finalize system sizing. While interconnection sites have already been chosen, the best interconnection type for each asset at each site must still be determined. Clean Coalition is working with PG&E to develop a design to connect each of the microgrid

sites together. After the overall design with utility connections is determined, the project will be submitted for permitting review.

Final engineering design work for the Master Community Design is currently in progress. Although detailed engineering, cost estimates, and economic analysis continue to evolve with new information, the PAEC team knows that the Final Master Community Design will include:

- Refined system sizes for solar and battery deployments;
- Detailed engineering designs including trenching and conduit paths, and single line drawings that refine the conceptual drawings produced to date for each site;
- Conceptual drawing and single line drawing demonstrating the design of the utility infrastructure that will connect each of the sites together; and
- Availability of funding and financing required to deploy this project at each site.

The Redwood City Community Microgrid Master Design incorporates learnings from the 21-month initiative and is the capstone of PAEC. Once completed, the Community Microgrid will result in economic, environmental, and resilience benefits for the site owners and patrons as well as for the wider community.

Evaluation of Project Benefits[9]

As advanced energy project developers in partnership with local government agencies and utilities deploy advanced energy communities, benefits will accrue to energy consumers, local communities, utility ratepayers, and society in general. The PAEC project analyzed qualitative and quantitative benefits, including a host of environmental, cost savings, and resilience attributes.

Energy Consumers

At a local level, benefits for energy consumers include the following.

- Energy bill savings - Commercial and residential building owners and tenants that implement EE measures will save money on their energy bill.
- Hedge against future energy rate increases - Commercial and residential building owners and tenants that install on-site solar PV will essentially pre-pay their electricity bills for the next 25 years and hedge against future energy rate increases.
- Reduced cost of clean local energy – The tools, data and expected policy adoption that are expected to result from the PAEC initiative will reduce the time, uncertainty, and other soft costs, associated with siting, financing, permitting and interconnecting clean

[9] Clean Coalition, Task 11 – Evaluation of Project Benefits

local energy projects. Where these practices are employed, PAEC expects energy consumers should enjoy roughly 20 percent lower prices for clean local energy.

PAEC Community

The community in southern San Mateo County will enjoy several benefits.

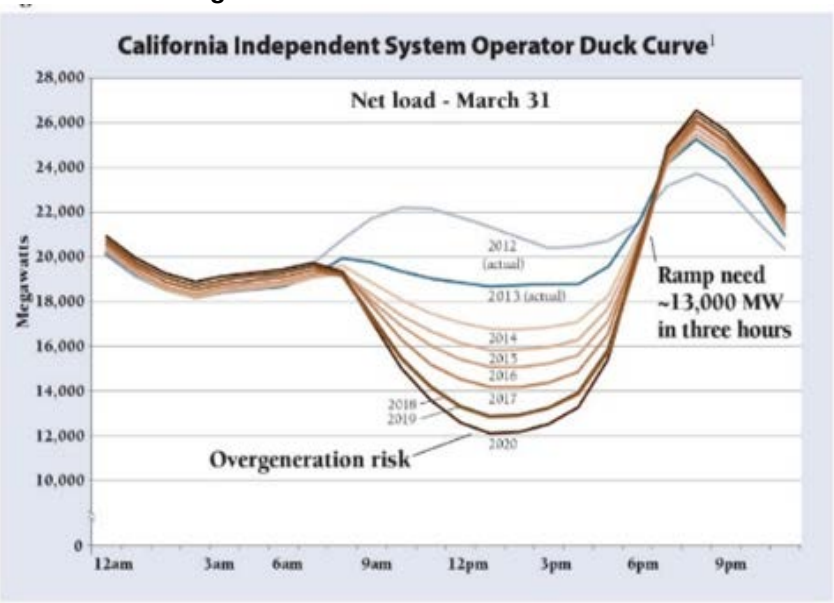
- Continuous backup power for critical community services - Solar emergency microgrids will provide renewable-based backup power at critical facilities that serve the community such as hospitals, municipal emergency response centers, and emergency shelters. Detailed project plans will be developed for at least one Solar Emergency Microgrid, which will set the stage to provide indefinite, renewable-based power backup to critical facilities in the PAEC region.
- Improved grid reliability and avoided financial losses from power outages
- Accelerated development of local solar generation – The PAEC Solar Siting Survey identified 65MW of commercial solar potential in southern San Mateo County.
- By streamlining the processes to identify, permit, finance, build, and connect AEC projects, the PAEC will drive down the costs of developing these resources. Increasing the efficiency of the permitting process reduces time for both agency and applicant staff by at least 10 percent and potentially up to 50 percent, typically saving $2,000 per commercial application.
- Reducing the time, uncertainty, and other soft costs associated with siting, financing, permitting, and interconnecting will result in roughly 20 percent lower prices for clean local energy where these practices are employed.
- The following 20-year benefits are estimated based on avoided conventional energy generation associated with each 25 MW of new local solar that is built due to the PAEC's improved tools and policies:
    - Economic stimulation: Investment equal to 25 MW of new solar PV deployment is estimated to generate $116 million in total added regional economic output and create $35 million in local wages from construction and installation.
    - Environmental benefits: Each year, the PAEC is projected to reduce GHG emissions by nearly 40 million pounds and save 7 million gallons of water.
    - Avoided loss costs from outages, plus improved reliability. Medium and large commercial facilities, small commercial enterprises, and residential customers (per 100) will be on track to save $83,600, $14,160, and $9,500 in avoided loss costs, respectively.

Ratepayers

The ratepayers in California will realize the following benefits:

- Energy consumers will save $12 million in PG&E peak capacity costs, $6 million in avoided transmission losses, and $9 million in costs over 20 years related to avoided transmission proportional capacity for every 25 MW of clean local solar built.
- Energy storage bridges the gap, as in the "duck curve" in Figure 18, between over-generation by solar PV during peak sunlight hours and peak energy demand later in the evening. Shifting loads saves ratepayers money.

Figure 18: California ISO Duck Curve



Source: California ISO

State Level

To meet California's bold energy and environmental goals, significant improvements are necessary in how the state generates, transmits, and uses energy. Developing advanced energy communities that use clean local energy will yield the following benefits for California:

- Obviating the expense of new power plant construction.
- Increasing the percentage of RE per California's Renewable Portfolio Standard (R.11-05-005) and help meet requirements for the ES roadmap, smart grid development, the Customer Data Access Program, the Distribution Resources Plans, Rule 21 regarding interconnection, Net Energy Metering, and the California Solar Initiative.
- Helping the state of California modernize the grid – Under Public Utilities Code 8360, the state seeks to modernize electrical transmission and distribution systems to maintain safe, reliable, efficient, and secure electrical service with infrastructure that can meet future growth in demand. On the demand side, advanced electricity storage, peak-shaving technologies, electric vehicles,

and thermal storage air-conditioning are leading edge technologies that will help make the grid safer and more reliable.

- Enhancing grid resilience and security
- Improving interconnection policies to accelerate adoption of distributed energy resources
- Creating green jobs installing equipment and retrofitting systems

Altogether, investing in a clean energy future will cost money but the investment will yield numerous valuable financial and environmental benefits at the individual, organizational, community, state level, and beyond.

Technology/Knowledge Transfer

One goal of this project was to make the knowledge gained and lessons learned from the PAEC initiative available to the public and to key decision makers. To accomplish this, Clean Coalition's PAEC Communications team conducted communications, media, and marketing campaigns to disseminate all technological, innovation, and deployment findings and reports from the PAEC Initiative. These included guidelines and recommendations, design plans, deployment plans, technology used, types of energy products and systems used, types of energy processes used, and more.

Activities completed to date, and those planned for the future, include educational webinars, published blog articles, outreach to media, outreach to like-minded organizations, outreach to PAEC supporters and collaborators, in-person event speaking engagements, reports, published press releases, and media coverage, including interviews and featured stories.

Specifically, one blog article per month has been published on Clean Coalition's website, with additional blog posts planned for the duration of the PAEC initiative. Each blog article is promoted via social media and through email marketing, and also cross-posted on Medium. Additionally, each blog article is sent to PAEC partners and collaborators with a request to disseminate the information through their own marketing and communications channels.

Supplemental to the blog articles, social media and email marketing, and outreach to partners and collaborators, the PAEC Communications team is conducting six educational webinars on various aspects of the PAEC Initiative. These webinars were held from January to June, 2018.

Finally, to round out the technology and knowledge transfer, Clean Coalition developed a PAEC Master Case Study that includes past and new content, including blog content, original graphics, and more. The team will promote the case study through media outreach, outreach through strategic partnerships, social media, and targeted email campaigns.

The method used to disseminate the PAEC findings draws from many combined decades of professional nonprofit and for-profit marketing and communications experience from each of the PAEC partners and other key stakeholders. The team used the appropriate and available channels under this Initiative, plus the consistent use of email address data, prospective targets, and media outreach.

Conclusion

The State of California provides a strong framework of policy goals and regulations that support the development of advanced energy communities. Goals for GHG reduction, standards for renewable portfolio development, and EE standards that strengthen every three years provide the scaffolding upon which future AECs are built.

To support these goals, the PAEC team identified the major economic, policy, and technical barriers facing use of AECs, and developed tools to overcome those barriers. There is no lack of sophisticated, efficient technologies to build AECs. Equipment for EE retrofits, solar PV, heat exchange, EV charging and ES is readily available for purchase and works well.

What holds back advancing AECs are mainly economic and policy barriers. PAEC developed findings and tools that will address these barriers, reduce costs, and shorten learning curves to accelerate the build-out of AECs.

As a society it is essential to invest in upgrading buildings and electric grid using clean local renewable energy. These investments will yield benefits of reduced costs, job creation, enhanced grid resilience, and a stable climate for individuals, communities and future generations.

PAEC is excited to share what they learned in southern San Mateo County. The team believes the findings will be useful to other communities that will replicate and scale them across California and beyond.

GLOSSARY

Term	Definition
AEC	Advanced Energy Communities
BEMS	Building Energy Management System
CAISO	California Independent Systems Operator
CCA	Community Choice Aggregation
CPUC	California Public Utilities Commission
DCFC	Direct Current Fast Charger
DER	Distributed Energy Resources
EE	Energy Efficiency
ES	Energy Storage
EPIC (Electric Program Investment Charge)	The Electric Program Investment Charge, created by the California Public Utilities Commission in December 2011, supports investments in clean energy technologies that benefit electricity ratepayers of Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company.
EVCI	Electric Vehicle Charging Infrastructure
GHG	Greenhouse Gas
ISO	Independent System Operators operate transmission systems in order to provide open access to the grid.
MUD	Multi-Unit Dwelling
NYISO	New York Independent Systems Operator
PAEC	Peninsula Advanced Energy Community
PJM	PJM is the Regional Transmission Organization that coordinates the movement of wholesale electricity in all or parts of DE, IL, IN, KY, MD, MI, NJ, NC, OH, PA, TN, VA, WV, and DC
RTO	Regional transmission organizations (RTOs) operate the transmission system in multi-state areas to advance the development of competitive wholesale power markets.
RE	Renewable Energy
Resilience	The capacity of a system to survive, adapt, and grow in the face of unforeseen changes, even catastrophic incidents
SEM	Solar Emergency Microgrid
SGIP	Self-Generation Incentive Program is a rebate program in California for energy storage technologies
smart grid	Smart grid is the thoughtful integration of intelligent technologies and innovative services that produce a more efficient, sustainable, economic, and secure electrical supply for California communities.
WDG	Wholesale Distributed Generation

REFERENCES

2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24, Part 6, and Associated Administrative Regulations in Part 1), CEC-400-2015-037-CMF

City of Berkeley Mandatory Requirements for the Installation of Photovoltaic Solar Energy Systems (September 27, 2016 Draft)

City of Palo Alto EVSE Ordinance (June 16, 2014)

City of San Francisco EV Ready Ordinance as Introduced February 28, 2017

City of San Francisco Better Roof Requirements for Renewable Energy Facilities

City of San Mateo Ordinance Amending Title 23 Building and Construction of the San Mateo Municipal Code

Oakland City Council Ordinance Adopting Local Amendments to Section 4.106.4 and 5.106.5.3 of the 2016 Edition of the California Green Building Standards

APPENDIX A:
Solar Siting Survey Summary

Total PV Summary

Summary by Structure PV Size

	Num_Sites	kW_Total	PV W_AC >= 500 kW		> and >= 250 kW		Less than 250 kW	
Totals:	484	66,228 kW	24	17,073 kW	56	18,840 kW	404	30,315 kW
Atherton, CA 94027	33	1,502 kW	-	- kW	-	- kW	33	1,502 kW
Menlo Park, CA 94025	102	18,909 kW	7	5,786 kW	17	5,544 kW	78	7,579 kW
East Palo Alto, CA 94303	91	8,134 kW	4	2,499 kW	2	575 kW	85	5,060 kW
Redwood City, CA 94061	14	1,190 kW	-	- kW	1	445 kW	13	745 kW
Redwood City, CA 94062	18	740 kW	-	- kW	-	- kW	18	740 kW
Redwood City, CA 94063	90	17,532 kW	9	6,466 kW	13	4,349 kW	68	6,717 kW
Redwood City, CA 94065	53	10,049 kW	1	532 kW	17	5,968 kW	35	3,550 kW
San Carlos, CA 94070	42	5,618 kW	2	1,258 kW	5	1,633 kW	35	2,727 kW
Belmont, CA 94002	27	1,403 kW	1	532 kW	-	- kW	26	871 kW
Woodside, CA 94062	14	1,151 kW	-	- kW	1	327 kW	13	824 kW

Summary by Structure Types

	Roof_Flat	kW_Total	Roof_Angled	kW_Total	Pkg_Lot	kW_Total	Pkg_Garage	kW_Total	dr
Totals:	282	34,928 kW	70	2,367 kW	113	22,440 kW	20	6,493 kW	#
Atherton, CA 94027	15	852 kW	15	397 kW	3	254 kW	-	- kW	
Menlo Park, CA 94025	61	11,909 kW	11	275 kW	30	6,725 kW	-	- kW	
East Palo Alto, CA 94303	60	4,991 kW	15	593 kW	15	2,312 kW	1	238 kW	
Redwood City, CA 94061	2	168 kW	9	195 kW	4	828 kW	-	- kW	
Redwood City, CA 94062	13	537 kW	1	30 kW	4	173 kW	-	- kW	
Redwood City, CA 94063	53	9,160 kW	1	77 kW	30	7,097 kW	6	1,198 kW	
Redwood City, CA 94065	18	2,446 kW	5	92 kW	18	3,077 kW	12	4,435 kW	
San Carlos, CA 94070	36	3,361 kW	1	67 kW	4	1,568 kW	1	623 kW	
Belmont, CA 94002	21	1,271 kW	2	50 kW	4	81 kW	-	- kW	
Woodside, CA 94062	3	233 kW	10	591 kW	1	327 kW	-	- kW	

Other symbols: Existing PV; Existing PV, High Density (Colored red in G-Earth); Questions, TBD

Aggregate Facilities Summary

Summary by **Aggregation Type**: PV at All Sites

Aggregation Type	Num_Sites	kW_Total	PV W_AC >= 500 kW		> and >= 250 kW		Less than 250 kW	
Totals:	67	41,721 kW	32	34,095 kW	13	4,793 kW	22	2,833 kW
Airport	-	- kW	-	- kW	-	- kW	-	- kW
Apartments	3	1,132 kW	1	627 kW	1	369 kW	1	136 kW
Biz	11	13,349 kW	11	13,349 kW	-	- kW	-	- kW
Bus	1	278 kW	-	- kW	1	278 kW	-	- kW
Edu	27	7,752 kW	5	4,099 kW	5	1,672 kW	17	1,981 kW
Fire_Stn	-	- kW	-	- kW	-	- kW	-	- kW
Golf	-	- kW	-	- kW	-	- kW	-	- kW
Hospital	2	1,018 kW	1	590 kW	1	429 kW	-	- kW
Pump_Stn	-	- kW	-	- kW	-	- kW	-	- kW
Shopping	13	14,794 kW	13	14,794 kW	-	- kW	-	- kW
Storage	10	3,399 kW	1	637 kW	5	2,045 kW	4	717 kW

Heavy Hitters	
Oracle	3,490 kW
Facebook	4,339 kW

Summary of **Aggregate Facilities** by City/ZIP

	Apartments		Biz		Edu		Shopping		Storage		Hospital		Bus	
	Num_Sites	kW_Total	Num_Sites	kW_Total	Num_Sites	kW_Total	Num_Sites	kW_Total	Num_Sites	kW_Total	Num_Sites	kW_Total	Num_Sites	kW_Total
Atherton, CA 94027	-	- kW	-	- kW	5	1,502 kW	-	- kW	-	- kW	-	- kW	-	- kW
Menlo Park, CA 94025	-	- kW	3	4,954 kW	5	865 kW	-	- kW	-	- kW	-	- kW	-	- kW
East Palo Alto, CA 94303	2	763 kW	-	- kW	8	1,726 kW	2	3,440 kW	3	582 kW	-	- kW	-	- kW
Redwood City, CA 94061	-	- kW	-	- kW	1	195 kW	1	996 kW	-	- kW	-	- kW	-	- kW
Redwood City, CA 94062	-	- kW	-	- kW	1	740 kW	-	- kW	-	- kW	-	- kW	-	- kW
Redwood City, CA 94063	1	369 kW	1	1,318 kW	4	587 kW	7	8,264 kW	3	1,200 kW	2	1,018 kW	-	- kW
Redwood City, CA 94065	-	- kW	6	5,869 kW	1	115 kW	2	1,550 kW	-	- kW	-	- kW	-	- kW
San Carlos, CA 94070	-	- kW	1	1,208 kW	-	- kW	1	544 kW	4	1,617 kW	-	- kW	1	278 kW
Belmont, CA 94002	-	- kW	-	- kW	1	871 kW	-	- kW	-	- kW	-	- kW	-	- kW
Woodside, CA 94062	-	- kW	-	- kW	1	1,151 kW	-	- kW	-	- kW	-	- kW	-	- kW
Totals:	3	1,132 kW	11	13,349 kW	27	7,752 kW	13	14,794 kW	10	3,399 kW	2	1,018 kW	1	278 kW

PAEC Solar Siting Survey Files

The following Solar Siting Survey files and information are available on Clean Coalition's website:

- Data spreadsheet including Summary sheet shown in Appendix A.
- kml file importable into Google Earth that contains city outlines and Solar Siting Survey sites
- A Google-Maps viewable version of the kml file that is accurate, but has fewer viewing features than when viewed in Google-Earth

http://www.clean-coalition.org/our-work/peninsula-advanced-energy-community/solar-siting-survey/

APPENDIX B:
Sample Model Ordinances Language for San Mateo County

Policy 1-EV-MF: EV Charging Station Ordinance for Cost-Share in Leased Buildings

ELECTRIC VEHICLE CHARGING STATION ORDINANCE FOR COST-SHARE IN LEASED BUILDINGS

Ordinance No. XXXXX

An uncodified ordinance of the City Council/Board of Supervisors of the City/County of [JURISDICTION] approving adoption of Chapter NUMBER (Electric Vehicle Charging Station Cost-share in Retrofit Projects) of the [JURISDICTION] [Municipal/Administrative/Building/Other] to establish a requirement for cost-share of installation of electric vehicle charging infrastructure in multi-unit dwellings.

The Council/Board of the City/County of [JURISDICTION] does ORDAIN as follows:

SECTION 1. Findings and Declarations.

California Assembly Bill (AB) 2565 provides that for a residential lease executed, extended, or renewed after July 1, 2015, "a lessor of a dwelling shall approve a written request of a lessee to install an electric vehicle charging station at a parking space allotted for the lessee that meets the requirements of this section and complies with the lessor's procedural approval process for modification to the property." The law assumes that the lessee pays the full cost of the charging station installation,

Promoting the use of electric vehicles is needed to meet the requirements of climate change and the city's/county's climate action plan. Split incentives are a market failure for leased properties related to a range of energy efficiency and clean energy project, including electric vehicle charging stations. Therefore, this ordinance seeks to overcome one of the most significant barriers to EV charging stations in leased property through requiring a cost-share by the lessor and lessee.

SECTION 2. Chapter NUMBER of the [JURISDICTION] [Municipal/Administrative/Building…] Code is hereby amended by adopting a new Chapter NUMBER to read as follows:

(A) DEFINITIONS

ELECTRIC VEHICLE CHARGING STATION. Electric vehicle charging station" or "charging station" means a station that is designed in compliance with Article 625 of the National Electrical Code, as it reads on the effective date of this section, and delivers electricity from a source outside an electric vehicle into one or more electric vehicles. An electric vehicle charging station shall meet applicable health and safety standards and requirements imposed by state and local authorities

as well as all other applicable zoning, land use, or other ordinances, or land use permit requirements.

LEVEL 1 CHARGING STATION. Level 1 outlets used for PEV charging should be National Electrical Manufacturers Association (NEMA) commercial grade outlets that meet National Electric Code (NEC) requirements. These outlets are 110-120V and on a dedicated circuit, preferably rated for 20 amps. Using a ground fault circuit interrupter (GFCI) outlet with an outlet cover is required for outdoor use or anywhere the outlet could get wet. Electric Vehicles come equipped from the manufacturers with portable Level 1 chargers.

LEVEL 2 CHARGING STATION. Level 2 outlets used for PEV charging should be National Electrical Manufacturers Association (NEMA) commercial grade outlets that meet National Electric Code (NEC) requirements. These outlets are 220-240V and on a dedicated circuit, preferably rated for 40 amps.

REASONABLE COSTS. "Reasonable costs" includes, but is not limited to, costs associated with those items specified in the "Permitting Checklist" of the "Zero-Emission Vehicles in California: Community Readiness Guidebook" published by the Office of Planning and Research.

(B) PURPOSE AND INTENT

In line with state policy, it is the policy of the City/County to promote, encourage, and remove obstacles to the use of electric vehicle charging stations. While AB 2565 requires a lessor of a dwelling to approve a written request of a lessee to install an electric vehicle charging station at a parking space allotted for the lessee, there is a split-incentive problem that discourages investment in charging stations for leased property. The cost of the installation is born entirely by the lessee even though significant components of the charging station are permanent modifications to the lessor's property. As such, the purpose of this ordinance is to address the split-incentive problem, by requiring a cost-share by the lessor for the installation of charging stations at the leased property.

(C) APPLICABLE PROJECTS

The provisions of this Chapter shall apply to both residential and commercial tenancies.

Consistent with AB 2565, this ordinance does not apply to residential rental properties where:

i. Electric vehicle charging stations already exist for lessees in a ratio that is equal to or greater than 10 percent of the designated parking spaces.
ii. Parking is not provided as part of the lease agreement.
iii. A property where there are less than five parking spaces.
iv. A dwelling that is subject to the residential rent control ordinance of a public entity.

Consistent with AB 2565, this ordinance does not apply to any of the following:

v. A commercial property where charging stations already exist for use by tenants in a ratio that is equal to or greater than two available parking spaces for every 100 parking spaces at the commercial property.
vi. A commercial property where there are less than 50 parking spaces.

(D) REQUIREMENT *(EDIT RELEVANT CONTENT)*

Consistent with AB 2565, for any lease executed, extended, or renewed on and after July 1, 2015, a lessor of a dwelling shall approve a written request of a lessee to install an electric vehicle charging station at a parking space allotted for the lessee that meets the requirements of this section and complies with the lessor's procedural approval process for modification to the property.

SECTION X-1. Cost-share

For any lease executed, extended or renewed on or after July 1, 2017, this ordinance extends the requirement of AB 2565 to obligate the lessor to provide, at the request of the tenant, 100 percent cost for Level 1 charging station or a 50 percent cost-share for Level 2 charging station and its infrastructure, including all reasonable costs associated with the installation of the charging station and its infrastructure. The reasonable costs associated with modifications and improvements shall include, but are not limited to, the cost of permits, supervision, construction, and, solely if required by the contractor, consistent with its past performance of work for the lessor, performance bonds.

For applicable residential rental properties, at the request of the tenant, the lessor shall incur 100 percent cost for Level 1 charging or a 50 percent cost-share for Level 2 charging, including upgrading the rental unit such that it is lessee has on-site access to overnight charging within 5 feet of the parking space. Acceptable access to overnight charging includes:

a) For Level 1 charging:
    a. NEMA compliant 120V, 12A outlet connected to the tenant meter
    b. NEMA compliant 120V, 12A outlet connected to the landlord meter, with reasonable capture of charging cost to landlord by tenant.
b) For Level 2 charging:
    a. NEMA compliant 220V, 40A outlet connected to the tenant meter
    b. NEMA compliant 220V, 40A outlet connected to the landlord meter, with reasonable capture of charging cost to landlord by tenant.
    c. Full Level 2 (220V) charging station installation

The cost-share does not extend to the lessee's payment for the costs associated with the electrical usage of the charging station, and cost for damage, maintenance, or repair of the charging station.

SECTION X-2. Financial Analysis

The lessee will provide a complete financial analysis and scope of work regarding the installation of the charging station and its infrastructure.

SECTION 3 – Effective Date. This ordinance shall become effective and be in full force on and after either MONTH DATE, 2017.

SECTION 4 - Posting. The City Clerk shall certify to the passage of this ordinance and shall cause it to be published according to legal requirements.

Policy 2-EV-NC: EV Fast Charger Ordinance for New Large Retail Buildings

ELECTRIC VEHICLE FAST CHARGER ORDINANCE FOR NEW LARGE RETAIL BUILDINGS

Ordinance No. XXXXX

Ordinance of the City Council/Board of Supervisors of the City/County of [JURISDICTION] Amending Chapter NUMBER of the [JURISDICTION] [Municipal/Administrative/Building/Other] Code, California Building Standards Code, 2016 Edition, and Local Amendments and Related Findings.

The Council/Board of the City/County of [JURISDICTION] does ORDAIN as follows:

SECTION 1. Findings and Declarations.

Governor Brown's Executive Order of March 2012, directs state government to support and facilitate the rapid commercialization of zero-emission vehicles (ZEVs), with a target of having 1.5 million ZEVs on California roadways by 2025. To meet this goal and in order for electric vehicles to proliferate, it is important that early consumers have a positive experience and that facilities be readily available to provide convenient charging stations for the electric vehicles.

Promoting the use of electric vehicles is needed to meet the requirements of climate change and the city's/county's climate action plan. California Health & Safety Code section 17958.7 provides that before making any changes or modifications to the California Building Standards Code and any other applicable provisions published by the State Building Standards Commission, including, but not limited to, green building standards, the governing body must make an express finding that each such change or modification is reasonably necessary because of specified local conditions, and the findings must be filed with the State Building Standards Commission before the local changes or modifications can go into effect.

The City Council/Board of Supervisors expressly declares that the following amendments to the [JURISDICTION] Green Building Code are reasonably necessary because of local climatic, topological, and geological conditions as listed below. Failure to address and significantly reduce greenhouse gas emissions could result in rises to sea level, heat waves, wildfire risk and health impacts that could put at risk [JURISDICTION] homes and businesses, and public facilities. The aforementioned conditions create hazardous conditions for which departure from California Green Building Standards Code is required.

Use of electric vehicles benefits the health, welfare, and resiliency of San Francisco and its residents.

[JURISDICTION]'s green building standards are contained in the [JURISDICTION]'s Building Code. In this Ordinance, [JURISDICTION] incorporates Sections 5.106.5.3 of the 2016 California Green Building Standards Code into the [JURISDICTION] Building Code with local amendments to Chapter NUMBER of the [JURISDICTION] [Municipal/Administrative/Building/Other] Code.

SECTION 2. Chapter NUMBER of the [JURISDICTION] [Municipal/Administrative/Building…] Code is hereby amended as follows:

(E) DEFINITIONS

ELECTRIC VEHICLE CHARGING STATION. Electric vehicle charging station" or "charging station" means a station that is designed in compliance with Article 625 of the National Electrical Code, as it reads on the effective date of this section, and delivers electricity from a source outside an electric vehicle into one or more electric vehicles. An electric vehicle charging station shall meet applicable health and safety standards and requirements imposed by state and local authorities as well as all other applicable zoning, land use, or other ordinances, or land use permit requirements.

ELECTRIC VEHICLE (EV) FAST CHARGER. Off-board charging equipment with a minimum direct current or alternating current power output of 24 kW, for the purpose of providing an electric vehicle charge in significantly less time than a Level 1 or Level 2 rated Electric Vehicle Charging Station.

FULL CIRCUIT. Required full circuits shall be installed with 40-Amp 208/240-Volt capacity including raceway, electrical panel capacity, overprotection devices, wire and termination point such as a receptacle at the time of construction. The termination point shall be in close proximity to the proposed EV charger location. Where a single EV parking space is required, the raceway shall not be less than trade size 1 (nominal 1-inch inside diameter).

INACCESSIBLE RACEWAY. Construction documents shall indicate wiring schematics, raceway methods, the raceway termination point and proposed location of future EV spaces and EV chargers. Raceways and related components that are planned to be installed underground, enclosed, inaccessible or in concealed areas and spaces shall be installed at the time of original construction.

ELECTRICAL PANEL CAPACITY. Electrical panels shall be installed with capacity to support one 40-Amp 208/240-Volt circuit for each parking space specified in 4.106.4.2 under "Electrical Panel Capacity". Construction documents shall verify that the electrical panel service capacity and electrical system including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at 40-Amps.

RETAIL BUILDING. A building that is Occupancy Group M, where the use of the building includes the display and sale of merchandise involves stocks of goods, wares or merchandise incidental to such purposes and accessible to the public. For the purposes of this ordinance, mercantile occupancy shall include department stores, drug stores, markets, retail or wholesale stores and sales rooms.

REASONABLE COSTS. "Reasonable costs" includes, but is not limited to, costs associated with those items specified in the "Permitting Checklist" of the "Zero-Emission Vehicles in California: Community Readiness Guidebook" published by the Office of Planning and Research.

(F) PURPOSE AND INTENT

In line with state policy, it is the policy of the City/County to promote, encourage, and remove obstacles to the use of electric vehicle charging stations. Electric vehicles depend upon convenient access to charging, and the ability to serve electric vehicles in existing buildings is commonly limited by 1) the electrical system capacity of the building and 2) the cost to install the necessary conduit and wiring from the panel to the charging station. Consequently, the

most cost-effective time to prepare a given building for electric vehicle charging station(s) is during construction particularly when the electric service is installed or upgraded and when otherwise inaccessible conduit pathways are available, because workers are already on-site, trenches are open, concrete/asphalt has not been poured, utility service upgrade costs are lower, permitting and administrative costs are lower, and it is more cost-effective to include such systems in existing construction financing.

Furthermore, while workplace and residential EV charging infrastructure is critical for EV owners, there remains gaps in EV charging infrastructure for public charging. This ordinance seeks to increase the availability of public charging infrastructure to support longer vehicle trips that may be outside of normal commute patterns and reduce EV owner "range anxiety."

NOTE: Additions to code are *in italics*

Deletion to code are in ~~strikethrough~~

SECTION 2. The Green Building Code is hereby amended by revising Section 5.106.5.3.3 to read as follows:

SEC.5.106.5.3.3 EV charging space calculation ~~[N]~~

With the exception of Group M occupancy buildings, Table 5.106.5.3.3 shall be used to determine if single or multiple charging space requirements apply for the future installation of EVSE.

SECTION 3. The Green Building Code is hereby amended by revising Section 5.106.5.3 to add a new Section 5.106.5.3.3.1 as follows:

5.106.5.3.3.1 Electric vehicle (EV) fast charging requirement for new retail

Table 5.106.5.3.3.1 shall apply to newly-constructed Group M occupancy buildings over 50,000 square feet, and to major alterations to existing Group M occupancy buildings over 50,000 square feet where electrical service to the building will be upgraded.

TABLE 5.106.5.3.3.1 Group M Occupancy EV Charging Requirements[1]

Total Number of Actual Parking Spaces	**Full Circuit**	**Inaccessible Raceway**	**EV Fast Chargers**	**Electric Panel Capacity**[2]
0-9	Not applicable to this building large retail building type			
10-25	Not applicable to this building large retail building type			
26-50	Not applicable to this building large retail building type			
51-75	10 percent of total	20 percent of total	1	Sufficient to supply 20 percent of spaces
76-100	10 percent of total	20 percent of total	1	Sufficient to supply 20 percent of spaces
101-150	10 percent of total	20 percent of total	1	Sufficient to supply 20 percent of spaces

151-200	10 percent of total	20 percent of total	2	Sufficient to supply 20 percent of spaces
201 and over	10 percent of total	20 percent of total	2	Sufficient to supply 20 percent of spaces

1. *Calculation for spaces shall be rounded up to the nearest whole number*
2. *Electric panel capacity for Level 2 EV charging, in addition to the required EV Fast Charger*

As required by Table 5.106.5.3.3.1, EV Fast Chargers consists of off-board charging equipment with a minimum direct current or alternating current power output of 40 kW, for the purpose of providing an electric vehicle charge in significantly less time than a Level 1 or Level 2 Electric Vehicle Charging Station.

The electrical panel board(s) provided at each parking level served by EV Fast Chargers shall have sufficient capacity to supply each EV Fast Charger with a minimum of 40 kW AC in addition to the capacity required to serve current and future Level 2 charger requirements.

SECTION 3. The Green Building Code is hereby amended by revising Section 5.106.5.3.4 to read as follows:

5.106.5.3.4 Identification ~~[N]~~

The service panel or subpanel(s) circuit directory shall identify the reserved overcurrent protective device space(s) for future EV charging as "EV READY" for full circuits and otherwise "EV CAPABLE.". The raceway termination location or receptacle shall be permanently and visibly marked as "EV READY" for full circuits and otherwise "EV CAPABLE" until such time as EV supply equipment are installed.

SECTION 3 – Effective Date. This ordinance shall become effective and be in full force on and after either MONTH DATE, 2017.

SECTION 4 - Posting. The City Clerk shall certify to the passage of this ordinance and shall cause it to be published according to legal requirements.

Policy 3-PV: Ordinance for Solar Photovoltaic Carports on New Parking

ORDINANCE FOR SOLAR PHOTOVOLTAIC CARPORTS IN NEW PARKING

Ordinance No. XXXXX

Ordinance of the City Council/Board of Supervisors of the City/County of [JURISDICTION] Amending Chapter NUMBER of the [JURISDICTION] [Municipal/Administrative/Building/Other] Code, California Building Standards Code, 2016 Edition, and Local Amendments and Related Findings.

The Council/Board of the City/County of [JURISDICTION] does ORDAIN as follows:

SECTION 1. Findings and Declarations.

California AB 32 and SB 350 mandate reductions in greenhouse gas emissions across the state. In order to reduce greenhouse gas emissions due to electricity in buildings, as well as heat island effects related to impermeable surfaces, cities across the state need to take steps to reduce energy consumed by buildings and produce renewable, low-carbon electricity to reduce pollution, benefit biodiversity, improve resilience to climate change by reducing localized heat islands and reduce the global warming effects of energy consumption.

California Health & Safety Code section 17958.7 provides that before making any changes or modifications to the California Building Standards Code and any other applicable provisions published by the State Building Standards Commission, including, but not limited to, green building standards, the governing body must make an express finding that each such change or modification is reasonably necessary because of specified local conditions, and the findings must be filed with the State Building Standards Commission before the local changes or modifications can go into effect.

The City Council/Board of Supervisors expressly declares that the following amendments to the [JURISDICTION] Green Building Code are reasonably necessary because of local climatic, topological, and geological conditions as listed below. Failure to address and significantly reduce greenhouse gas emissions could result in rises to sea level, heat waves, wildfire risk and health impacts that could put at risk [JURISDICTION] homes and businesses, and public facilities. The aforementioned conditions create hazardous conditions for which departure from California Green Building Standards Code is required.

SECTION 2. Chapter NUMBER of the [JURISDICTION] [Municipal/Administrative/Building…] Code is hereby amended by adopting a new Chapter NUMBER to read as follows:

(G) DEFINITIONS

SURFACE PARKING SPACES. A parking space for motor vehicle where there is no gross building area or roof above it, which includes the uppermost levels of parking structures that are otherwise uncovered. Area occupied by small, permanent building, such as booths used by parking attendants, is not parking area.

NEW CONSTRUCTION. A newly constructed building (or new construction) is a building that has never been used or occupied for any purpose and does not include additions, alterations or repairs.

NEW PARKING SPACES. New parking spaces included in building plans submitted for new construction permits.

SOLAR PHOTOVOLTAIC (PV) CARPORT. A carport is a covered structure used to offer limited protection to vehicles, primarily cars, from the elements. A solar photovoltaic carport consists of solar photovoltaic (PV) panels/modules that are designed to be on this covered structure and span to structural supports. The structure can either be free standing or attached to a wall, and shall comply with the minimum fire/roof classification requirements for roof covering as required by CRC Section R902.

(H) PURPOSE AND INTENT

Requiring solar photovoltaics at the time of new construction is more cost-effective than installing the equipment after construction because workers are already on-site, permitting and administrative costs are lower, and it is more cost-effective to include such systems in existing

construction financing. Surface level parking lots contribute to urban heat island effect, increasing energy use in buildings and vehicles. Larger parking lots represent opportunities for significant renewable energy generation.

SECTION 2. The Building Energy Efficiency Standards for Residential and Non-residential Buildings, 2016 Edition, Title 24, Part 6 of the California Code of Regulations, as adopted and amended by the State of California, hereinafter called "Energy Code," are adopted as the rules, regulations and standards within this City as to all matters therein except as hereinafter modified or amended;

Section XX.XX.XXX. Local Amendment for Mandatory Solar Installations

All newly constructed buildings with more than 50 new surface parking spaces which apply for a building permit on or after January 1, 2017 shall install solar PV carports covering at least 50 percent of the parking spaces.

Solar PV carport systems: The total nameplate capacity of photovoltaic collectors shall be at least 10 $Watts_{DC}$ per square foot of PV collector. Solar PV carport systems shall be installed in accord with all applicable state and local code requirements, manufacturer's specifications.

Exception: As an alternative, buildings may meet the solar PV carport requirement through a combination of building rooftop solar PV and solar PV carport. Up to 100 percent of the solar PV carport may be met with a rooftop solar PV system. The total nameplate capacity of photovoltaic collectors shall be at least 10 $Watts_{DC}$ per square foot of PV collector and installed in accord with all applicable state and local code requirements, manufacturer's specifications.

SECTION 3 – Effective Date. This ordinance shall become effective and be in full force on and after either MONTH DATE, 2017.

SECTION 4 - Posting. The City Clerk shall certify to the passage of this ordinance and shall cause it to be published according to legal requirements.

Policy 4-HP: Ordinance for Renewable Space and Water Heating

RENEWABLE ENERGY THERMAL SYSTEMS ORDINANCE

Ordinance No. XXXXX

Ordinance of the City Council/Board of Supervisors of the City/County of [JURISDICTION] Amending Chapter NUMBER of the [JURISDICTION] [Municipal/Administrative/Building/Other] Code, California Building Standards Code, 2016 Edition, and Local Amendments and Related Findings.

The Council/Board of the City/County of [JURISDICTION] does ORDAIN as follows:

SECTION 1. Findings and Declarations.

California AB 32 and SB 350 mandate reductions in greenhouse gas emissions across the state. In order to reduce greenhouse gas emissions due to electricity in buildings, cities across the state are mandating energy efficiency strategies coupled with renewable energy requirements. However, due to the lack of biogas available in the market, there is no viable way to eliminate fossil fuel emissions due to natural gas use in buildings.

The predominant use of natural gas in the California building stock is for space heating systems, followed by water heating systems. In the past, utilizing gas for space and water heating systems was an understandable choice due to the lower operating cost and the relatively high emissions associated with grid-supplied electricity. This is no longer the case. Improvements in heat pump technology have reduced the operating cost of electric heating systems, while the uptake of renewable energy in California's grid has made grid-supplied electricity the cleanest choice available. It has become clear that reducing carbon emissions in new building stock will depend on choosing electric solutions over natural gas solutions wherever possible.

Promoting the use of space and water heating systems which are capable of running on 100 percent zero greenhouse emission energy sources is needed to meet the requirements of climate change and the city's/county's climate action plan. California Health & Safety Code section 17958.7 provides that before making any changes or modifications to the California Building Standards Code and any other applicable provisions published by the State Building Standards Commission, including, but not limited to, green building standards, the governing body must make an express finding that each such change or modification is reasonably necessary because of specified local conditions, and the findings must be filed with the State Building Standards Commission before the local changes or modifications can go into effect.

The City Council/Board of Supervisors expressly declares that the following amendments to the [JURISDICTION] Green Building Code are reasonably necessary because of local climatic, topological, and geological conditions as listed below. Failure to address and significantly reduce greenhouse gas emissions could result in rises to sea level, heat waves, wildfire risk and health impacts that could put at risk [JURISDICTION] homes and businesses, and public facilities. The aforementioned conditions create hazardous conditions for which departure from California Green Building Standards Code is required.

[JURISDICTION]'s green building standards are contained in the [JURISDICTION]'s Building Code. In this Ordinance, [JURISDICTION] incorporates Sections 4.508 and 5.508 of the 2016 California Green Building Standards Code into the [JURISDICTION] Building Code with local amendments to Chapter NUMBER of the [JURISDICTION] [Municipal/Administrative/Building/Other] Code.

SECTION 2. Chapter NUMBER of the [JURISDICTION] [Municipal/Administrative/Building…] Code is hereby amended as follows:

(I) DEFINITIONS

THERMAL SYSTEMS: Thermal systems as referenced in this ordinance include space heating and water heating systems.

ZERO CARBON THERMAL SYSTEMS. Zero carbon thermal building systems are those which are capable of running on a power or fuel source that is defined as renewable energy.

RENEWABLE ENERGY. Acceptable renewable energy to be used in zero carbon thermal systems includes: on-site renewable electricity, grid-sourced renewable electricity, solar thermal, non-SOx-producing biofuels, and renewably-produced hydrogen from water or biomass conversion.

(J) PURPOSE AND INTENT

In line with state policy, it is the policy of the City/County to reduce greenhouse gas emissions associated with buildings. This requires the reduction of energy use in buildings coupled with the capability of supplying the remaining energy use via renewable sources. The most cost-effective time to create a building incorporating zero carbon thermal systems is during design and construction, because the incremental capital cost of choosing zero carbon thermal systems is negligible at this time. In comparison, the costs of retrofitting installed fossil fuel systems with zero carbon thermal systems at a later time is much higher due to space and electrical infrastructure constraints.

SECTION 2. The Green Building Code is hereby amended by revising Section 4.508 Outdoor Air Quality (Residential) Section 5.508 Outdoor Air Quality (Nonresidential) to include the following additional subsections:

SEC.4.508.1 Zero carbon thermal systems [N]

For all new residential construction, all building thermal systems (space and water heating) must utilize renewable energy through any combination of the following measures:

a) On-site renewable electricity;
b) Grid-sourced renewable electricity;
c) Solar thermal;
d) Non-SOx-producing biofuels;
e) Renewably-produced hydrogen from water or biomass conversion.

If the intent is to utilize a utility-supplied renewable energy source (renewable electricity, renewable gas) it must be proven that the renewable energy source is available from the local utility at the time of construction.

If the intent is for liquid or gas fuel to be stored on-site due to inability to source from the utility, a tank must be included in the building design and meet all applicable codes and standards.

SEC.5.508.3 Zero carbon thermal systems [N]

For all new nonresidential construction, all building thermal systems (space and water heating) must utilize renewable energy through any combination of the following measures:

a) On-site renewable electricity;
b) Grid-sourced renewable electricity;
c) Solar thermal;
d) Non-SOx-producing biofuels;
e) Renewably-produced hydrogen from water or biomass conversion.

If the intent is to utilize a utility-supplied renewable energy source (renewable electricity, renewable gas) it must be proven that the renewable energy source is available from the local utility at the time of construction.

If the intent is for liquid or gas fuel to be stored on-site due to inability to source from the utility, a tank must be included in the building design and meet all applicable codes and standards.

Exceptions:

1. Hospitals may utilize non-renewable water heating equipment due to the high hot water demand in this building type

SECTION 3 – Effective Date. This ordinance shall become effective and be in full force on and after either MONTH DATE, 2017.

SECTION 4 - Posting. The City Clerk shall certify to the passage of this ordinance and shall cause it to be published according to legal requirements.