REGULAR MEETING of the Citizens Advisory Committee of the Peninsula Clean Energy Authority (PCEA)
Thursday, September 20, 2018

Peninsula Clean Energy
2075 Woodside Road, Redwood City, CA 94061
6:30 p.m.

Meetings are accessible to people with disabilities. Individuals who need special assistance or a disability-related modification or accommodation (including auxiliary aids or services) to participate in this meeting, or who have a disability and wish to request an alternative format for the agenda, meeting notice, agenda packet or other writings that may be distributed at the meeting, should contact Anne Bartoletti, Board Clerk, at least 2 working days before the meeting at abartoletti@peninsulacleanenergy.com. Notification in advance of the meeting will enable the PCEA to make reasonable arrangements to ensure accessibility to this meeting and the materials related to it. Attendees to this meeting are reminded that other attendees may be sensitive to various chemical based products.

If you wish to speak to the Committee, please fill out a speaker's slip located on the tables as you enter the meeting room. If you have anything that you wish to be distributed to the Committee and included in the official record, please hand it to a member of PCEA staff who will distribute the information to the Committee members and other staff.

WELCOME

ROLL CALL

PUBLIC COMMENT
This item is reserved for persons wishing to address the Committee on any PCEA-related matters that are as follows: 1) Not otherwise on this meeting agenda; 2) Chief Executive Officer's of Staff Report on the Regular Agenda; 3) Committee Members' Reports on the Regular Agenda. Public comments on matters not listed above shall be heard at the time the matter is called.

As with all public comment, members of the public who wish to address the Committee are requested to complete a speaker's slip and provide it to PCEA staff. Speakers are customarily limited to two minutes, but an extension can be provided to you at the discretion of the Committee Chair.

ACTION TO SET AGENDA AND APPROVE CONSENT AGENDA
This item is to set the final regular agenda and approve the consent agenda.

REGULAR AGENDA

1. Chair Report (Discussion) (est. 5 min.)

2. Outreach Report (Discussion) (est. 5 min.)

3. Review Potential Proposed Awardees for Community Pilots Program (Discussion) (est. 60 min.)

4. Appoint Up to Two CAC Members onto the Community Pilot Program Applicant Interview Planel (Action) (est. 5 min.)

5. Regulatory and Legislative Update (Discussion) (est. 10 min.)

6. Review Draft Board Retreat Agenda for September 29, 2018 Meeting (Discussion) (est. 10 min.)

    6.1 Market Outlook
    6.2 Review of Strategic Goals
    6.3 Programs Road Map
    6.4 Reserves Policy
    6.5 Marketing Strategy

7. Committee Members' Reports (Discussion) (est. 5 min.)

CONSENT AGENDA

8. Approval of the Minutes for the August 16, 2018 Meeting (Action)

Public records that relate to any item on the open session agenda for a regular Committee meeting are available for public inspection. Those records that are distributed less than 72 hours prior to the meeting are available for public inspection at the same time they are distributed to all members, or a majority of the members of the Committee. The Board has designated the Peninsula Clean Energy office, located at 2075 Woodside Road, Redwood City, CA 94061, for the purpose of making those public records available for inspection. The documents are also available on the PCEA's Internet Web site. The website is located at: http://www.peninsulacleanenergy.com.

PENINSULA CLEAN ENERGY
JPA Citizens Advisory Committee Correspondence

DATE: September 14, 2018
BOARD MEETING DATE: September 20, 2018
SPECIAL NOTICE/HEARING: None
VOTE REQUIRED: None

TO: Peninsula Clean Energy Citizens Advisory Committee

FROM: Rafael Reyes, Director of Energy Programs

SUBJECT: Review Potential Proposed Awardees for Community Pilots Program

BACKGROUND

In September 2017, the Board approved opening a public process to execute a Community Pilots program with a budget of $450,000. PCE issued a Request for Proposals for Community Pilots on June 21, 2018. Individuals, organizations, and municipalities were eligible to submit a proposal for consideration. Funding up to $75,000 has been offered to pilot projects up to 18 months of duration. It is anticipated that funding will be available for up to 6 awardees.

PCE is evaluating these proposals on the basis of the following criteria:

1. Accelerates GHG reductions and renewables

Delivers clear quantifiable GHG reductions and/or renewables in a cost-effective manner.

2. Delivers community benefits

The project provides community benefits including delivering tangible benefits to low income communities, develops workforce (including aligning with PCE workforce policy), and/or serves customers across PCE's geography.

3. Supports PCE's load serving needs

Supports PCE's objective to reach 100% renewables by 2025 by matching supply and load.

4. Can be executed within PCE capacity and builds PCE capabilities

Can be managed by PCE staff without undue burden and/or creates valuable expertise or data for ongoing use.

5. Additional benefits

Supports community resilience; is innovative, scalable and replicable; and/or addresses program gaps in the region.

6. Credentials and Approach

The applicant and its partners have the demonstrated capacity to execute the proposed project, the budget is realistic and appropriate, objectives and approach are feasible, and evaluation approach is credible.

Schedule for awards is as follows:

Aug 3:	Applications due
Aug 8:	Preliminary screening
Aug 16:	CAC feedback on summary
Aug 23:	Board briefed on summary
Sept 11:	Executive Committee reviews proposed awardees
Sept 20:	CAC review of proposed awardees
Oct 25:	Board selection of awardees
Nov - Jan:	Contracting and Projects Start

On September 11, 2018, the Executive Committee directed staff to interview the top 8 candidates before providing the full board with recommended awardees. Interviews will take place the during the first two weeks of October by staff and 1-2 CAC members.

PROPOSALS RECEIVED

The application deadline closed August 3, 2018 at 5:00pm PDT. PCE received a total of 37 proposals. Two were disqualified as late or incomplete. Proposals vary widely across technology area and approach (see Figure 1 and Figure 2).

Figure 1 (at right) shows the breakdown of primary technology areas across proposals. Please note that for the applicants that selected a combination of two or more of these areas in the submission form, PCE selected a main technology area for each of these.

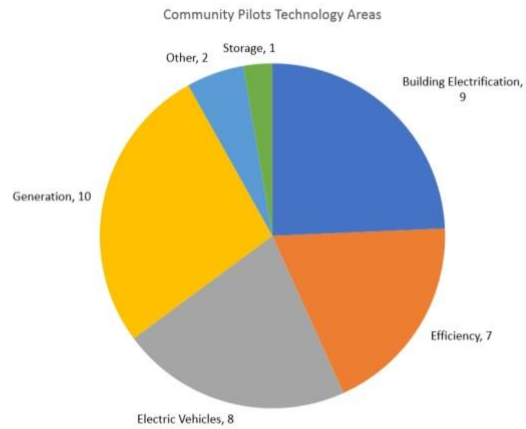
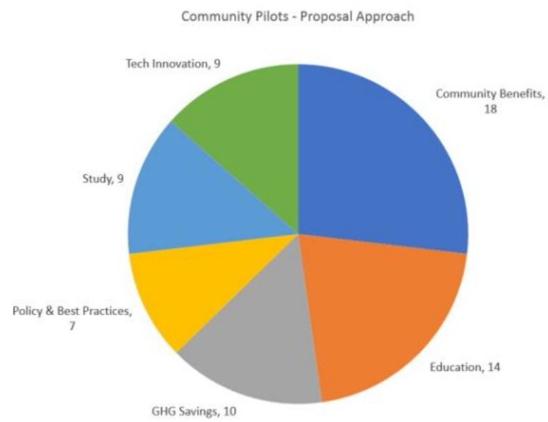


Figure 2 (at right) shows the approach the proposals propose. Approach refers to what kind of activity and emphasis the project proposes. Because some proposals may have a strong emphasis on two or three of these approaches, the number reflected in the pie chart is greater than the sample size of 37 applications.



POTENTIAL PROPOSED AWARDEES

Based on the criteria listed above and with input from the CAC and Executive Committee, PCE staff evaluated the remaining 35 proposals and identified 12 promising proposals. The evaluation was done in two rounds.

A first pass elimination screening was completed with input from the CAC based on the following criteria:

- Generation/efficiency projects, including:
  - Paper studies including DER and site assessments
  - Solar-only install projects
  - Basic efficiency install projects
- Public education-only projects
- Software tools intended for broad adoption that do not have clear path to broad adoption
- Concepts duplicative of robust existing efforts
- Projects requiring significant PCE time investment

Please note that generation projects may be reviewed as part of future PCE distributed generation plans. Additionally, interesting projects that require significant PCE time investment may be reviewed as part of future programs outside of pilots.

A second round detailed evaluation of the proposals was done by PCE staff to identify the top 12 proposals. Of the top 12, 8 proposals were categorized as possible recommended awardees and the remaining 4 as credible candidates. Funding has been approved for no more than 6 final awardees.

Please find attached a list of all proposal abstracts as submitted. The list separates the proposals into three categories: possible recommended awardee (top 8 proposals), candidates (other proposals in the top 12), and remaining proposals which are not recommended for award. Within each category, proposals are organized alphabetically by organization name. Full applications for the top 12 and remaining proposals are included as part of the agenda packet.

	A	B	C	D	E	F	G	H
1		Submitter Organization	Proposal Name	Proposal Abstract	Partners	$ Requested	Main Technology Area	Evaluation Status
2	1	ARCA Recycling, Inc.	ARCA Recycling, Inc. Appliance Recycling Program Proposal	ARCA Recycling, Inc. (ARCA) proposes the implementation and management of a turnkey appliance recycling program (ARP) for Peninsula Clean Energy (PCE). ARCA's ARP for PCE provides customers with a convenient and satisfying solution for disposal of their old appliances. PCE benefits from increased customer satisfaction and energy savings. Additionally, the ARP helps protect the environment through decreased greenhouse gas (GHG) emissions and reduced contamination of water and soil. ARCA's forty-year history in energy efficiency and the company's commitment to responsible appliance disposal provide the foundation for energy efficiency programs with seamless program operations. Comprehensive turnkey services ensure all aspects of program operations are handled professionally, with minimal work required by PCE.	Herrera Transportation and Trucking, Promotion Management Center	$ 74,000	Efficiency	Possible Recommended Awardee
3	2	Ardenna Energy, LLC	Peninsula Climate Comfort Pilot Project	Project will demonstrate a scalable program model for delivering residential electrification retrofits. A key focus will be to minimize installation and operating costs to support the feasibility of a Managed Energy Services Agreement. Project will conduct in-depth assessments for 5 home owners who wish to electrify space heating and/or water heating. Assessments will evaluate the technical, financial, and performance opportunities and challenges, including opportunities to bundle electrification with energy efficiency, PV, electric vehicle, and energy storage. Project will offer participants up to $2,000 to offset installation costs. Completed projects will be documented and published as case studies. Financial analysis will consider how added electric demand and load shape changes may reduce PCE's cost of service to its customers. One result will be a recommendations for a residential electrification tariff that rewards customer actions that support PCE's load serving needs.	Build It Green, Home Energy Analytics, Tom Kabat	$ 75,000	Building Electrification	Possible Recommended Awardee
4	3	Build It Green	Healthy Home Connect	The Healthy Home Connect pilot program, developed and administered by Build It Green and its partners, will deliver upgrades to up to 16 low-income homes in East Palo Alto and Daly City that would otherwise be disqualified from housing assistance programs. Thanks to $75,000 in PCE gap funding, homes will receive healthy home remediations and roof repairs/replacements, allowing these formerly disqualified homes to then receive energy efficiency improvements and demand response ready technologies via complementary public programs which have historically been disconnected. The Program will smartly leverage PCE funds with existing corporate philanthropy, utility weatherization and solar programs, plus Hayward Score, a breakthrough technology to assess and improve the health of any home.	El Concilio, GRID Alternatives, Hayward Lumber, Owens Corning	$ 75,000	Efficiency	Possible Recommended Awardee
5	4	CA Interfaith Power & Light	Community Resiliency - Solar to Storage at Faith Institutions	This project will improve the Peninsula's resilience to climate change, energy outages and other emergencies by recruiting and equipping 3-5 faith institutions to be community hubs with clean energy back up power and cooling spaces open to all in need in the community. Because faith institutions generally offer much more than worship services, providing space for everything from Girl Scout meetings to polling places to soup kitchens, they are uniquely visible, familiar and welcoming places for community members. In addition, the architectural style of houses of worship tend to make them naturally cooler on high heat days, which are occurring with increasing frequency as climate change intensifies. These 3-5 faith institutions will be equipped with solar power, back up battery, at least two electric vehicle charging stations, space for at least 300 to gather, a back-up water supply and first aid supplies.	Member congregations, Acterra, Luminalt, RE-volv, American Solar, GRID Alternatives, Resilient Bayview, Greenworks Lending	$ 75,000	Generation	Possible Recommended Awardee
6	5	DNV GL	RICAPS Measures for Electrification and Distributed Energy Resources	County's Office of Sustainability's RICAPS program that provides climate action technical assistance that will impact all communities across the County. Our local cities need support in meeting the state's 2030 targets, and the RICAPS assistance provides the vehicle to do so, but needs (currently) unavailable funding to incorporate new strategies related to electrification, load-shifting and equitable access to reliable, clean energy. The proposed project will focus on updating the RICAPS Menu of Measures, which is used by cities to engage with stakeholders on key actions for local governments to reduce GHG emissions and provides standardized methodologies for estimating emissions savings, energy savings, cost savings and other benefits. The current tool focuses on energy efficiency and resource conservation, and does not include any measures related to electrification, zero net energy or other DERs.	C/CAG, San Mateo County Office of Sustainability	$ 74,725	Building Electrification	Possible Recommended Awardee
7	6	Envoy Technologies Inc.	Disadvantaged Community Car Sharing Pilot Proposal	*** Note: Detailed abstract submitted in PDF via email filing *** Envoy Technologies Inc. ("Envoy") is pleased to submit this Disadvantaged Community Car Sharing Pilot Proposal ("Proposal") under PCE's 2018 Community Pilots Call for Proposals. Under this pilot, Envoy will deploy 3 pure electric vehicles (EVs) to be used for car sharing within a disadvantaged community in San Mateo County. Envoy will focus on deployment in support of designated low-to-moderate income areas, affordable housing communities, other areas defined as disadvantaged (based on further input and consensus from PCE stakeholders). Envoy will leverage the "Community Vulnerability Index," and work with stakeholders, to identify ideal locations for deployment, and will deploy the car sharing service for no less than 18 months. Envoy is also prepared to extend or expand this Pilot, depending on the program's success.	Low-income MUDs	$ 70,161	Electric Vehicles	Possible Recommended Awardee
8	7	SMC Office of Sustainability	A Roadmap for Municipal Green Fleets	Local governments own and operate fleets of vehicles that serve a variety of critical functions from heavy duty vehicles including fire trucks and road maintenance to sedans for staff to use for government business. The function of these vehicles is to serve, protect and advance our communities. Often overlooked is how fleets can be managed and upgraded to align with organizational and local climate action goals. The Office of Sustainability is proposing to develop a clean fuel fleet toolkit for local governments to support the planning and scoping phases of a municipal fleet overhaul. In addition, the creation of a toolkit, the Office of Sustainability is poised to provide technical assistance to jurisdictions interested in strategic planning of their fleets to identify a custom roadmap based on vehicle use cases, budget, and climate goals. With commitment from the County of San Mateo's fleet, budget would be used for direct implementation of electric transportation solutions.	San Mateo County cities and towns	$ 75,000	Electric Vehicles	Possible Recommended Awardee

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9	8	TRC Energy Services	TRC Community Pilot Grant Proposal	Gas wall furnaces are a common heating system type in multifamily buildings. These systems are inefficient and contribute indoor air pollutants into residents' living spaces. Like-for-like (in-kind) replacement options for older wall furnaces are limited and not significantly more efficient than the old equipment they replace. We propose to use Peninsula Clean Energy grant funding to explore energy efficient and clean space heating alternatives to wall furnaces. Our proposal leverages PCE grant funding, building owner contributions, and PG&E funding to replace wall furnaces with efficient heat pump solutions that will deliver energy savings, GHG reduction and improved indoor air quality. There are also many challenges and cost uncertainties related to the heat pump replacement options and this funding will also support a detailed case study to document challenges and key considerations to scale this retrofit option in the multifamily market.		$ 74,995	Building Electrification	Possible Recommended Awardee
10	9	Center for Sustainable Energy	Water Heater Electrification Program	The Center for Sustainable Energy (CSE) proposes a water heater electrification pilot for consideration by Peninsula Clean Energy (PCE), designed to test the ability of heat pump water heaters (HPWH) to offer both greenhouse gas reductions and load shaping benefits. CSE proposes a streamlined pilot focused on replacing natural gas water heaters with heat pump water heaters in PCE territory. The initial pilot would target a small number of customers and identify key metrics to evaluate the overall performance and load shaping capability of these devices. The pilot is designed to work with a single contractor to ensure quality installation of devices and to potentially capture water heater replacements in addition to retrofits.	GRID Alternatives, Open Energy Efficiency	$ 74,938	Building Electrification	Candidate
11	10	Home Energy Analytics	Accelerating Residential Beneficial Electrification	HEA proposes to enhance 2 existing HEA products, Smart Audit and AskDrPower.com to: promote and educate the community about BE; analyze home energy usage to better target BE candidates; and then measure the GHG savings by tracking the energy savings using AMI data. At the completion of this proposal PCE will have the technology to promote and manage an scalable community BE program. The proposal takes advantage of ongoing projects with both PG&E and the CEC to achieve greater customer outreach than could otherwise be achieved.	Ardenna Energy LLC	$ 75,000	Building Electrification	Candidate
12	11	SMC Office of Sustainability	Wind and PV in Pescadero	The County has set a goal of reducing emissions for unincorporated areas and for the County's operations. The County completed a feasibility study to construct a solar PV and wind installation at the Pescadero landfill site. This project has the capacity to generate 4MW of innovative, local renewable energy, which is 1/5 of PCE's goal of 20MW by 2025 and the revenue generated has a long-term benefit of continuing to provide recycling options for South Coast residents. Considering Pescadero's location for wind and solar viability, staff estimates the site to generate around 7.5 kWh each year, equivalent to 5.6 MTCO2e. This equals 1,200 cars driven each year, and 840 homes' electricity for one year. For sequestration, it is around 6,600 acres of U.S. forests in one year and 145,000 tree seedlings grown for 10 years. If awarded the grant, the County plans to complete the site assessment and prepare a Report to the Board and an RFP for construction of this renewable energy project.	SCS Engineers, Yancy Group LLC	$ 75,000	Generation	Candidate
13	12	Sustainable Silicon Valley	Solar Pump Up Pilot	The Solar Pump Up Pilot will implement the new technology of Heat Pump Water Heaters (HPWHs) in select homes that have solar in East Palo Alto, then develop a guide establishing best practices. This pilot will bring attention to the low-income community of EPA as an innovation leader by being a testbed for the new technology of HPWHs. HPWHs are the most efficient way to turn electricity into heat. SSV has already received a $20K grant from the Bay Area Air Quality Management District (BAAQMD) to gather data in preparation for the installation of HPWHs in homes with solar. HPWHs and solar pair well together for several reasons. Solar improves the ROI of moving to HPWHs by lowering the cost of electricity. HPWHs also enable load shifting as they can be used for thermal storage and demonstrate a way for households to reduce greenhouse gas (GHG) emissions to comply with AB 32 and SB 350. This pilot will lay the groundwork for market transformation of the fuel we use to provide heat.	Air District (BAAQMD), GRID Alternatives, SunWork, Plumbing and Electrical Contractors, City of East Palo Alto, Ecumenical Hunger Program, St. Francis Church	$ 75,000	Building Electrification	Candidate
14	NOT RECOMMENDED							
15	13	Acterra	Electrify! Paving the Way for Heat Pump Water Heaters in San Mateo County	Acterra, in partnership with SunWork, seeks a $75,000 grant to launch the "Electrify!" Pilot Program in San Mateo County. Acterra is expanding its existing Green@Home program, which is focused on home energy waste mitigation, to encompass the next phase of education and awareness around the importance of shifting away from gas-fired home appliances such as cooktops, water heaters, dryers, and heating systems. This pilot project will seed the first phase of this expansion with a focus on advocacy for residential heat pump water heaters. The pilot program will consist of two main components: • Workforce development: Hands-on training for plumbers and contractors who serve San Mateo County to do the electrical work associated with installing heat pump water heaters in residences. • Demand development: Education and awareness for San Mateo County community members about the benefits of moving away from gas-fired water heaters, including the cultivation of a team of "Electric Ambassadors."			Building Electrification	Not Recommended
16	14	Blue Strike Environmental	Low-Income Smart Thermostat Pilot	The Low-income Smart Thermostat Pilot aims equip disadvantaged community members within the PCE service area with a free smart thermostat. Once in place, these devices will create increased awareness of energy use and be supported by educational and community engagements that will catalyze energy savings, subsequent electric bill reductions, and the mitigation of greenhouse gas (GHG) emissions. Immediate energy and gas savings of 8% are immediately available and supplemented by partnership with non-profit San Francisco - Peninsula Energy Services SFPES, a local installer and administrator of the Low Income Home Energy Efficiency Assistance Program (LIHEAP) program, enables match funding able to cover a portion of installation and assessment costs while providing sanctimonious LIHEAP Energy Efficiency measure installation for qualified low-income PCE customers.			Efficiency	Not Recommended
17	15	Bright Energy 101	Deep De-Carbonizationfor San Mateo County Schools	The Bright Energy 101 (BE101) grant proposal will fund implementation of its Program at a pilot high school in San Mateo County, expecting the success of that to support PCE in expanding the Program to schools throughout the County. The BE101 Program helps schools meet these critical goals: bettering the Environment, improving STEM Education and achieving Operational Cost Savings. The BE101 Program is a 10-year program. Through the grant funding, the Program will be implemented at a single high school in San Mateo County, and includes the following integrated elements: (1) BE101 Energy Intelligence Software, (2) a high school internship program and (3) implementation of energy efficiency, renewable energy and clean electrification measures. A key outcome of the BE101 Program is reducing the school's GHG emissions, from electricity and natural gas, by 80% by 2030.			Efficiency	Not Recommended

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18	16	CAST Energy Solutions Inc.	CAST Energy Solutions' Proposal	CAST Energy Solutions has a highly qualified team of energy experts capable of developing distributed energy resource solutions in Peninsula Clean Energy's (PCE) service territory. The proposal has five components: solar PV, wind, energy storage, EV charging infrastructure, and an energy management system. These five components can be adopted all at once, or incrementally. PCE could also choose just one or two components. The projects, initially proposed for the south San Francisco area, are scalable and replicable to cover PCE's entire service territory. The PCE strategic objectives for community pilots will all be achieved by this proposal, namely: Reducing GHG emissions Delivering local community benefits Advancing innovation Aligning energy supply and load			Generation	Not Recommended
19	17	Design-Manage-Sustain LLC	Bridging the Gap: Energy Project Financing	Design-Manage-Sustain proposes to create a one-stop shop resource for PCE's residential, business and multifamily customers to discover and explore available financing options for energy-related projects, products and vehicles– the Financing Finder. It is an innovative tool that leverages private financing to provide a community benefit by producing more renewable energy, achieving greater energy efficiency and reducing carbon emissions. It will coordinate with, complement and enhance many of the region's existing energy programs. Energy financing influences energy savings and GHG reductions by enabling customers to overcome the "first-cost" barrier to completing projects driving energy efficiency, renewable energy and energy storage – allowing additional and more comprehensive projects to be completed. PCE's Financing Finder can be executed quickly with low risk by leveraging an existing financing database and incorporating lessons learned from previous implementation under the CPUC.			Other	Not Recommended
20	18	Electric Auto Association	Electric Vehicle 101	Electric Vehicle 101 will present a series of classes to educate the EV curious about the feasibility of becoming electric vehicle owners in an open environment with no sales pressure. Experienced and passionate presenters will cover all the topics involved in choosing the right EV and having a successful ownership experience. Topics to be covered include the models of available vehicles including all-electric and plug-in hybrid vehicles, their respective ranges, prices, available rebates and incentives, the options available to charge vehicles, what's needed to set up personal charging infrastructure and the complications of multi-unit dwellings, along with public charging, as well as the individual, environmental and social benefits of ownership. All of this will be discussed in the context of communicating that switching from a gas or diesel to an electric car is likely the most significant action an individual or business can take to reduce their own GHG footprint.			Electric Vehicles	Not Recommended
21	19	Energy Solutions	City of San Mateo Decarbonization Framework-Phase 1	The City of San Mateo Decarbonization Framework-Phase 1 project seeks to demonstrate a scalable framework for PCE to: engage cities in collaborative planning, support local policy development, and introduce programs that support city efforts. This Phase 1 project will seek to: (1) increase Electric Vehicle (EV) readiness in San Mateo by facilitating adoption of an EV reach code and (2) develop a roadmap of high-impact policy initiatives and program opportunities that can be undertaken by PCE and its member communities. The engagement process, tools and templates used for the project can be leveraged to support similar initiatives throughout PCE territory. At the end of the project, Energy Solutions will facilitate a workshop for all PCE's member cities to review the project and learn about and discuss opportunities to undertake similar initiatives in their territory.			Electric Vehicles	Not Recommended
22	20	EVmatch, Inc.	EVmatch Community Charging Network	Electric vehicles (EVs) serve as a critical clean energy solution with zero tailpipe emissions and lower life-cycle emissions compared to gasoline vehicles. Yet inadequate public charging infrastructure limits the range of current EV owners and causes them stress. This is especially problematic for EV drivers without home charging access. EVmatch directly addresses this infrastructure challenge through an innovative peer-to-peer network for EV charging. EVmatch harnesses the power of sharing to immediately create more reliable charging options. Drivers access the network through the company's application and can quickly find, reserve, and pay for use of a private charger. EVmatch will expand its service to San Mateo County through this project, recruiting a minimum of 50 charging hosts and 150 EV drivers over the course of twelve months. EVmatch will increase access to reliable charging options through this innovative pilot and directly reduce 55 metric tons of CO2e.			Electric Vehicles	Not Recommended
23	21	Intermountain Electric Company	Devil's Canyon Solar	Carport Solar and parking lot rehabilitation			Generation	Not Recommended
24	22	Intertie Incorporated	Versailles Smart Grid Project	Versailles is an independent senior living community consisting of 61 condominium residences located in downtown San Mateo. Its residents recently asked Ash Street Green Partners, the manager of the services at Versailles, to provide EV charging and to reduce their GHG emissions. Ash Street Green Partners is working with Intertie Incorporated to build an innovative pilot project that meets the emerging EV needs of the Versailles community while advancing the grid of the future for PCE. The project will deploy Intertie's modular, smart-grid technology, the EV ChargePod, that draws power from available grid capacity and local solar resources, efficiently stores electricity; then optimally routes power to fast-charge EVs and supply the host or grid. The system provides fast-charging to EVs without stressing the grid, integrates local solar PV, provides backup power to the senior community, supplies demand response, peak shaving and other grid services while improving grid reliability.			Electric Vehicles	Not Recommended
25	23	npc Solar	Solar4Cars: Selling solar electricity as vehicle "fuel"	An urgent need exists to reduce Greenhouse Gas emissions. Transportation is a large source of these in the Peninsula Clean Energy territory. Switching transportation from gasoline-powered vehicles to plug-in vehicles enables the move to zero emissions, alongside the transition to renewable energy generation. Solar systems are typically sold on their economic benefits versus buying grid electricity, however there is a more compelling case for solar electricity when it is used to offset vehicle "fuel", potentially resulting in 80+% financial savings. The Solar4Cars center will be a for-profit educational facility for customers to learn about plug-in vehicles, whilst also selling PV systems, Electric Vehicle Supply Equipment and Energy Storage Systems. Center staff will be impartial regarding vehicle choice and can recommend a plug-in vehicle tailored to customer needs, whilst providing a commercial transaction on the solar + EVSE + energy stationary storage side.			Electric Vehicles	Not Recommended

	A	B	C	D	E	F	G	H
26	24	Open Energy Efficiency	OpenEE Platform - Efficiency and Electrification	Open Energy Efficiency (OpenEE) offers Peninsula Clean Energy (PCE) a unique opportunity to manage its demand-side management portfolio, including energy efficiency and electrification efforts. OpenEE provides an advanced M&V platform to track and normalize metered consumption data from individual buildings so that portfolios of assets can be aggregated to provide a flexible, demand-side load balancing platform. The OpenEE platform enables near real-time performance analytics and supports performance-based procurements and programs.			Efficiency	Not Recommended
27	25	Powerley	PCE Live Home Energy Management Platform	PCE LIVE A PCE-branded Home Energy Management solution for 50 residential customers comprised of a gateway that connects to the PG&E AMI meter, a mobile app, a thermostat and Alexa (optional). PCE Live will deliver real-time energy consumption for the whole house, disaggregation of key loads, including HVAC, ability to conduct DR events and personalized coaching. Expected results include 5%-10% reduction in energy waste, 1.2kW in demand savings and a deeper relationship with customers.			Efficiency	Not Recommended
28	26	Presidio Graduate School	Renewable Energy Policies: Pilot Programs for San Mateo Businesses & Communities	Together with three San Mateo County cities -- starting with the City of Pacifica -- we will pilot requirements for commercial buildings to generate and purchase renewable energy. The City of Pacifica has identified prospective businesses for the pilot. Reducing building energy consumption and GHG emissions through renewable energy generation will accelerate the city's progress toward achieving its goal of reducing emissions by 35% below 2005 levels by 2020, and 80% below 1990 levels by 2050. The community will benefit from improved health and safety, reduced pollution; green jobs; and enjoyment of living in a clean and responsible city. We have contacts also at the Cities of South San Francisco and San Bruno. Together, three cities' exemplary action will inspire San Mateo County and all of California to achieve clean-energy and zero-carbon goals			Generation	Not Recommended
29	27	San Mateo County Event Center	Proposal Narrative - San Mateo County Event Center	The San Mateo Event Center with the support of San Mateo County is seeking installation of a Solar PV rooftop and potential ground installation system to offset SMCEC's retail energy usage and potentially generate excess supply that could be provided back to Peninsula Clean Energy (PCE). Project components include a system electrically interconnected to SMCEC's onsite electrical facilities, providing energy savings that would accrue toward SMCEC's annual operating budget. This project would underscores PCE's, the Event Center, and the County's commitment toward environmental sustainability. Additional consideration is being given to Solar PV rooftop and/or ground installation for wholesale energy supply to PCE due to available space by way of adding a Tier 1 stationary battery system. If realized, this would be the largest solar-microgrid site in San Mateo County. The proposal seeks grant funding for a feasibility study and preparation of Request for Proposal for Solar installation.			Generation	Not Recommended
30	28	Sewer Authority Mid-Coastside	Aeration System blower Efficiency Pilot Study	Sewer Authority Mid-Coastside (SAM) owns and operates the Regional Wastewater Treatment Plant and currently operates three 125 horsepower centrifugal multistage blowers that deliver air to the aeration tanks as part of the wastewater treatment processes. These blowers continuously operate at a higher speed than desired. This causes SAM to spend more electricity than what is necessary to supply sufficient amount of air to sustain the biological processes in the secondary aeration tanks. SAM is requesting a grant from PCE to conduct pilot study to evaluate the energy efficiency of various turbo blower units. Replacing these blowers with modern high efficiency units will reduce greenhouse gas (GHG) emission by 35%, and save SAM over $40,000 on energy costs every year. The avoided GHG over 10 years is expected to be over 400 tons. In addition, this will allow SAM to optimize their operation and improve the infrastructure resilience at the plant.			Efficiency	Not Recommended
31	29	Sewer Authority Mid-Coastside	Cogeneration System Feasability Study	Sewer Authority Mid-Coastside (SAM) requests a grant from Peninsula Clean Energy (PCE) to perform a detailed feasibility study of a cogeneration system to produce clean electricity and heat from renewable, digester gas (biogas) already produced at SAM's wastewater treatment plant. If awarded the grant, SAM would partner with kW Engineering, an energy efficiency and renewables engineering firm in Oakland, CA, to investigate current potential cogeneration (electric energy generation plus heat generation) capacity of the plant's anaerobic digester's biogas production, avoided utility energy costs from onsite generation, associated GHG reduction, secondary environmental benefits, project costs, and project financing options. When completed, the feasibility study will be presented to SAM's board of directors to decide whether to pursue construction of a cogeneration system to produce clean electricity and heat from renewable biogas.			Generation	Not Recommended
32	30	Sewer Authority Mid-Coastside	Methane Fueled Microturbine Project	Sewer Authority Mid-Coastside (SAM) owns and operates the Regional Wastewater Treatment Plant . SAM processes and stabilizes its wastewater sludge in anaerobic digesters prior to dewatering and ultimately landfill disposal. Sludge digestion produces carbon dioxide and methane gas. Part of the methane is combusted and the methane gas that is not used in the digester heating process is wasted and combusted in a flare system on site.SAM is requesting a grant from PCE to install a combined heat and power (CHP) generation system that could make beneficial use of all of the plant's methane production by running it through a microturbine. The microturbine will generate electricity and heat. The heat will be captured and used to maintain optimal digester temperatures. The proposed SAM WWTP digester-gas-fueled CHP system will provide both a reduction in greenhouse gas (GHG) emissions and a reduction in PG&E/PCE purchased power costs for the plant.			Generation	Not Recommended
33	31	SPIN Storage Systems	SPIN Flywheel Energy Storage	SPIN is developing an advanced 30kWh/10kW flywheel for grid energy Storage. First units will be available in early 2019. We propose to install one or more of these in San Mateo County in conjunction with a new or existing solar generation facility. The project will consist of three phases. 1) Site Selection. In conjunction with PCE and other local partners SPIN will conduct a survey of potential sites and identify one that would benefit form the addition of up to five SPIN storage units. Criteria for selection will be GHG Benefit and total site installation cost. 2) Deployment. SPIN will engage suitable contractors for the deployment of the storage units, electrical integration, and connection to our remote monitoring systems. 3) Evaluation. SPIN will operate the units for a minimum of three years and provide annual reports on GHG benefit, usage, and any service anomalies. At the end of the Monitoring Period SPIN will continue to support the system use under a ten year warranty.			Storage	Not Recommended

	A	B	C	D	E	F	G	H
34	32	The HEAL Project	Solar Powered Learning	Solar Powered Learning is a partnership to install solar power at two sites to provide renewable energy and community education from The HEAL Project (THP) and Elkus Ranch, 501(c)3 nonprofits offering farm-based outdoor education in San Mateo County. THP operates the SMC School Farm and Elkus Ranch is operated by UC Cooperative Extension. Under the California Healthy Soils Initiative, Elkus Ranch and THP have initiated Carbon Farm Plans designed to reduce GHG and sequester carbon using a suite of sustainable farm practices. Solar Powered Learning provides each farm with solar arrays, and in turn, each farm will provide lessons about renewable energy to the combined 11,000 visitors from SMC and the greater Bay Area who visit the two sites annually. Elkus Ranch, where solar production will supply energy back to PCE's load, will receive the bulk of the funding. As the SMC School Farm is not on the grid, InterMountain Electric will build a small solar array to replace a gas generator.			Generation	Not Recommended
35	33	University of California, San Francisco	Oyster Point Heat Pump Replacement	University of California has pledged to become carbon neutral by 2025, becoming the first major university to accomplish this achievement . At UCSF, nearly 75% of our carbon emissions is due to on site burning of natural gas for heating and electrical generation. UCSF Oyster Point building is currently in the process of installing solar panels on the roof. The panels are expected to generate enough electricity to serve the entire building. UCSF is exploring the possibility of increasing the solar generating capacity and replacing natural gas burning equipment to all electric equipment. Replacing the natural gas burning carbon emitting heat pumps with solar electric heat pumps will contribute to UCSF overall pledge of reducing carbon emissions.			Building Electrification	Not Recommended
36	34	Weave Grid	Smart Charging Management for Connected Electric Vehicles	Weave Grid uses connected vehicle data from electric vehicles to remotely optimize EV charging management. By utilizing machine learning to predict consumer driving patterns and create "virtual fleets", we aggregate the EVs into a powerful grid asset that can reduce the strain on the grid. The EVs can then be used as a flexible demand-side resource, both at the macro grid level and also at the nodal, neighborhood-level distribution grid. This enables us to better predict EV demand and then manage the charging of electric vehicles, hence reducing the cost of real time supply-demand imbalances for Community Choice Aggregators (CCAs) and utilities. Additionally this reduces the need for costly grid upgrades, can help better integrate renewable energy (esp. excess solar), and save EV owners money on their energy bills. Our use of vehicle telematics data enables us to be agnostic to charger or car type, and given driving behaviors can optimize EV charging both across time and location.			Electric Vehicles	Not Recommended
37	35	YellowTin Inc	Accelerating Clean Electrification	Objective for PCE residential customers: The project targets residential customer base but can be conceivably scaled to the C&I customer base longer term. 1. Provide education on building and automotive solutions to help them electrify their homes. 2. Empower homeowners with a personalized set of unbiased recommendations based on an analysis of their preferences, their energy-usage data (obtained from PG&E), current technology costs, available incentives, etc. 3. Enable homeowners to easily understand and evaluate quotes from vendors so they can make informed decisions confidently. 4. Accelerate the adoption of electric technologies, including PV, EVs, battery storage, and heat pumps that can help customers save money and reduce the need for fossil fuels. 5. Improve the overall economics of technology adoption by reducing the soft costs (especially customer acquisition costs) of implementation.			Building Electrification	Not Recommended
38	36	Anamatangi Polynesian Voices	"Matae Ulua" (Top Level Quality)	Anamatangi is pleased to apply for a $75,000 grant, with Youth Community Service as our fiscal agent. Having partnered with Acterra and One East Palo Alto, we are the ones who translated your PCE flyer into Tongan. The goal of this grant is to "develop capacity and agency" within Pacific Islander communities in San Mateo County to educate ourselves in how to achieve greater participation in conservation and clean energy. We are filing under "Developing Local Community Benefits." In terms of metrics, it is our goal to reach 8,000 Pacific Islanders (out of 11,200 total) in San Mateo County and convert them to the 100% Equal Plus plan. Our strategy has three components: (1) "reaching out to Pacific Islanders in their churches;" (2) "following up with direct messaging to homes via radio" in Tongan, Samoan and Fijian; and (3) "empowering Pacific Islander youth and their parents" where the community studies its own needs, seeks grants, and (here) transitions to non-carbon energy			Other	Disqualified - Late
39	37	FIRM Clean energy	FIRM utility-scale community DER	Community utility-scale renewable generation co-located to leverage existing land use amongst a portfolio of local disturbed & industrial land parcels and interconnected directly to PG&E's distribution system at pre-determined locations (POI's) with potential to deliver maximum value to the rate-payer.			Generation	Disqualified - Incomplete

PENINSULA CLEAN ENERGY

2018 Community Pilots:
Top 12 Promising Proposals

Peninsula Clean Energy is San Mateo County's locally-controlled electricity provider. We are reducing greenhouse gas emissions and offering customer choice at competitive rates.

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ARCA RECYCLING, INC. APPLIANCE RECYCLING PROGRAM PROPOSAL

Prepared for:

Peninsula Clean Energy

2018 Community Pilot Program

Date: August 3, 2018

Contact: Andrew Healy

Vice President, Business Development

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ARCA RECYCLING, INC.

ARCARecyclingInc.com

P/N 12502301

PROJECT **DESCRIPTION**

INTRODUCTION AND **PROJECT SUMMARY**

ARCA Recycling, Inc. (ARCA) proposes the implementation and management of a turnkey appliance recycling program (ARP) for Peninsula Clean Energy (PCE).

ARCA's forty-year history in energy efficiency and the company's commitment to responsible appliance disposal provide the foundation for energy efficiency programs with seamless program operations. Comprehensive turnkey services ensure all aspects of program operations are handled professionally, with minimal work required by PCE.

Since 1994, ARCA has served over 25 California utilities, recycling over 3 million appliances. Our seasoned team has implemented and operated appliance recycling, low-income replacement, and retail recycling programs throughout California.

ARCA's ARP for PCE provides customers with a convenient and satisfying solution for disposal of their old appliances. PCE benefits from increased customer satisfaction and energy savings. Additionally, the ARP helps protect the environment through decreased greenhouse gas (GHG) emissions and reduced contamination of water and soil.

NOTE: A supporting document with the filename 12800102_ARCA-GHG-Reductions.pdf is included as part of this proposal. It provides additional information about how ARPs help reduce GHG emissions and how the savings are quantified.

SCOPE OF **WORK**

Turnkey **Services Summary**

- Customer service and call center functions.
- Collection of used appliances from residences and transport to recycling center.
- Appliance processing and materials recycling in compliance with all local, state, and federal laws, including removal and recycling or destruction of hazardous components and materials, recycling of metals and other recyclable materials.
- Hazardous, toxic, and non-hazardous wastes disposal in accordance with state and federal laws and regulations.
- Monthly program tracking and reporting.
- Support for third-party evaluation, measurement, and verification (EM&V) activities.
- Optional program marketing and promotion.
- Incentive fulfillment.

Appliance and Program **Eligibility Requirements**

- Operational primary or secondary refrigerators/freezers, running at the time of collection.
- Units must be between 10 and 30 cubic feet.
- Unit must be owned by the customer and picked up at their place of residence.
- Adult 18 years or older must be present at the time of collection.

Program **Management**

- ARCA account manager responsible for coordinating operations and overall program performance.
- Interface with the utility client via periodic meetings and ongoing communications regarding daily operations and issues.
- Marketing coordination and program reporting.
- Program monitoring for compliance with key performance indicators (KPIs) and contract requirements.

Customer **Service**

- Scheduling, rescheduling, and cancellation of in-home appliance collection appointments, including weekday and weekend appointment availability.
- Appointment scheduling via toll-free phone number or web portal.
- Call center 100% dedicated to ARCA appliance programs.
- Highly trained customer service staff with bilingual agents.
- Customer eligibility verification per PCE requirements.
- Unit eligibility verification (e.g., age, working condition, size).
- Providing customers with information about preparing their appliances for removal (e.g., empty, defrosted, plugged in, accessible).
- Customer confirmation phone calls, including day-ahead and in-route calls.
- Written confirmation of appliance collection for PCE customers and PCE staff.
- One-business-day response to customer questions or unresolved customer complaints that cannot be taken care of at the collection appointment.
- Established incident response and escalation policy.
- Customer information confidentiality, except as expressly authorized by PCE.

Transportation and **Appliance Collection Appointments**

- Strict adherence to United States Department of Transportation (DOT) Drug and Alcohol regulations mandated by the Federal Motor Carrier Safety Administration (FMCSA). Compliance with FMCSA in 49 CFR regulations and adherence to state and local requirements.
- Recruitment, screening, training, and monitoring of ARCA third-party transportation partners.
- Maintenance and inspection of collection vehicles and the tools and equipment required for safe and efficient appliance removal.
- Verification of unit eligibility (e.g. age, working condition, size).
- Removal of used appliance from the residence.
- Recording appliance information, completion of paperwork to transfer ownership, and providing the participant with applicable program forms.
- Immediate decommissioning of the appliance to ensure no resale.
- Established damage response process in the event of damage to the residence.
- Transportation of appliances to the processing and recycling facility in compliance with all federal, state and local regulations.

Appliance Processing and **Recycling**

- Recycling facility in compliance with all federal, state, and local hazardous and toxic waste management and recycling regulations, including but not limited to, the federal Clean Air Act, Resource Conservation and Recovery Act, Toxic Substance Control Act and the Emergency Planning and Community Right-to-Know Act.
- Employee certification(s) required to handle hazardous materials.
- Recovery, reclamation, and/or destroying all chlorofluorocarbon (CFC), hydro-chlorofluorocarbon (HCFC), and non-CFC refrigerants in compliance with applicable air quality regulations.
- Removal and recycling or disposal of hazardous substances including capacitors, mercury switches, fluorescent bulbs, batteries, oil, refrigerants, insulated foam, and blowing agents.
- Removal and recycling or disposal of non-hazardous waste, including metals, glass, plastics, motors, and other materials.
- Transportation of associated wastes from the recycling facility in compliance with all federal, state, and local laws and Environmental Protection Agency's (EPA) Responsible Appliance Disposal (RAD) guidelines.
- Production and maintenance of processing records and reports.
- Development of RAD reports that include quantified GHG emission data.

Information Technology and **Program Management**

- Comprehensive program management via proprietary Appliance Turn-In Order (ATO) system.
- Tracking and reporting available throughout entire collection order process.
- Secure, real-time, online access 24/7 for PCE staff for program data and reports.
- Data security measures to ensure data security and privacy.
- Established backup, redundancy, and disaster recovery procedures.

Quality **Assurance**

- Call center statistic tracking to ensure program performance goals are met.
- Audits of all aspects of program operations including call center, collection, invoicing, incentives, and recycling.
- Annual and unscheduled facility audits at recycling centers.
- Equipment and facility area inspections and reporting.
- Weekly monitoring and evaluation of call center employees.
- Periodic and unscheduled audits of transportation/collection employees.
- Support for process and impact evaluations.

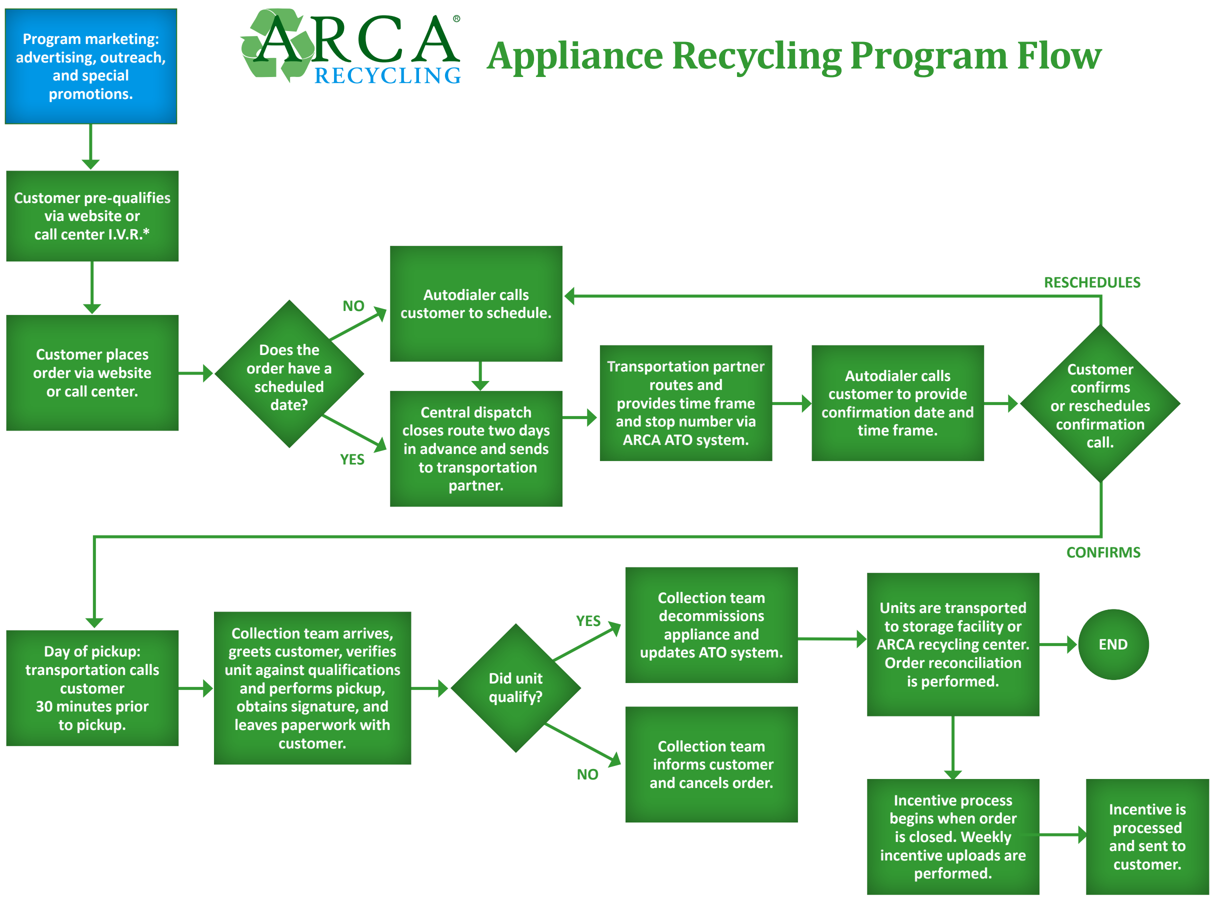
Incentive **Fulfillment**

- Incentive processing, disbursement, tracking and reporting.

Optional **Program Promotion and Marketing**

- Development of an annual marketing plan requiring approval by PCE.
- Advertising, marketing, and outreach targeted to reach ARP unit goals.
- Compliance with PCE’s brand and creative guidelines.
- Marketing venues include Internet, direct mailers, social media, radio, and more.

PROGRAM **FLOW**



*Interactive voice response.

Item in blue box is an optional program element.

ARCA Part Number 12700201

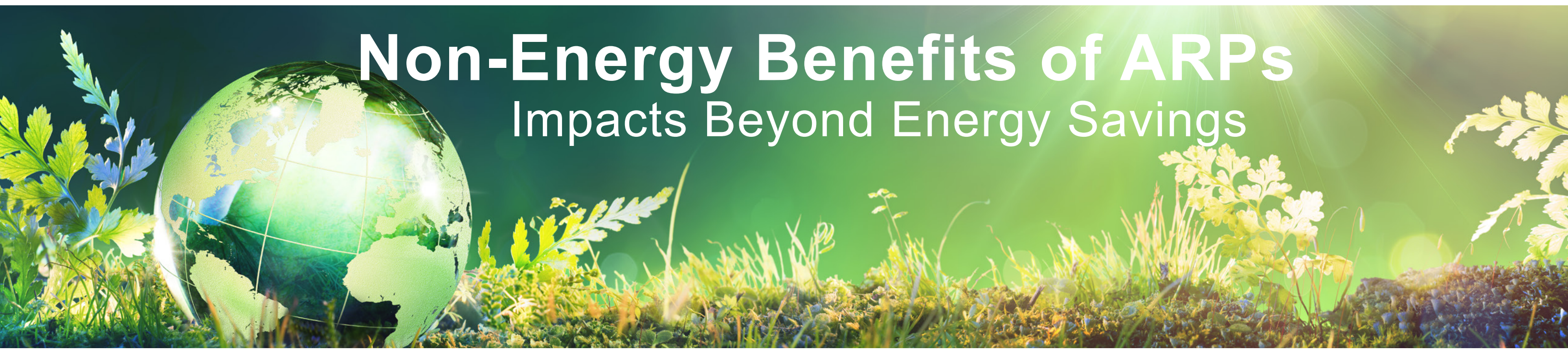
PROGRAM **OBJECTIVES**

ARCA estimates approximately 350 refrigerators/freezers will be collected in the first year of operation of the PCE appliance recycling program.

PROGRAM OUTCOMES AND **BENEFITS**

Appliance recycling programs (ARPs) are a popular component of a utility's residential energy efficiency program portfolio. Consumers enjoy the benefits of free appliance removal and recycling, receiving a monetary incentive, and lower electricity bills.

The success of appliance recycling programs has historically been determined by the energy savings the program creates. ARPs also reap important benefits in addition to energy savings. These benefits are called non-energy benefits (NEBs) and are explained below.



ENVIRONMENTAL PROTECTION

ARPs that comply with the U.S. EPA RAD program ensure that materials are handled and disposed of properly.

1 GHG EMISSIONS

When appliances are properly disposed of, GHG emissions are reduced, and water and soil resources are protected.

2 REFRIGERANTS

When appliances containing refrigerants are recycled properly, the release of dangerous greenhouse gases (GHGs) and ozone-depleting substances (ODS) is avoided.

3 FOAM BLOWING AGENTS

Refrigerators and freezers manufactured before 2005 contain foam insulation that can harm the environment through the release of GHG and ODS.

4 OTHER HAZARDOUS MATERIALS

Appliances can contain harmful materials such as oil and mercury. If an appliance is not processed correctly at its end of life, groundwater contamination and other forms of release can lead to human exposure to these harmful substances.

NEBS: Cost **Savings**

When appliances are recycled using EPA RAD standards, non-energy benefits (NEBs) can be quantified and reported, including cost savings from recycling durable materials and savings from avoided emissions.

Calculated RAD NEBs from Properly Disposing of 1,000 Refrigerators 20+ Years Old*

NON-ENERGY BENEFITS	COST SAVINGS	GHG EMISSIONS AVOIDED ($MTCO_2eq$)
Recycling ferrous and non-ferrous metals	$5,820	145
Recycling plastics	$2,680	14
Avoided release of used oil	Not estimated	Not estimated
Avoided release of mercury	Not estimated	Not estimated
Avoided release of PCBs	Not estimated	Not estimated
Avoided refrigerant emissions	$27,140	2,240
Avoided foam emissions	$25,050	2,070
Non-Energy Benefit Subtotal:	**$60,690**	**4,468**

$25 BILLION
IN CONSUMER SAVINGS SINCE RAD'S INCEPTION IN 2006

53%
of old, inefficient appliances stay on the grid without ARPs

940
MILLION POUNDS of materials have stayed out of landfills because of RAD

ARCA prepares annual RAD reports for its programs that quantify NEBs, including GHG emissions avoided, as well as standard energy savings.

*Supporting information at https://www.epa.gov/rad/program-benefits

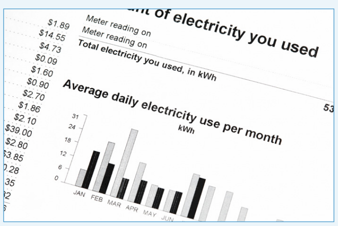
Customer **Satisfaction**

ARPs are popular energy efficiency programs with consumers. ARPs are often the top-rated program in a utility's residential energy program portfolio, with consistently high levels of customer satisfaction.

CUSTOMER AND **SOCIETAL BENEFITS**

INCENTIVE

ARPs offer an incentive to consumers who choose to recycle their old, working appliances. The incentive encourages responsible disposal and puts money in the consumer's pocket, stimulating the economy.



ENERGY BILL REDUCTION

The energy savings realized from retiring energy-inefficient appliances results in lower residential electricity bills, saving a consumer approximately $50 per year.

CUSTOMER SATISFACTION

The consumer gets satisfaction from knowing the unit is disposed of properly, contributing to the well-being of the planet. Consumers report viewing their utility favorably because of the utility's sponsorship of the program.

A CLEANER PLANET

As a whole, society benefits from a cleaner and healthier environment when appliances are recycled using RAD best practices. Human exposure to harmful substances is avoided when hazardous materials from refrigeration appliances are handled and disposed of properly.

NOTE: A supporting document with the filename 12800102_ARCA-GHG-Reductions.pdf is included as part of this proposal. It provides additional information about how ARPs help reduce GHG emissions and how the savings are quantified.

PROGRAM **SPECIFICS**

Customer **Segment**

ARCA's ARP will serve PCE residential customers throughout San Mateo County.

Low-Income **Program**

ARCA operates several low-income appliance replacement programs in California and throughout the country. Replacement programs serve low-income customers by replacing energy-inefficient appliances with energy-efficient models at no cost to the consumer. The possibility of a replacement program for PCE can be explored upon request.

ARCA **Partners**

Transportation and **Collection**

ARCA is supported by subcontractor Herrera Transportation and Trucking, Inc. (Herrera). Herrera is a certified minority-owned business (MBE) that would perform appliance deliveries, collection, and transportation activities for PCE's ARP.

Herrera is marked by a high degree of professionalism and responsiveness to client needs while maintaining an efficient operation to optimize the cost-effectiveness of the program's transportation functions. Herrera currently provides appliance collection and transportation services for appliance recycling programs throughout California.

Incentive **Fulfillment**

ARCA's incentive fulfillment services are performed by Promotion Management Center (PMC), a Women-Owned Business Enterprise (WBE). PMC provides excellence in service and fast turnaround time for incentives. PMC has been in business since 1983 and is based in Minnesota. The company's longevity in fulfillment services and experience in working in the utility industry makes PMC an ideal partner for ARCA's ARPs.

Additional **Program Benefits**

Scalable **and Replicable**

ARCA's ARPs are scalable and replicable in the following ways:

- Marketing efforts can be adjusted to increase (or decrease) overall consumer participation.
- The marketing program can be fine-tuned to reach specific demographics or geographic regions.
- Additional appliance types can be added to the program, including room air conditioners and dehumidifiers.
- Additional promotional efforts can be employed to increase public awareness and participation, such as a booth at community events, milestone events, contests, drawings, and limited-time incentive increases.

Scalable **and Replicable** - continued

- Special events such as appliance turn-in days can be added to a program at additional cost, increasing energy savings, and providing convenience to consumers.
- Additional appliance-based energy efficiency programs can be added to a utility's portfolio including the low-income appliance replacement program mentioned earlier, programs focused on small businesses, or programs with a multi-family focus
- ARCA's ARPs are replicable, allow for expanded capabilities, and are flexible to meet specific client requirements.

ARCA Qualifications and **Proven Performance**

ARCA's forty-year history of leadership in the energy efficiency industry and management of over 250 programs provides the foundation for a successful ARP for PCE:

- North America's largest appliance recycler.
- Currently operating over 100 appliance programs across the U.S. and Canada.
- Over 3 million appliances recycled in California since the mid-1990s.
- Currently serving California utilities:
    - Sacramento Municipal Utility District (SMUD)
    - Los Angeles Department of Water and Power (LADWP)
    - Riverside Public Utilities
    - Anaheim Public Utilities
    - Southern California Gas Company
    - Pasadena Water and Power
    - Burbank Water and Power
    - Colton Electric Department
    - Imperial Irrigation District
- Previously served Southern California Edison, Pacific Gas and Electric, San Diego Gas and Electric, and Glendale Water and Power.
- Won EPA Best-of-the-Best Stratospheric Ozone Protection Award and EPA Stratospheric Ozone Protection Award with Southern California Edison.

Turnkey Services Result in **Minimal Effort for PCE**

ARCA's turnkey service approach minimizes program implementation and management efforts by PCE staff. An ARP typically has a program manager at the utility, and has an account manager at ARCA who work together to implement and manage the ARP.

ARCA's account managers are key to a program's success and are responsible for its overall operations. Scheduled meetings, reporting, and ongoing communications ensure that the program remains on target and problems are resolved quickly.

ARCA's turnkey services feature a seamless and transparent experience for the consumer, with PCE branding and identity in its marketing, incentive processing, and customer service scripts.

Program **Evaluation**

Periodic program reporting, marketing reports, and annual RAD reports ensure that ARCA's ARPs are performing to program goals. Program status reports are typically performed on a weekly or bi-weekly basis in conjunction with program meetings. Status reports and marketing reports help steer changes to promotional activities to achieve program goals.

Annual RAD reports generated by ARCA provide energy savings and non-energy benefits (NEBs) data to measure a program's effectiveness.

To ensure that ARCA's ARPs are performing to ARCA's and PCE's requirements, stringent quality assurance practices are in place including scheduled and blind audits of collection teams and recycling processes.

Program **Metrics**

Program success is measured by units collected in relation to program goals, energy savings, and non-energy benefits.

The number of collected units is reported on a weekly or biweekly basis. Program reports include the period's collection data and cumulative data with graphical representation to easily assess program performance. Monthly marketing reports include a comprehensive examination of program performance data and an analysis of the effectiveness of specific marketing tactics.

RAD reports include:

- Number and age of appliances collected.
- Type and quantity of refrigerant recovered and reclaimed or destroyed.
- Type and quantity of foam blowing agent recovered and reclaimed or destroyed.
- Weight of metals, plastics, and glass recycled.
- Quantity of hazardous waste products and used oil recovered or destroyed.
- Energy savings information associated with retirement of old appliances.

RAD non-energy benefits reporting is explained on page 6 of this proposal.

Looking to the **Future**

ARCA is currently working with Silicon Valley Power and City of Palo Alto Utilities to implement ARPs that have received partial funding through grants by the Bay Area Air Quality Management District (BAAQMD). ARCA believes that the BAAQMD funding source might be accessed by PCE after the ARP's pilot year to continue and expand the program.

Additionally, ARCA is discussing implementation of energy efficiency programs with other local utility companies, including Roseville Electric, Turlock Water and Power, and Modesto Irrigation District. Expanded program implementation in these districts will work to build overall program awareness, enable route sharing to reduce vehicle emissions, and contribute to increased GHG reductions for the region.

ARCA RECYCLING, INC.
APPLIANCE RECYCLING PROGRAM
August 3, 2018
Community Pilots

ARCA Program Parameters: Refrigerator and freezer collection estimate: 350 units annually
Incentive amount: $35 per refrigerator/freezer
Length of program for this budget: One year

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**	$74,000	**$74,000**	100%	Requested
	Total	**$74,000**	**$74,000**		

REVENUE SUMMARY		
Total Requested	**$74,000**	100%
TOTAL PROPOSAL REVENUE	**$74,000**	100%

Note: ARCA's program expenses are calculated on a per-unit basis.

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	One-time program startup fee	$7,500	**$7,500**	10%	
Expense #2	Per-unit fee for program administration, collection, and recycling at $135 per unit	$47,250	**$47,250**	64%	
Expense #3	Program marketing fee at $20 per unit	$7,000	**$7,000**	9%	
Expense #4	Incentive to customers at $35 per unit	$12,250	**$12,250**	17%	
TOTAL PROPOSAL EXPENSES		**$74,000**	**$74,000**	**100%**	

Net Income - Expenses	-	-

SUBCONTRACTORS

Transportation	Herrera Transportation and Trucking, Inc. (Herrera)
Incentive Fulfillment	Promotion Management Center (PMC)

Subcontractor descriptions found on Page 8 of proposal

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

NON-ENERGY BENEFITS

OF

APPLIANCE RECYCLING PROGRAMS

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ARCA P/N 12800102

APPLIANCE RECYCLING PROGRAMS

Program Benefits from New Perspectives

SUMMARY

There has been a recent shift in the consideration of benefits related to appliance recycling programs (ARPs).

Historically, appliance recycling program effectiveness metrics have focused on energy savings. Program success was evaluated and based on a utility's savings in terms of kWh saved.

With a new focus on greenhouse gas (GHG) reductions and other non-energy benefits (NEBs), utilities are examining ARP performance from other angles.

This document provides information on the benefits of ARPs beyond energy savings.

WHY IMPLEMENT AN ARP?

ARPs reap benefits beyond the energy savings. These benefits are called non-energy benefits (NEBs).

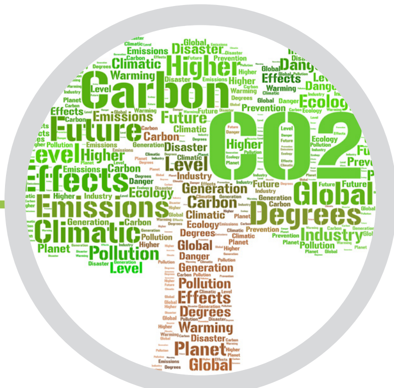
NEBs touch the complete spectrum of program stakeholders and beyond. Who benefits?

- The sponsoring utility
- The program participant
- The program implementer
- The workforce and economy
- The environment
- Human health
- Society as a whole

RECYCLING 1,000 REFRIGERATORS THAT ARE OVER 20 YEARS OLD AVOIDS GHG EMISSIONS EQUIVALENT TO THE BENEFIT OF NOT DRIVING 1,000 CARS FOR ONE YEAR

NON-ENERGY BENEFITS OF Appliance Recycling Programs

Appliance recycling programs (ARPs) are a popular component of a utility's residential energy efficiency program portfolio. Consumers enjoy the benefits of free appliance removal and recycling, receiving a monetary incentive, and lower electricity bills.



ENVIRONMENTAL PROTECTION

When appliances are properly disposed of, GHG emissions are reduced and water and soil resources are protected.

Appliance recycling programs that comply with U.S. EPA RAD program* ensure that appliance foam is handled and disposed of properly.

In addition, GHG emissions are avoided by manufacturing a product with recycled materials instead of virgin materials.

COST SAVINGS AND THE ECONOMY

Implementation of an ARP realizes cost savings from recycling durable materials, while avoiding environmentally damaging emissions from CFC-containing refrigerants and polyurethane foam insulation.

ARPs help stimulate the economy through consumer financial incentives and monthly savings on electricity bills.

ARPs create employment opportunities in the local economy, especially in the waste management and transportation industries.

CUSTOMER SATISFACTION

ARPs are popular energy efficiency programs with consumers.

ARPs are often the top rated program in a utility's residential energy program portfolio, with consistently high levels of customer satisfaction.

Consumers report viewing their utility more favorably because of the utility's sponsorship of the program.

*** The U.S. Environmental Protection Agency's (EPA) Responsible Appliance Disposal (RAD)program is a voluntary partnership program that protects the ozone layer and cuts greenhouse gas through disposal of refrigerated appliances using best practices that exceed federal law requirements.**

APPLIANCE RECYCLING

Protecting the Environment and Human Health

APPLIANCE RECYCLING AND PROPER DISPOSAL HELP KEEP THE EARTH AND ITS POPULATION HEALTHY

REFRIGERANTS

When appliances containing refrigerants (refrigerators, freezers, room air conditioners, dehumidifiers) are recycled properly, the release of dangerous greenhouse gases (GHGs) and ozone-depleting substances (ODS) is avoided. Without proper disposal processes, refrigerants such as CFC-12, HCFC-22, and HFC-134a may be released into the environment, contributing to climate change.

FOAM-BLOWING AGENTS

Refrigerators and freezers manufactured before 2005 contain foam insulation that can harm the environment through release of GHG and ODS.

OTHER HAZARDOUS MATERIALS

Appliances can contain other harmful materials such as oil and mercury. If an appliance is not processed correctly at its end of life, groundwater contamination and other forms of release can lead to human exposure to these harmful substances.

WHAT NEGATIVE EFFECTS CAN THESE MATERIALS HAVE?

ENVIRONMENTAL DAMAGE: Destruction of the ozone layer, contribution to greenhouse gas emissions and soil and groundwater contamination.

HEALTH EFFECTS: Pollutants such as mercury are known for causing long-term damage to human and animal populations.

Air Water Climate Health

PROPER DISPOSAL OF REFRIGERANT AND FOAM AVOIDS THE RELEASE OF GREENHOUSE GASES

CFC-12: 10,200 GWP

Refrigerants in refrigerators and freezers produced prior to 1996.

HFC-134a: 1,300 GWP

Refrigerants in refrigerators and freezers produced since1996.

CFC-11: 4,600 GWP

Foam insulation in refrigerators and freezers produced between 1971-1995.

HCFC-141b: 782 GWP

Foam insulation in refrigerators and freezers produced since 1996.

GLOBAL WARMING POTENTIAL (GWP) is a relative measure of how much heat a greenhouse gas traps in the atmosphere. It is the amount of energy that emissions from one ton of a given gas will absorb over 100 years, compared to the emissions of one ton of CO_2. The higher the GWP, the more damaging the gas is.

COST SAVINGS AND AVOIDED EMISSIONS

The Benefits of Responsible Recycling

COST SAVINGS AND AVOIDED EMISSIONS

When appliances are recycled using EPA RAD standards, non-energy benefits can be quantified and reported, including:

- Cost savings from recycling durable materials
- Cost savings from avoided emissions
- Gallons of used oil recycled or properly disposed
- Number of PCB-containing capacitors destroyed
- Number of mercury-containing components recycled or properly disposed

An EPA calculation of non-energy benefits follows. To learn more about the subject visit https://www.epa.gov/rad/program-benefits.

Note: The values below are based on average quantities of materials recovered per unit, based on 2013 RAD partner reports. Units are assumed to contain CFC-12 refrigerant and CFC-11 foam blowing agent.

Cost savings associated with avoided emissions are calculated using the California auction reserve price for CO2eq. As of February 2015, this price was $12.10 per ton.

$25 BILLION
IN CONSUMER SAVINGS SINCE RAD'S INCEPTION IN 2006

Responsible Appliance Disposal Program
RAD
EPA

Calculated RAD NEBs from Properly Disposing of 1,000 Refrigerators 20+ Years Old

NON-ENERGY BENEFITS	COST SAVINGS	GHG EMISSIONS AVOIDED ($MTCO_2eq$)
Recycling ferrous and non-ferrous metals	$5,820	145
Recycling plastics	$2,680	14
Avoided release of used oil	Not estimated	Not estimated
Avoided release of mercury	Not estimated	Not estimated
Avoided release of PCBs	Not estimated	Not estimated
Avoided refrigerant emissions	$27,140	2,240
Avoided foam emissions	$25,050	2,070
Non-Energy Benefit Subtotal:	**$60,690**	**4,468**

AVOIDING THE NEGATIVE IMPACTS OF Improper Disposal of Refrigeration Appliances

MATERIALS RECOVERED DURING RAD PROCESSING

The following components and materials are disposed of or recycled in an environmentally-sound manner in RAD best practices:

- Ferrous and nonferrous metals
- Glass and plastics
- Capacitors containing PCB fluid
- Mercury switches and other components containing mercury
- Batteries and fluorescent bulbs
- Oil
- Chlorofluorocarbon (CFC), hydrochlorofluorocarbon (HCFC) and hydrofluorocarbon (HFC) refrigerants
- Blowing agents in foam insulation

RAD partners ensure that:

- Refrigerant is recovered and destroyed
- Foam blowing agent is recovered and either reclaimed or destroyed through incineration at a waste-to-energy facility
- Metals, plastic, and glass are recycled
- PCBs, mercury, batteries, and used oil are recovered or properly disposed of

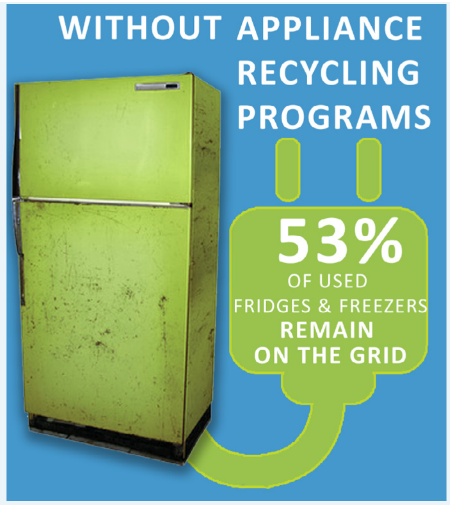
Recycling center agents are certified and trained to identify and handle hazardous components in appliances. Utility EPA RAD partners are required to follow specific recycling procedures and report on the recovery of ozone-depleting chemicals from old refrigerators, freezers, and dehumidifiers.

AVOIDING IMPACTS OF IMPROPER DISPOSAL

Beyond environmental and health impacts, other negative outcomes result from not using EPA RAD recycling practices to recycle and dispose of household appliances.

LANDFILL IMPACT: Recycling appliances prevents metals, plastics, and glass from going to landfills.

INCREASED ENERGY CONSUMPTION: When an ARP is not implemented, many energy-inefficient units stay on the grid. Consumers may opt to sell their old appliance, give it away, or use it as a secondary unit.



APPLIANCE RECYCLERS SUBMIT **ANNUAL RAD REPORTS** ON BEHALF OF UTILITIES THAT QUANTIFY MATERIAL RECOVERY AS WELL AS ENERGY SAVINGS

RAD SAVES MILLIONS OF POUNDS OF WASTE

795 MILLION LBS. METALS

126 MILLION LBS. PLASTICS

19 MILLION LBS. GLASS

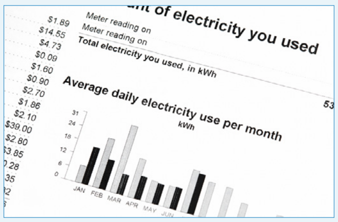
FROM BEING DUMPED INTO LANDFILLS

EPA DATA 2007-2014

CONSUMER AND SOCIETAL BENEFITS

INCENTIVE

ARPs offer an incentive to consumers who choose to recycle their old, working appliances. The incentive encourages responsible disposal and puts money in the consumer's pocket, stimulating the economy.



ENERGY BILL REDUCTION

The energy savings realized from retiring energy-inefficient results in lower residential electricity bills, saving a consumer approximately $50 per year.

CUSTOMER SATISFACTION

A consumer's decision to recycle a used appliance results in the satisfaction in knowing the appliance will be disposed of properly, contributing to the well-being of the planet.

CLEANER AIR AND WATER

Society as a whole benefits from a cleaner and healthier environment when appliances are recycled using RAD best practices.

ARPs contribute to the efforts of the California Air Resource Board's (ARB) **2030 Climate Commitment** to reduce emissions of short-lived climate pollutants.

REFERENCES AND RESOURCES

The following documents and web pages were used to produce this document and can be used to learn more about the non-energy benefits of appliance recycling programs and the RAD program.

RAD PROGRAM BENEFITS	EPA Website	http://bit.ly/2tipTTv
GLOBAL WARMING POTENTIALS	EPA Website	http://bit.ly/2bQgLd1
EPA RAD Program Page	EPA Website	http://bit.ly/2jc26hB
EPA Benefits Page	EPA Website	https://bit.ly/2Io40bZ
CA ARB 2030 Climate Commitment	CA.gov Website	http://bit.ly/2I8AKmA
RAD Program Results	EPA Website	http://bit.ly/2FlYcz7

Peninsula Climate Comfort

A Residential Electrification Feasibility Study and Demonstration Project

Proposal to Peninsula Clean Energy in Response to 2018 Community Pilots Call for Proposals

Submitted by Ardenna Energy, LLC

In Partnership with

- Tom Kabat
- Build It Green
- Home Energy Analytics

Bruce Mast

Principal, Ardenna Energy, LLC

510-435-1371

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Project Description

Problem Statement

According to California Air Resources Board, residential fossil fuel consumption accounted for seven percent of 2016 statewide emissions, equal to 30 million metric tons of CO_2e.[1] To reach the state's climate action goal of reducing 2050 emissions to 80 percent below 1990 levels, California's residential fossil fuel end uses must be converted to high-performance electric technologies powered by low- or zero-carbon electricity.

Peninsula Clean Energy (PCE) is well on its way to providing 100 percent zero-carbon electricity to its ratepayers. PCE can further advance its climate action goals by helping San Mateo County residents convert their natural gas furnaces and hot water heaters to heat pumps and heat pump water heaters. Full conversion would reduce countywide GHG emissions by an estimated 162.7 thousand metric tons of CO_2e per year, given PCE's current electricity emissions factor, and by 178.8 thousand tons per year if powered by zero-carbon electricity.

Despite the obvious climate benefits of electrification, consumers face daunting technical and financial challenges, including requirements for electric panel upgrades, condensate lines, and space limitations. On the financial front, Rocky Mountain Institute found that a heat pump installed in Oakland, CA, would cost customers $20,800 over 15 years, compared to $16,100 for the natural gas alternative.[2] Contractors often charge a premium for installing unfamiliar heat pumps and current average gas-electric price ratios are not favorable to conversion.

Project Objectives and Approach

Ardenna Energy offers the Peninsula Climate Comfort Pilot Project to demonstrate a viable and cost-effective program model for delivering residential-sector electrification retrofits at scale. The Project will conduct in-depth technical and financial feasibility assessments for five home owners who wish to consider electrification of space heating and/or water heating as part of planned equipment replacement. The feasibility assessments will evaluate the technical, financial, and performance opportunities and challenges for beneficial electrification, including opportunities to improve financial performance by bundling electrification with energy efficiency upgrades, PV installation, electric vehicle charging, and behind-the-meter battery energy storage. Feasibility assessments will inform a program design report that addresses:

- Technical challenges facing customers and recommendations to address them through design assistance services
- Customer economics of electrification and recommendations to improve them through innovative financing solutions and CCE rate structures

Peninsula Climate Comfort will offer a $1,500–$2,000 incentive to offset installation costs for those customers who elect to move forward with a project that includes beneficial electrification. The Project Team will further assist customers in accessing available incentives, tax credits, and other financial benefits. On the technical front, the Project Team will help customers select a qualified contractor, finalize project specifications, manage construction, and conduct quality assurance. Completed projects will be fully documented and published as case studies. These

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[1] https://www.arb.ca.gov/cc/inventory/data/graph/pie/pie_2016_by_sector.png
[2] Billimoria, Sherri, Mike Henchen, Leia Guccione, and Leah Louis-Prescott (2018). *The Economics of Electrifying Buildings: How Electric Space and Water Heating Supports Decarbonization of Residential Buildings*. Rocky Mountain Institute, http://www.rmi.org/insights/reports/economics-electrifying-buildings/

projects may also produce recommendations to address contractor training needs in in collaboration with BayREN / StopWaste.

Partner Roles

Ardenna Energy has assembled a highly skilled team of Bay Area-based thought leaders and practitioners to perform the described work.

- **Ardenna Energy, LLC,** will provide overall project management and coordination; coordinate with PCE and local governments on marketing and outreach; lead economic analysis; conduct project measurement and verification; and prepare case studies and reports. Ardenna Energy's Principal, Bruce Mast, brings almost three decades of industry experience with program design, implementation, and evaluation.
- **Build It Green (BIG)** will lead site assessments and technical analysis of project design scenarios, including load impact analysis. BIG is a nationally recognized green building nonprofit organization with extensive expertise in green building practices and quantification of associated energy, water, and climate impacts.
- **Tom Kabat** will provide technical assistance in developing financial models to compare alternative investment scenarios. Mr. Kabat brings strong analytical skills and experience in the areas of electric resource optimization, renewable energy procurement, utility resource planning, solar thermal and electric system design, and integrated resource planning, all honed over 35 years in the municipal electric and gas utility field.
- **Home Energy Analytics (HEA)** will provide access to customer AMI meter data; provide utility bill disaggregation and related analytical capabilities; and meter actual performance of electrified homes in support of measurement and verification (M&V) activities. If HEA is also awarded a PCE Innovation Grant, then they can perform an initial qualification (based on energy profile and survey responses) and provide a "funnel" of candidate homes. HEA has been providing software for cost-effective community energy efficiency programs since 2011 and has has analyzed smart meter data for more than 6,000 residents. HEA now has residential energy efficiency pay-for-performance contracts with California's three largest investor-owned utilities.

Sequence of Activities

Ardenna Energy proposes the following implementation calendar, assuming an October 15 start date:

Activity	Start	End
Marketing and Outreach	Oct. 15, 2018	Dec. 15, 2018
Design Assistance and Financial Analysis	Jan. 5, 2019	Mar. 31, 2019
Feasibility Assessment Report	Apr. 1, 2019	May 31, 2019
Installation	Apr. 1, 2019	Jun. 30, 2019
Post-Retrofit M&V	Jul. 1, 2019	Apr. 30, 2020
Case Studies & Final Report	May 1, 2020	May 31, 2020

If design assistance and retrofit installation can be completed during the fall of 2018, then M&V can proceed during the winter of 2018-2019, with complete case studies in late spring of 2019. That timeline appears rather ambitious, so the proposed schedule assumes we will miss the 2018-2019 heating season for post-retrofit performance monitoring.

Marketing and Outreach

The marketing goal will be to recruit at least one case study candidate from every Supervisorial District, with case studies exemplifying a range of home sizes and vintages, household income, and occupant demographics. Outreach will be through direct mail since we anticipate a lack of email addresses and phone numbers for the vast majority of prospective participants. Ideally, the outreach campaign will be strongly supported by PCE and local governments. Invitation letters will be much more impactful if they come from PCE and/or local governments rather than Ardenna Energy.

The proposed budget assumes the Project will need to be self-sufficient with minimal reliance on public sector resources (but see PCE Implementation Requirements for opportunities to reduce Project marketing costs and/or improve effectiveness). Outreach efforts for this grant would be simplified if HEA's grant is also approved by PCE: the two are complementary but not co-dependent.

The ideal participant is a home owner with relatively high annual gas bills and aging furnace and/or water heater in need of planned replacement. In practice, we expect to have limited information about equipment vintages, so we will use home vintage as a proxy. We will mail invitations to a sample of 5,000 owners of homes constructed prior to 2005. Interested home owners will complete a pre-screening process, which will include enrolling in Home Energy Analytics' HomeIntel service and providing access to at least one year of baseline energy consumption data from PG&E (both gas and electric).

Of the 5,000 home owners contacted, our goal is to elicit interest from at least 100 home owners who complete the pre-screening process (i.e., two percent response rate). From this pool, we will recruit at least five home owners to move forward in the Project. Participants will need to sign a participation agreement, which will include a liability release and permission to publish a case study, including photos and customer quotes.

Design Assistance

Case study customers will benefit from turn-key design assistance services to help them navigate the electrification process. Peninsula Climate Comfort will:

- Evaluate alternative retrofit scenarios, including bundling electrification with energy efficiency, PV, storage, and/or electric vehicle investments
- Evaluate technical and financial feasibility of residential electrification
- Capture installation requirements for preferred alternatives

For those customers who elect to move forward with an electrification upgrade, Project specialists will lead the client through the ensuing project steps – contractor selection, scheduling, permitting, on-site installation, inspections and ongoing warranty and support services, quality assurance / quality control, and M&V based on customer AMI data through a complete heating season.

Peninsula Climate Comfort will help customers select an installation contractor who can provide high quality installation services. The Project will seek contractors with the following qualifications:

- General contractor (B) license and/or specialty trade licenses in Electrical (C-10), HVAC (C-20), and Plumbing (C-36)
- Demonstrated experience installing heat pumps and heat pump water heaters
- High customer satisfaction ratings (Yelp, Angie's List, or equivalent)
- Certified BPI Building Analyst on staff

- Participating contractor in the BayREN or PG&E Home Upgrade Programs

We will use best efforts to identify qualified local contractors who utilize union labor, hire from local apprenticeship programs, and adopt fair compensation practices for their employees, per PCE workforce development guidelines. The final contractor selection decision will be up to the customer.

Financial Analysis

Peninsula Climate Comfort will assess the financial feasibility of a Managed Energy Services Agreement (MESA) suitable for the residential electrification market. The MESA would offer customers a pathway to retrofits with zero upfront out-of-pocket costs and repayments tied to project performance. MESA can work in tandem with a utility-sponsored Tariffed On-Bill (TOB) solution or it can function as a stand-alone financing option.

MESA helps the customer avoid the high up-front costs of replacing fossil-fueled devices with efficient electric devices by converting the capital investment into a monthly operating cost. TOB further simplifies the transaction by placing the MESA payment on the customer utility bill. TOB also offers the potential to extend MESA financing solutions to tenant-occupied buildings by bridging the landlord-tenant split incentive.

A viable business model for MESA financial services will require monetization of all Project benefits, both customer-facing and CCE-facing. Toward that end, Peninsula Climate Comfort will conduct a comprehensive analysis of customer and PCE costs and benefits.

Customer-facing financial analysis will evaluate load shape impacts of project design alternatives, utility tariff options, and opportunities to minimize utility bills via load shifting or load reductions during peak time-of-use periods. Preliminary analysis suggests that price differentials within TOU rates may offer savings opportunities that are masked when analyzing costs using average prices. This information will be combined with installation cost information to derive customer return on investment (ROI).

One potential source of operational benefits is on the CCE power procurement side. CCE-facing financial analysis will evaluate how additional electric demand and beneficial load shape changes may reduce PCE's cost of service to its customer base. To arrive at this result, Peninsula Climate Comfort will calculate the Net Energy Value (NEV) for each analysis scenario, equal to the forecast retail revenue from delivering energy to the project minus the wholesale cost of energy. NEV analysis will incorporate time variations in retail TOU prices along with a time-value function of PCE's energy procurement contracts and/or forecast market prices for wholesale energy. The net result of this analysis will be a set of recommendations to PCE for designing a residential electrification tariff that rewards customer actions that support PCE's load serving needs.

Launching a residential electrification MESA will require a roadmap to scale the market beyond the five case studies planned for this Pilot. As a short-term alternative, Peninsula Climate Comfort will offer a $1,500–2,000 incentive to offset installation costs for those customers who elect to move forward with a project that includes beneficial electrification. We will provide full assistance to customers to apply for all eligible incentives, tax credits, and financing as needed.

Feasibility Assessment Report

Peninsula Climate Comfort will prepare a feasibility assessment report to PCE that conforms to the following outline:

- The situation: home owner profiles, energy management and home improvement goals

- Baseline conditions, including physical conditions, energy consumption patterns, and energy costs
- Scenarios evaluated
- Feasibility study results by scenario:
    - Technical requirements / scope of work
    - Expected customer installation costs
    - Expected customer operating costs and benefits
    - PCE Net Energy Value calculations
- Findings
    - Project opportunities and challenges
    - Implications and lessons learned for customer design assistance
    - Implications and lessons learned for project financing and CCE rate design
- Preliminary recommendations on designing residential electrification programs, incentives, and financing products

Installation

When the customer elects to move forward with an upgrade project, Peninsula Climate Comfort will help customers select a qualified contractor, finalize project specifications, secure building permits, and manage construction, as needed. Project personnel will conduct periodic progress inspections for quality assurance / quality control purposes.

Measurement and Verification (M&V)

For case study participants who elect to move forward with a retrofit project, the HEA platform will be used to support M&V. This analysis will focus on understanding how well we are able to predict operating costs and benefits of adopted retrofit solutions, with the goal of predictint actual performance within ±10 percent. For the selected retrofit scope of work, the Project team will construct a detailed time series forecast of load and utility bill impacts from the adopted measures. Forecasts will be disaggregated into expected changes to “always on,” “variable,” “heating and cooling,” and “recurring” loads. Actual metered consumption and utility bills will be tracked over a full winter heating season and compared to forecast. Realization rates will be calculated on a monthly basis.

Case Studies and Final Report

Project case studies will be prepared for customers who elect to move forward with an electrification upgrade. Interim case studies will be published upon retrofit completion. These case studies will be updated and finalized as metered M&V results become available. Case studies will incorporate the following information:

- Feasibility study results
- Retrofit process and outcomes
- M&V Results
    - Forecast versus actual energy consumption
    - Forecast versus actual customer utility bills
    - Forecast versus actual NEV

In addition to individual case studies, Peninsula Climate Comfort will produce a final report, outlined as follows:

- Pilot goals, objectives, and research questions
- Methodology

- Summarized case study results
- Findings
    - Technical and user acceptance challenges
    - Opportunities to address challenges through customer design assistance
    - Customer and CCE/utility economics of electrification
    - Market potential to scale a residential electrification program
- Recommendations on designing residential electrification programs, incentives, and financing products

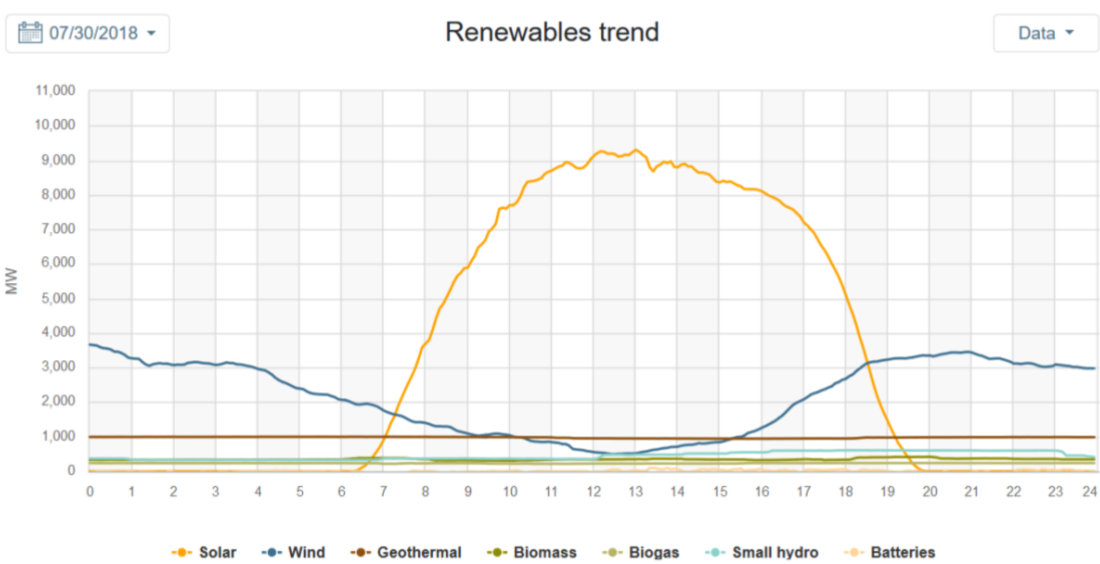
Outcomes

Accelerates GHG Reductions and Renewables

As described above, Peninsula Climate Comfort will demonstrate how to deliver quantifiable GHG reductions in a cost-effective manner via beneficial electrification of residential natural gas end uses. As documented in the attached Excel spreadsheet, Ardenna_Energy_Calcs, the Project will demonstrate the feasibility of reducing annual GHG emissions by 0.96 metric tons per furnace replacement and by 0.52 metric tons per water heater replacement.

Peninsula Climate Comfort will directly support PCE's procurement goal of acquiring 100 percent renewable energy by 2025. Each new heat pump will add 1,477 KWh per year and each new heat pump water heater will add 584 KWh per year. By scheduling this new load to be coincident with renewable power availability, Peninsula Climate Comfort will improve the economics of acquiring renewable energy.

Installed heat pumps and heat pump water heaters will be equipped with Internet-enabled controls to enable flexible scheduling. This feature exploits the inherent thermal energy storage capabilities of both technologies to schedule loads during daytime hours when renewable power is plentiful (see for example, the following renewables trend graph from CAISO for July 30, 2018).



Delivers Community Benefits

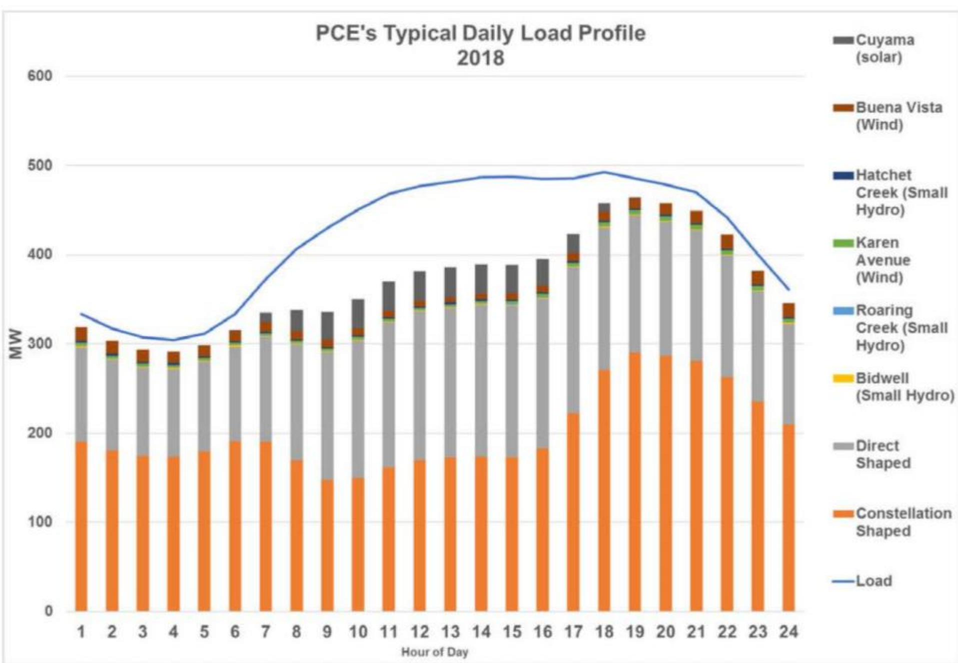
Beneficial electrification of residential natural gas end uses is expected to deliver an array of local community benefits.

- Reduce transaction costs for customers and contractors by identifying the biggest barriers to electrification and developing standardized solutions
- Show how innovative financing solutions can increase market share for high performance technologies and further reduce costs.
- Improve indoor air quality in homes by eliminating carbon monoxide hazards and avoiding NO_x and SO_x emissions
- Enable the eventual abandonment of natural gas distribution infrastructure, which would eliminate methane leaks, natural gas-fueled fires, and catastrophic explosions

A key objective of Peninsula Climate Comfort is to improve the economics of electrification to reduce customers' overall costs of procuring vital energy services. Pilot study recommendations will include tariff and financing solutions to bring residential electrification within reach of all economic strata, including low-income households and renters. A successful, full-scale beneficial electrification program will also spur local economic activity and expand local workforce opportunities by stimulating approximately 14,500 furnace and water heater replacements per year in the San Mateo County.

Supports PCE's Load Serving Needs

PCE currently meets the bulk of its load balancing needs via its contracts with Constellation and Direct Energy, as shown in the figure 4 of PCE's 2018 Integrated Resource Plan. These contracts include unspecified system power, which will need to be replaced with renewable power to meet PCE's renewable procurement goals.



With proper project design and flexible scheduling, heat pumps and heat pump water heaters can be used to shift the customer's load from peak periods (morning and evening) to off-peak periods (late evening/early morning and afternoon). Peninsula Climate Comfort will determine the optimum scheduling strategy to minimize customer operating costs and miminize PCE dependence on unspecified system power.

Residential electrification is also expected to contribute to PCE's procurement goals by improving the economics of meeting its Resource Adequacy obligations. By adding load during daytime hours, electrification will reduce the evening ramp up and the associated reserve capacity required to service extreme demand periods.

Additional Benefits

Peninsula Climate Comfort puts PCE at the forefront of developing a scalable and replicable residential electrification strategy. Residential electrification has been recognized as a policy and program priority by CCEs and local governments throughout the Bay Area. For example,

- Sonoma Clean Power has made electrification a top priority by developing innovative programs to incentivize customers to buy electric vehicles and convert to heat pump hot water heaters
- Stopwaste and City of Palo Alto Utilities recently teamed up on a successful proposal to Bay Area Air Quality Management District for a mid-stream program to incentivize distributors to stock heat pumps and promote them through their contractor networks
- Both City of Palo Alto Utilities and Sacramento Municipal Utilities District offer customer incentives for conversion to heat pump water heaters and, in SMUD's case, heat pump space heating and cooling.
- As part of Pacific Gas and Electric Company's (PG&E) Assembly Bill 2868 proposal, PG&E proposes a behind-the-meter (BTM) thermal storage program with a goal to reduce peak load by up to 5 megawatts (MW) by 2025 using smart electric water heaters and/or smart control devices.

Eearly results from these forays into residential electrification indicate that much work remains to be done to remove customer market barriers to widespread adoption. PCE's investment in this arena is both timely and needed.

PCE Implementation Requirements

PCE should support the project in the following ways:

- Facilitate introductions to prospective local government partners
- Include Project announcements with other customer communications
- Mail invitation letters on PCE letterhead to customers that PCE and Project Team jointly identify as good prospects
- Share energy procurement cost and related information required to assess financial impacts of electrification scenarios from CCE perspective
- Review and comment on CCE cost of service analysis

These functions are expected to dovetail with PCE's pre-existing communication and outreach activities. They also align neatly with PCE's core competencies of customer care, program design, energy portfolio procurement and management, resource planning and analysis.

The Peninsula Climate Comfort Pilot does not require any external policy changes for pilot program implementation. Pilot study results are expected to identify policy changes needed to facilitate full-scale deployment of a residential electrification program, including incentives and financing mechanisms that align with expected reductions in PCE's cost of service and tariffed on-bill financing to bridge tenant-landlord split incentives and facilitate MESA payments.

Qualifications

Bruce Mast, Principal, Ardenna Energy, LLC. Mr. Mast is a nationally recognized thought leader on residential green building, with more than 27 years of experience in the field. In 2018, he founded Ardenna Energy, a clean energy consulting practice focused on bringing residential energy efficiency, electrification, and storage technologies to market. Mr. Mast is particularly passionate about helping consumers navigate the electrification landscape, based on his own experience converting his 1923 bungalow to electric space heating and water heating.

In 2004, Mr. Mast co-founded Build It Green, an industry-leading green building non-profit organization. Mr. Mast's many accomplishments at BIG include his pioneering work to develop a performance-based residential energy efficiency practice, design and launch of the GreenPoint Rated certification system, and launching PG&E's Home Upgrade rebate program. He has authored and published numerous reports and studies on market transformation, energy efficiency best practices, and incentive program evaluation.

Tom Kabat, Consultant to Western Area Power Administration. As an environmental engineer with more 35 years in the municipal electric and gas utility field, Mr. Kabat brings strong analytical skills and experience in the areas of electric resource optimization, renewable energy procurement, utility resource planning, design thinking, solar thermal system design, solar electric systems, energy efficiency design, integrated resource planning, sustainability, and product design. Since retiring from full-time employment, Mr. Kabat has consulted with cities, utilities, community choice energy agencies and the DOE to advance their energy and climate goals. Mr. Kabat is a board member of SunWork.org and Carbon Free Silicon Valley as well as an environmental quality commissioner for City of Menlo Park. He has participated in the installations of dozens of solar systems, three heat pump water heaters, three EV chargers and a mini-split heat pump.

Amy Dryden, Director of Policy and Technical Innovation, Build It Green. Ms. Dryden serves as BIG's chief building scientist and researcher. As a nationally recognized thought leader on green and low-carbon building, Ms. Dryden brings more than 18 years of leadership experience in the industry. She has led the development of GreenPoint Rated for existing homes and multifamily energy efficiency program and currently leads a CEC-funded multifamily net zero energy project. Before joining BIG in 2007, Ms. Dryden initiated green building standards for two affordable housing developers, changing the way they build homes. Ms. Dryden holds a Masters in City Planning and a Masters in Landscape Architecture / Environmental Planning from UC Berkeley College of Environmental Design.

Torsten Glidden, Senior Manager, Build It Green. Mr. Glidden brings over 15 years of experience in research, analysis, construction and project management, with more than five years of leadership experience in program management and implementation. He also draws on his on-site construction experience to help train and mentor contractors and raters. Before joining Build It Green in 2011, Mr. Glidden served as Owner and President of TJ Glidden Company, Inc. in San Francisco, a 15-employee general construction company in San Francisco. He is a licensed General Contractor, Certified Sustainable Building Advisor, BPI Building Analyst (Single- and Multi-family), and GreenPoint Rater, and is trained in Home Performance with ENERGY STAR and HERS.

Steve Schmidt, Founder and COO, Home Energy Analytics. Mr. Schmidt is an entrepreneur with a three-decade track record in the software industry. Along the way, he has developed specialties in software business issues and small/virtual business administration, GHG inventories, residential demand analysis and energy efficiency, electronic design automation, software project management, and electric vehicles. Since 2008, he has focused on residential energy efficiency tools, services, and initiatives motivated by greenhouse gas emission reductions. He and his wife, Lisa, founded Home Energy Analytics, an online service to help residents, municipalities, utilities, and home performance contractors identify and reduce wasted energy, water, and greenhouse gas emissions.

Evaluation

The Peninsula Climate Comfort Pilot workplan incorporates the full set of reporting, quality assurance / quality control, and M&V activities to demonstrate Pilot success relative to the following Key Performance Indicators:

- Complete feasibility studies for five case study homes
- Supervise electrification retrofits and document the results for at least three case study homes
- Show metered changes in natural gas and electricity consumption from electrification within ±10 percent of forecast
- Quantify actual GHG reductions, derived from changes in metered gas and electric energy consumption
- Customer satisfaction: for all completed case studies, score 9 or 10 on the question "Considering your complete experience with heat pump conversion, how likely would you be on a scale of 1 to 10 to recommend heat pump conversion to a friend or colleague?"
- Develop recommendations for technical solutions, model incentive structures, and model tariffs that, if fully implemented by PCE, would render residential electrification cost effective for at least one end use for at least 50 percent of PCE single-family home owners.

Metrics and Assumptions

GHG reduction calculations are fully documented in the attached Excel file, Ardenna_Energy_Calcs. For impact estimation purposes, it assumes that at least three of the five case study projects will move forward with hot water heater replacement and three will move forward with furnace replacement (but not necessarily the same three). Calculations are shown on a per-appliance basis, for the cohort of case study participants, for a full-scale county-wide program, and for full 100 percent conversion of all owner-occupied residential water heaters and furnaces in San Mateo County. These benefits could be further increased by developing a Tariffed On-Bill solution or other mechanism for making electrification financially feasible for rental properties.

GHG reductions are calculated only for hot water heater and furnace replacement because electrification of these end uses is the primary research focus of this Project. That said, the five feasibility studies will investigate opportunities to improve electrification economics by bundling it with energy efficiency, PV installation, EV charger installation, and/or battery storage. These solutions are expected to further extend the GHG reduction benefits of electrification and will be fully analyzed as part of the feasibility studies.

A central focus of Peninsula Climate Comfort will be to determine how electrification costs and benefits can be optimized to make retrofit solutions cost-effective. An expected outcome of the Project will be a set of recommendations for an electrification tariff that improves the economics of retrofitting while improving the financial performance of PCE's renewable power portfolio.

Ardenna Energy, LLC
Peninsula Climate Comfort
Aug. 3, 2018
Community Pilots

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	Requested from PCE	$75,000	$75,000	88%	Requested
Income #2	HEA in-kind M&V services	$10,000	$10,000	12%	
Income #3			$0	0%	
Income #4			$0	0%	
Income #5			$0	0%	
Income #6			$0	0%	
Income #7			$0	0%	
Income #8			$0	0%	
Income #9			$0	0%	
Income #10			$0	0%	
	Total	**$85,000**	**$85,000**		

REVENUE SUMMARY		
Total Requested	**$75,000**	100%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$75,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Customer incentives for electrification	$10,000	$10,000	12%	0
Expense #4	Ardenna Energy: 100 hours @ $175	$17,500	$17,500	21%	0
Expense #2	Build It Green: design assistance and cost estimation, 160 hours @ $125	$20,000	$20,000	24%	0
Expense #3	Tom Kabat: Technical Assistance, 100 hours @ $150	$15,000	$15,000	18%	0
Expense #5	Mailing list acquisition @ $0.12/address	$600	$600	1%	0
Expense #6	Direct Mail Marketing, including printing and postage	$10,000	$10,000	12%	0
Expense #7	Travel	$500	$500	1%	0
Expense #8	Program website	$1,400	$1,400	2%	0
Expense #9	HEA: M&V platform and analytics (SAAS)	$10,000	$10,000	12%	0
Expense #10			$0	0%	0
TOTAL PROPOSAL EXPENSES		**$85,000**	**$85,000**	**100%**	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Number of customer mailed to	5000	
Number of customers who prequal	100	2%
Number of pilot projects	5	5%
Customer incentive per project	2000	
Contractor fees per project	1500	

	A	B	C	D	E
1	**Metric**	**Count**	**Units**	**Comment**	**Reference**
2	**Peninsula Climate Comfort Direct Impacts**				
3	Number of case studies	5	homes		
4	Number of heat pumps installed	3	systems		
5	Number of heat pump water heaters installed	3	systems		
6	Conversion: 1 therm =	29.30	KWh		
7	PCE electricity emissions factor	-	Mt CO2e / KWh		
8	Gas emissions factor	0.0053	Mt CO2e / Therm		
9					
10	**GHG Avoided from Converting Natural Gas Furnace to Heat Pump**				
11	Natural gas furnace input unit energy consumption	180.5	Therms / year	2228 Mtherms /12.345 million households	per PCE data from CEC
12	Natural gas furnace baseline efficiency	0.81	AFUE	Minimum code requirement	https://energycodeace.com/download/14962/file_path/fieldList/2016MiniEfficiencies-0529
13	Space heating output (Therms)	146.21	Therms / year	UEC * EF	
14	Space heating output (KWh)	4,283.95	KWh / year	Assume constant heating load (no energy efficiency improvements to building shell or distribution system)	
15	Heat Pump efficiency	2.9	COP	Conservative lower bound for HPWH efficiencies for multiple manufacturers and models @ CEE Tier 3	https://www.ahridirectory.org
16	Heat Pump input unit energy consumption	1,477.2	KWh / year	Assume no change in cooling load or cooling energy consumption	
17	Baseline emissions (furnace)	0.9567	Mt CO2e / year		
18	Project emissions (heat pump)	-	Mt CO2e / year		
19	**GHG Avoided Emissions-Heat Pump**	0.9567	Mt CO2e / year		
20					
21	**GHG Avoided from Converting Natural Gas Water Heater to Heat Pump Water Heater**				
22	Natural gas hot water heater input unit energy consumption	97	Therms / year	1200 Mtherms /12.345 million households	per PCE data from CEC
23	Natural gas hot water heater baseline efficiency	0.615	EF	Minimum code requirement for 40 gal. tank	https://energycodeace.com/download/15283/file_path/fieldList/FactSheet.Res-DHW.2016-
24	Water heating output (Therms)	59.78	Therms / year	UEC * EF	
25	Water heating output (KWh)	1,751.56	KWh / year	Assume constant heating load (no energy efficiency improvements to building shell or distribution system)	
26	Heat Pump Water Heater efficiency	3.0	COP	Conservative lower bound for HPWH efficiencies for multiple manufacturers and models	http://www.passivehousecal.org/sites/default/files/media/1_PHCA-%20HPWH%20Worksho
27	Heat Pump Water Heater input unit energy consumption	583.9	KWh / year		
28	Baseline emissions (NG water heater)	0.5152	Mt CO2e / year		
29	Project emissions (heat pump water heater)	-	Mt CO2e / year		
30	**GHG Avoided Emissions-Heat Pump Water Heater**	0.5152	Mt CO2e / year		
31					
32	**Total Annual GHG Avoided-Direct Pilot Impacts**	**4.42**	Mt CO2e / year		
33					
34	**Peninsula Climate Comfort Indirect Impacts**				
35	Number of owner-occupied housing units in San Mateo County	154,344	Number of homes		US Census: 2016 American Community Survey, Table DP04
36	Percentage of occupied housing units in San Mateo County with utility gas heating fuel	78.4%			US Census: 2016 American Community Survey, Table DP04
37	Percentage of owner-occupied housing units in PG&E territory with natural gas water heating	79.3%			2010 Residential Appliance Saturation Survey: PG&E Banner Tables, Table PRWHFUEL
38	Number of natural gas water heaters in San Mateo County	122,395			
39	Est. number of owner-occupied homes with natural furnaces in San Mateo County	121,006			
40	Replace 7% of NG water heaters per year	8,568		Required replacement rate (13-year average life) for 100% conversion before 2030 (requires 100% capture of expiring water heater opportunities)	BE Smart: Proposed Program Design for Beneficial Electrification of Buildings, prepared by Carbon Free Palo Alto
41	Replace 5% of NG furnaces per year	6,050		Required replacement rate (20-year average life) for 100% conversion before 2037 (requires 100% capture of expiring water heater opportunities)	BE Smart: Proposed Program Design for Beneficial Electrification of Buildings, prepared by Carbon Free Palo Alto
42	**Total Incremental Annual GHG Avoided-Residential Electrification at Scale**	**10,201.71**	**Mt CO2e / year**		
43					
44	**Annual GHG Avoided at 100% Residential Electrification**	**178,813.00**	**Mt CO2e / year**		

Healthy Home Connect

A Community Pilot Proposal to Peninsula Clean Energy in Partnership with El Concilio of San Mateo County & Hayward Score

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Ericka Mackie, Chief Executive Officer, GRID Alternatives
Michael D'Esposito, Project Manager, Owens Corning

Description of the Project

Summary: The Opportunity for Peninsula Clean Energy

Peninsula Clean Energy (PCE) has a unique opportunity to invest in San Mateo County's low-income communities in a way that will help achieve its climate action goals—and help struggling families to thrive in healthier homes. The Healthy Home Connect pilot program, developed and administered by Build It Green and its partners, will deliver upgrades to up to 16 low-income homes in East Palo Alto and Daly City that would otherwise be disqualified from housing assistance programs. Thanks to $75,000 in PCE gap funding, homes will receive healthy home remediations and roof repairs/replacements, allowing these formerly disqualified homes to then receive energy efficiency improvements and demand response ready technologies via complementary public programs which have historically been disconnected. The Program will smartly leverage PCE funds with existing corporate philanthropy, utility weatherization and solar programs, plus Hayward Score[1], a breakthrough technology to assess and improve the health of any home.

The result will be homes that are:

- Safer and healthier, with improvements that mitigate indoor air quality issues that exacerbate asthma and other medical conditions
- More affordable, with lower utility bills that will help stabilize the finances of low-income families and prevent displacement
- Demand-harmonizing and climate-friendly, contributing to lower greenhouse gas emissions and optimizing grid-delivered clean energy resources

In short, Healthy Home Connect can help PCE to simultaneously address the affordable housing crisis, the climate crisis, and the public health issues that affect thousands of individuals and families across the Peninsula's low-income neighborhoods. As a Community Choice Energy provider, PCE can play a unique and innovative role to implement combined health and energy programs that the investor-owned utilities are unable or unwilling to deliver.

The Funding Gap that Leaves San Mateo County Families Behind

Safe, affordable, and healthy housing is *foundational* to enabling quality of life for individuals and families, especially vulnerable populations and children. There is a clear relationship between housing and health: Sub-standard housing contributes to lifelong financial, emotional, and health challenges. At the same time, there is a strong link between health and energy efficiency in homes: energy upgrades often provide health co-benefits. But existing utility and state low-income weatherization programs don't fund or integrate healthy home education or interventions.

Instead, these programs leave tremendous numbers of people behind. This is because funds can only be spent on energy efficiency (or rooftop solar) measures and not on the pre-existing home conditions or deferred maintenance that prevent such measures from being installed in the first place. For example, the need for major roof repairs or replacements has disqualified 75% of eligible participants from receiving free solar PV via the State of California's Low-Income Weatherization Program (LIWP), which Build It Green administers. Likewise, mold, major pest infestations, moisture, water leaks, poor or non-existent mechanical ventilation, outdoor air pollution, and other problems not only exacerbate asthma, but again disqualify homes from receiving energy upgrades.

[1] www.haywardscore.com

The families most in need of energy efficiency savings and lower energy bills may also be the ones least likely to obtain this relief due to this gap in funding.

Build It Green has seen this scenario play out repeatedly, through our experience administering LIWP in the Bay Area and Los Angeles County. Working in East Palo Alto and Daly City, BIG, El Concilio and GRID Alternatives are unable to help countless disqualified families with our programs.

Smart Leveraging of Existing Programs and Funds

Through the unique approach of BIG's Healthy Home Connect pilot program, we can leverage significant public and private funding to bridge these funding gaps and deliver comprehensive home improvements that address both clean energy and health in San Mateo's disadvantaged communities.

With $75,000 in funding from PCE for Phase 1, we can assess homes for health issues—using Hayward Score's innovative home assessment survey (see below for details)—and provide roof repairs and health and safety remediation for up to 16 low-income homes in San Mateo's disadvantaged communities of East Palo Alto and Daly City. PCE funding will thus enabling these homes to participate in other low-income housing assistance programs. In addition, BIG will refer and enroll eligible residents in PCE's upcoming EV/Clean Vehicle Assistance Program.

PCE's investment will allow BIG to achieve the following goals:

Community Pilot Investment in East Palo Alto & Daly City	Homes Served w/ Roofing Repairs & Replacements*	Homes Served w/ Healthy Home Interventions*
$75,000	**6-8**	**10**

**Assumes approximately $6K on average for roofing repairs or replacement using discounted products from partner Owens-Corning; $3.5K on avg. for major home health interventions; a split of 60% to roofing repairs or replacements and 40% towards healthy home interventions (unleveraged) plus various administrative and other expenses. Actual remediation costs may vary.*

Healthy Home Assessments with Hayward Score

A key to the Program's success will be the use of Hayward Score to identify unhealthy conditions in low-income homes. This patent-pending web-enabled tool, built by the best minds in the healthy homes industry over the past three years, provides an easy to use, customer-centric, self-reporting mechanism by which an individual can answer a series of approximately 30-45 questions in less than 10 minutes and receive both a score (on a scale of 1-100) and a set of recommendations (ranging from the simple and free to the expensive and complex) outlining steps to improve the health and safety of their home. Hayward Score's targeted survey questions and refined algorithms typically achieve the same level of accuracy as expensive indoor air quality testing, which most residents cannot afford.

Replicating a Pilot Program with Ability to Scale Statewide

PCE has the opportunity to expand an innovative and proven program model that can scale statewide. BIG, El Concilio and Hayward Score are currently operating a similar project in San Mateo County in the low-income community of Belle Haven, via funding from Facebook. Our team has the experience and capacity to work in East Palo Alto and Daly City initially, and then move to other low-income communities within San Mateo with remaining funds and/or future work scopes.

Through this pilot phase of the program, BIG and PCE will provide proof of concept to an approach with potential to scale up and encompass more communities in San Mateo County and beyond. In order to harmonize with existing and future PCE programs, our recommendations and measure selection will be directed toward demand response and load-shifting technologies to optimize the GHG reducing potential of customers who utilize renewable procurement.

Program Steps and Activities

To accomplish our goals in East Palo Alto and Daly City, we will pursue the following activities:

1. **Screening & Outreach:**
   a. The *Promotores* (community outreach specialists) of El Concilio will identify and screen program participants via the following criteria:
      - Qualified for LIWP and/or ESA through location and income criteria – 80% area median income; 60% state median income
      - Homeowner(s)
      - Home has been red-tagged due to safety issues
      - Home characteristics are good for solar and homeowner is qualified to participate in a low-income solar program (LIWP or SASH), but roofing repairs are a major barrier to installation
      - Analysis generated by Hayward Score indicates significant health risk
      - Families or individuals living in the home who are more likely to be impacted by the low score are: the elderly and disabled, children, and those with asthma, allergies or other medical conditions.
      - We will also work with GRID Alternatives to identify homes in our target neighborhoods that already qualified for solar under their programs, but that could not be serviced due to deferred roofing and maintenance work.

   b. *Promotores* from El Concilio will outreach by phone to approximately 75-80 residents.
   c. Of those, approximately 35 will qualify for services and meet with a *Promotore* to receive a Hayward Score.
   d. Of those, 10 or more will actually commit to and receive the services offered.
   e. Up to 23 residents will be referred to PCE's Clean Vehicle Assistance Program.
   f. *Promotores* will maintain the connection with the homeowner so as to follow up in three- and/or six-month intervals and encourage the participant(s) to retake the Hayward Score, post-remediation work, to demonstrate improvement.

2. **Remediation Packages:** We have analyzed the current East Palo Alto and Daly City housing stock and have developed an initial set of "packages" that will be available through the program. By getting their Hayward Score and report, homeowners will be educated and empowered to work with the team to make the best choices for health and energy efficiency. Packages will be selected with homeowner input in consideration of the recommendations made in the report, and a maximum budget allocation including all leveraged funding sources. One or more packages may be selected, and all will be screened for the Solar PV package offered through the LIWP program currently administered by Build It Green.

Package	Key Element
Basic Health and Comfort	Seal Garage/House Connection
	Combustion Appliance Diagnostic & Repair
	Dryer Ventilation Correction
	Natural Gas Leak Repairs (minor)
	Other Minor Repairs
	Air Seal House
	HRV/ERV
	External Storage Shed
High Risk	Lead, Asbestos, Radon, Gas Line, Structural Assessment
	Lead Remediation
	Asbestos Remediation
	Radon Remediation
	Gas Leak Remediation (possible co-funding)
	Structural Repair
Roofing and Solar	Roof Assessment
	Roof Repair/Replacement
	Solar Photovoltaics (PV) – provided by other program(s)
	Solar Hot Water Heater – provided by other program (s)
Asthma, COPD, other Chronic Illness	Air/Soil Seal Crawlspace
	Provide HEPA Vacuum
	Remove/Replace Carpeting for hard surface flooring
	Add/improve Kitchen Ventilation
	Deep clean, un-clutter, and organize the home
Outdoor Pollution (if <1000 ft. from Highway)	Add Carbon Filtration to HRV/ERV
Mold Remediation	Complete Mold Remediation

3. **Training:** El Concilio's *Promotores* and weatherization contractors have already been fully trained to deliver this program, via previous funding from Facebook. Hayward Score and BIG have already developed a one-day course for existing and future *Promotores*, and a two-day course for weatherization contractors, to familiarize them with how & why to use Hayward Score and how to present its findings to homeowners. Course materials include:
    a. Effective data capture for the Hayward Score via an iPad, home computer or mobile device
    b. Familiarity with and discussion of how to present the findings to homeowners
    c. Familiarity with and discussion of the available remediation packages w/ homeowners
    d. Familiarity with and ability to refer homeowners to additional resources
    e. Clear understanding of what work on the home will do (enable solar install after roofing repairs, reduce asthma triggers in the home) and what it will not do (cure asthma, eliminate all future home problems, fix all problems in the home, etc.)

f. Any/all contractors providing services to the program will be vetted to ensure adherence to best practices, with randomized site inspections to confirm compliance.

4. **Leverage Existing Funding, Donors & Partners**: To maximize our impact and serve as many homes as comprehensively as possible, we will leverage other funding sources available from federal, state and local programs, including but not limited to:
    a. LIWP (Low-Income Weatherization Program) – administered by Build It Green, delivered by El Concilio – up to $15,000 per home
    b. ESA (Energy Savings Assistance) – delivered by El Concilio – up to $3,500 per home
    c. Peninsula Small Home Repair – up to $3,500 per home – delivered by El Concilio
    d. Solar LIWP – managed by Build It Green, delivered by GRID and Tesla – up to $10,000 per home
    e. Single-family Affordable Solar Homes Program (SASH) – rebates for low-income homeowners to defray the cost of solar PV, managed and delivered by GRID
    f. Area HUD Lead Hazard & Healthy Homes programs – delivered by El Concilio

    The energy efficiency packages for this pilot will leverage dollars and opportunities under existing program designs. But BIG's approach can also evolve and expand to support electrification and renewable utilization through time of use controls whenever possible. By removing and reducing combustion appliances in homes and utilizing renewable resources, this program will address health impacts from fossil fuels and help to ensure greater loads will be offset by renewable energy.

5. **Installation:** Restoration work will be installed in qualifying homes by the following specialist teams:
    a. El Concilio for energy efficiency, HVAC, small home repair, lead hazards, asbestos removal (subcontracted) and work scope coordination
    b. GRID and/or Tesla for solar installation & servicing
    c. Owens Corning qualified roofing contractors for roofing repairs and replacements
    d. ServPro, Service Master or other qualified group for major mold remediation work

6. **Field QC:** BIG will provide randomized field quality control services to the program to ensure remediation measures are appropriately installed.

Populations We Will Serve

In the disadvantaged communities of East Palo Alto and Daly City, we will initially serve low-income residents that own and reside in single-family homes. These neighborhoods are undergoing rapid and asymmetric transition, with a current population of approximately 60% Latino, 14% African American, and 12% Asian/Pacific Islander. Approximately 30-40% of the low-income population in this neighborhood does not speak English, 60% are homeowners, more than 50% are elderly, and 23.9% lives under the federal poverty level. With the recent changes to the building codes, El Concilio has also reported an increase in red tagging of low-income homes, both rented and owned, resulting in forced and immediate evictions due to safety hazards.

In East Palo Alto, a lack of affordable and safe housing impacts the health and stability of countless low-income families. More than 23% of households in East Palo Alto experience overcrowding conditions, and 67% spend at least one-third of their income on housing (32%

spend at least half!) [2]. Many low-income residents can only afford to live in homes with unsafe conditions like mold, lead, or other health hazards. Building code changes are triggering more of these homes to be "red tagged" because of these and other safety hazards, resulting in forced and immediate evictions[3].

Asthma is a particular challenge. Nationwide, 40% percent of asthma episodes are caused by housing-based triggers like mold and dust[4]. In East Palo Alto, asthma is a major problem: For children ages 0-17, asthma hospitalizations and ER visits are nearly three times higher than the County-wide average[5]. For these reasons, creating healthier housing conditions is a key priority for Get Healthy San Mateo County, a collaboration of city and county governments, schools, and hospitals[6]. But a major funding gap prevents meaningful progress.

Outcomes

We will achieve the following outcomes as the result of our work:

1. In San Mateo's disadvantaged communities of East Palo Alto and Daly City, we will improve immediately the health, clean energy generation, and affordability of up to 16 low-income single-family residential homes:
    a) 6 or more of these to receive new or repaired roofing via PCE funding, enabling the subsequent installation of free rooftop solar systems; and
    b) 10 will receive home health interventions via PCE funding to improve the indoor air quality within the home;
    c) Up to 35 homes will receive a Hayward Score and a set of recommendations that identify and provide do-it-yourself opportunities for residents to improve the health of their homes
    d) All homes will be served by either LIWP, ESA, SASH and/or Peninsula Small Home Repair, leveraging additional funding from these other programs

2. We will quantifiably reduce energy use and greenhouse gas emissions in these homes via energy efficiency measures and renewable optimization installed via multiple programs.

3. We will deliver quantifiable community benefits by improving home health conditions that exacerbate asthma and other chronic illnesses, as well as reducing energy bills and making housing more affordable, repairing and improving dilapidated housing stock to increase property values and reduce evictions and displacement.

4. We will support PCE's load-serving needs by marketing and enrolling customers for its upcoming Clean Vehicle Assistance program to the community members we will serve.

5. We will provide many additional desired benefits such as improved community resilience in disadvantaged neighborhoods, deployment of cutting-edge technology, local workforce

[2] U.S. Census Bureau's 2010-2014 American Community Survey
[3] El Concilio of San Mateo County reporting, 2017
[4] Robert Wood Johnson Foundation Commission to Build A Healthier America. "Beyond Health Care: New Directions To A Healthier America Report." April 2009
[5] OSHPD 2010 Emergency Dept and Patient Discharge Databases
[6] Get Healthy San Mateo County Strategic Plan: Strategies for Building Healthy, Equitable Communities 2015–2020.

development, consumer energy and health education, innovative and scalable program design, and funding for program gaps very apparent in the region.

Alignment with PCE Goals and Priorities

The proposal outlined below satisfies a number of PCE's key criteria, including:

1) Accelerates GHG reductions and renewables by enabling solar PV on low-income homes and energy retrofits funded by current state and IOU programs such as LIWP, ESA, and PSHR.

2) Delivers life-changing community benefits by reducing energy bills, improving home health conditions, and addressing deferred maintenance—protecting affordable housing especially targeted to those scoring high on the community vulnerability index in San Mateo County.

3) Supports PCE's load-serving needs by providing education, marketing, and enrollment for its forthcoming Clean Vehicle Assistance Program targeting the same population group.

4) Builds local workforce capacity and complies with PCE's Sustainable Workforce Policy.

5) Provides many additional desired benefits such as improved community resilience in disadvantaged neighborhoods by embedding distributed energy resources, deployment of time-of-use technologies, consumer energy and health education, through innovative and scalable program design.

6) Through the retrofit scopes of work, BIG will be evaluating the opportunity for transportation and residential electrification including the deployment of heat pump water heaters for shifting loads to high renewable production periods. These opportunities will be identified in recommendations for an expansion of this pilot.

7) Allows PCE to play a unique role in addressing a persistent funding gap and delivering programs that investor-owned utilities cannot or will not implement.

8) Expands a proven program model that has the ability to scale County-wide and statewide. Contractors will be supplied innovative tools that streamline overlapping program complexities, effectively facilitating deeper retrofits and grid harmonizing technologies.

PCE Implementation Requirements

The Program will require minimal administration and oversight from PCE (10% of an FTE's time) and is thus easily executed with current staffing levels.

Qualifications

BIG, El Concilio, and our partners are uniquely positioned to execute this project. We have decades of collective knowledge of direct install energy efficiency programs, green building science and home health science, together with the infrastructure and capabilities to administer large-scale energy efficiency programs and the local workforce to execute. In addition, our team has the demonstrated commitment to serve San Mateo's communities most in need with holistic, sustainable, and healthy home solutions. Detailed resumes can be provided.

Build It Green

Build It Green (BIG) is a 501c3 nonprofit and certified woman-owned business whose mission is to help create healthy and sustainable homes for *all* people. We are thought leaders and building industry veterans who share a vision for better buildings and a diligence for getting results. We are nationally known for our green building expertise and our innovative approach to administering large-scale energy efficiency and green building programs for utilities like PG&E, local governments like Los Angeles County, and state agencies like the California Department of Community Services & Development. In 2016 alone, BIG's programs touched approximately 34,000 homes, saving 18 million kilowatt hours of electricity and preventing 21,000 metric tons of carbon emissions.

BIG's role will be to manage and design the Healthy Home Connect program, coordinate the partners, manage the contractor training, and facilitate the leveraged funding opportunities.

Hayward Score

Founded in Monterey in 2012 by the CEO of Hayward Lumber, Hayward Score provides the foundation upon which this end-to-end community service will be built. Hayward Score is willing to provide its tool as an in-kind contribution to this program for use by El Concilio's *Promotores*, including a version already translated into Spanish. They are further willing to capture and analyze the data coming in to the database from the scores to identify any patterns or health hot spots that may emerge from the data which may be of interest to local health officials and/or anti-poverty agencies in San Mateo county. Hayward will provide supplemental training on how to best use the Hayward Score as needed and on-site mentoring. To date, over 15,000 homes have been given a Hayward Score nationwide.

El Concilio of San Mateo County

Founded in 1980, El Concilio of San Mateo County is a 501c3 community organization committed to increasing education, employment and access to quality of life services for underserved communities of San Mateo County. They provide services that enhance the community health and safety net, energy efficiency, consumer awareness and protection, energy education and employment services. In Belle Haven, El Concilio operates the Peninsula Small Home Repair Program, the PG&E Energy Savings Assistance Program, and works closely with the Ravenswood Health Center serving both East Palo Alto and Belle Haven. El Concilio has 20 years of experience in direct-install residential programs.

El Concilio will engage members of the Daly City and East Palo Alto disadvantaged communities through its team of *Promotores*, deliver the Hayward Score surveys, and then perform the remediation work or find specialists as needed. Contact will be initiated through their existing staff of *Promotores,* who will be trained on the Hayward Score and sit with homeowners to walk them through the tool on an iPad in English or Spanish. They will then educate these homeowners about their home health score, the recommendations provided, and communicate these findings back to the team with recommendations for funding. El Concilio will then involve a specialized contractor team capable of doing the remediation work according to a suite of packages and leveraged funding opportunities across LIWP, ESA, and Peninsula Small Home Repair. Once remediation work is complete, El Concilio will refer them (or send them back) to GRID Alternatives so that they can install free rooftop solar PV on these same homes.

Owens Corning

Owens Corning (OC) is a global company that develops and produces insulation, roofing, flex duct, and fiberglass composites. They understand the inter-connectedness of home health as it relates to occupant health. OC will identify the best local roofers who can repair and/or replace roofs with their discounted products. OC will offer the program volume discounts on roofing and insulation materials, on HVAC materials, and may also donate materials to the program.

GRID Alternatives

GRID Alternatives is 501(c)(3) certified non-profit organization based in Oakland, California, with nine affiliate offices serving all of California, Colorado, Washington D.C., Virginia, Maryland and Delaware.

GRID Alternatives is a national leader in making clean, affordable solar power and solar jobs accessible to low-income communities and communities of color. GRID's vision: a successful transition to clean, renewable energy that includes everyone.

Statewide and in San Mateo County, GRID implements the Single-family Affordable Solar Homes Program (SASH), a ratepayer-funded program that provides no-cost solar to qualifying low-income families. GRID is also a primary solar installer for LIWP, administered by BIG. For Healthy Home Connect, GRID will install solar PV systems on homes that would otherwise have been disqualified due to pre-existing conditions. GRID will receive referrals from BIG and El Concilio after the homes have received necessary repairs and energy efficiency and health improvements.

Timing and Timeline

BIG believes the following is a reasonable timeline for this program, given that it can be layered into our existing LIWP program and/or PG&E's ESA program already operating in these areas and managed alongside our existing Healthy Homes program currently operating in Belle Haven:

1. October 2018: Kick-off, program set-up, coordination & confirmation of all partners & service providers, target list identification, delivery of any additional training to new crews
2. November 2018: *Promotores* begin outreach and participant identification and qualification; Hayward Score collection, EV Program marketing and lead generation
3. November 2018–March 2019: Installation of deferred maintenance and home health measures
4. April-May 2019: Final services completion, participant interviews, and project close-outs
5. June 2019: Final reporting

Evaluation

BIG will track and report and following key performance indicators to evaluate success:

- Outreach calls & touches and conversion rates
- Ineligible homes or homes untreated
- Hayward Scores delivered
- Total homes treated
- Roofs repaired or replaced
- Health measures delivered
- Energy efficiency measures delivered
- Solar PV installations
- GHGs reduced
- kWh, therms and kW saved
- PCE funds spent
- Leveraged program funds spent
- Total dollars per home
- Referrals to EV Assistance Program

We will follow up with program participants between three and six months, interviewing residents to document and communicate impacts, and to encourage them to retake their Hayward Score to demonstrate baseline improvements. Build It Green will also survey residents to gain insight to self-reported health conditions and symptoms pre and post retrofit work.

PCE will receive from BIG a monthly report on KPIs. We would also provide a monthly or bi-monthly work scope presentation to inform PCE of our findings in the community, specific work plans for the selected batch of homes, and funds we will leverage from other sources. Depending upon PCE's marketing team's interest, we would further aim to work with PCE as desired to help communicate to its constituents the positive results of this program and how it has improved lives, homes, financial stability, and hope for a brighter future for the participating residents.

Metrics and Assumptions

This pilot will include metrics on energy savings and GHG reductions as well as non-energy benefits demonstrating alignment in healthy and efficient homes. As described above, BIG will track metrics to evaluate program performance, participation rates and eligibility, home conditions, and renewable and energy efficiency installations. This will allow BIG to evaluate program design, accessibility and scalability. For this pilot, BIG will track the GHG reductions associated with the home improvements as well as self-reported health improvements. These factors will result in a cost/GHG metric for the program. The table below demonstrates conservative metrics for PCE dollars invested and assumptions for investment.

Metric	Count	Unit	Reference
GHG emission - therms	0.005269	Mtons CO2e	CCAR General Reporting Protocol, Version 2.2 (March 2007). Addendum to Table C.5 distributed June 2007.
GHG emission - kWh	0.000644	Mtons CO2/kWh	Based on 0.142 lbs of CO2e/kWh Ecoplus emission factor for 2017. Using 0.000453592 conversion lbs to metric tons
Energy upgrades	10	Homes	
Average therm savings/home	195	Therms	Average therm savings per home based on mix of LIWP measures appropriate for climate zones 3 and 4
Average kWh savings/ home	922	kWh	Average kWh savings per home based on mix of LIWP measures appropriate for climate zones 3 and 4.
GHG savings per home	1.6	Mtons/ CO2e	This is estimated savings per home
GHG reductions from energy efficiency	16.2	Mtons/ CO2e	Estimated savings for 10 homes
Roof repairs and Solar Install	6	Homes	6 of the homes need roof repair to support solar installation
Healthy Homes Assessments	35	Homes	35 homes will receive a Hayward Score
Healthy Homes Upgrades	10	Homes	All 10 homes will receive a level of improvements for healthy homes
Average system size	2.75	kW	
Emission offsets for PV	0.000468741	Mtons/ CO2 per watt	CARB GHG reductions
GHG reductions - Solar	7.7342265	Mtons/ CO2e	
EV Referral	Up to 23	Homes	Assume 66% will be eligible for EV program referral
Reduction of Occupant health costs	$1.00	Savings per home	This is TBD. Through the survey BIG will identify occupant self-reported health cost savings associated with improvements to the homes.
Assessment and Installation Costs	$53,500.00		This is accounts for PCE dollars covering assessment and health interventions and roof repairs for up to 35 homes.
GHG reduced	23.9	Mtons CO2e	Total GHG reductions with solar PV and EE measure installation
Dollar per GHG	$2234.03	$/MtonsCO2e	Assessment and installation costs covered in PCE budget minus health cost savings of occupants. We expect this effectiveness to increase with accounting of occupant benefits.
Scaled number of homes	1,669	Homes	10% of San Mateo low-income households
Average therm savings per home	427.5	Therms	Based on mix of LIWP measures appropriate for climate zone 3 and 4 and fuel switching for 50% of the homes.
Average kWh savings per home	174.5	kWh	Based on mix of LIWP measures appropriate for climate zone 3and 4 and fuel switching for 50% of the homes.
Scaled GHG reduction	3,945.69	Mtons CO2e	

Build It Green
Healthy Home Connect
Juy 31, 2018
Community Pilots

REVENUE SOURCE	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	PCE	$75,000	**$75,000**	24%	Requested
Income #2	LIWP Weatherization Assistance	$105,000	**$105,000**	34%	Received
Income #3	LIWP Solar PV	$52,800	**$52,800**	17%	Received
Income #4	ESA	$17,500	**$17,500**	6%	Requested
Income #5	Peninsula Small Home Repair	$35,000	**$35,000**	11%	Requested
Income #6	SASH	$18,000	**$18,000**	6%	Requested
Income #7	HUD Lead Hazard & Healhty Homes	$8,000	**$8,000**	3%	Requested
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$311,300**	**$311,300**		

REVENUE SUMMARY		
Total Requested	**$153,500**	49%
Total Pledged	**$0**	0%
Total Received	**$157,800**	51%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$311,300**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Staff Labor - Program Management ($95/hr, 192 hours)	$18,240	**$18,240**	6%	
Expense #2	Staff Labor - Program Support ($60/hr, 24 hours)	$1,440	**$1,440**	0%	
Expense #4	Staff Labor - Marketing & Outreach ($95/hr, 16 hours)	$1,520	**$1,520**	0%	
Expense #5	Travel Expenses	$300	**$300**	0%	
Expense #6	Home Assessments	$3,500	**$3,500**	1%	
Expense #7	Health Improvements	$14,000	**$14,000**	4%	
Expense #8	Roof Repairs	$36,000	**$36,000**	12%	
Expense #9	LIWP Weatherization Upgrades	$105,000	**$105,000**	34%	
Expense #10	LIWP Solar Installations	$52,800	**$52,800**	17%	
Expense #11	ESA Repairs	$17,500	**$17,500**	6%	
Expense #12	Peninsula Small Home Repairs	$35,000	**$35,000**	11%	
Expense #13	SASH Repairs	$18,000	**$18,000**	6%	
Expense #14	HUD Lead Hazard & Healhty Homes Repairs	$8,000	**$8,000**	3%	
TOTAL PROPOSAL EXPENSES		**$311,300**	**$311,300**	**100%**	

Net Income - Expenses		-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

GHG Emissions Reduction and Cost Effectiveness: References for Calculating Energy End-Use, Electricity Demand, and GHG Emissions Build It Green PCE Proposal

The following document was developed by the California Energy Commission for use in developing emissions calculations.

Peninsula Clean Energy's GHG emissions factor for electricity is lower than that state average. The Emissions Factor for electricity in Table 5 has been modified to reflect PCE's cleaner electric power.

Emissions factors not covered in this document (motor fuels) may be found at the California Air Resources Board Emissions Factor Database: https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/cci_emissionfactordatabase.xlsx?_ga=2.200085870.1992283159.1529530734-504331174.1529443208

Additional factors are available at the EPA: https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf

***

The tables in this attachment provide a basis for applicants to estimate the potential impact and benefits associated with their proposals. Applicants must use these tables when estimating the proposed project's energy and peak demand savings and greenhouse gas (GHG) impacts, to the extent that the data apply to the proposed project. The tables characterize California's residential and commercial electricity market in terms of consumption and peak demand for major end use categories and a statewide GHG emissions factor.

Applicants must temper their market impact estimates with realistic assumptions about the timeframe for achieving market penetration as it relates to construction activity and the market connection challenges associated with all technology transfer efforts. Applicants must also discuss the potential for competing technologies, and account for them in their discussion of market impacts assumed for the proposed efforts.

A. Residential Data

The following tables have been assembled from source data used by the Energy Commission for assembling the **California Energy Demand 2006-2016 Residential Demand Forecast.** These standardized end-use data will provide the project evaluation committee with a common reference for comparing residential energy and demand savings estimates. The total number of homes used in the forecast was 12,345,233.

Table 1: Residential Peak Demand and Energy Consumption by End-Use

Residential Sector End Uses	Peak Demand*		Annual Energy	
	MW	% of Total MW	Total Energy (GWh/ Year)	% of Total Energy
Air Conditioning	12,660	50%	7,252	8%
Cooking	1,098	4%	2,888	3%
Dishwashers	502	2%	2,805	3%

GHG Emissions Reduction and Cost Effectiveness: References for Calculating Energy End-Use, Electricity Demand, and GHG Emissions
Build It Green PCE Proposal

Residential Sector End Uses	Peak Demand*		Annual Energy	
	MW	% of Total MW	Total Energy (GWh/ Year)	% of Total Energy
Domestic Hot Water	246	1%	1,691	2%
Dryers	805	3%	4,497	5%
Freezers	352	1%	2,251	2%
Misc (includes lighting)	4,955	20%	36,901	41%
Pools & Spas	1,151	5%	5,415	6%
Refrigerators	2,214	9%	15,218	17%
Space Heating	-	0%	3,662	4%
TVs	1,004	4%	6,409	7%
Washers	279	1%	1,658	2%
Waterbeds	-	0%	-	0%
Total	**25,266**	**100%**	**90,647**	**100%**

*Peak demand numbers are estimates based on load factor.

Table 2: Residential Gas Consumption by End-Use

End Use	Millions of Therms/Year	% of Total
Air Conditioning	52	1.0%
Cooking	304	5.7%
Dishwashers (water heating)	368	6.9%
Domestic Hot Water	1,200	22.5%
Dryers	166	3.1%
Miscellaneous	189	3.5%
Pools & Spas	287	5.4%
Space Heating	2,228	41.7%
Washers (water heating)	543	10.2%
Total	**5,336**	**100%**

B. Commercial End-Use Data

For commercial buildings, use the energy and peak demand tables found in the Energy Commission's California Commercial End Use Survey (CEUS) Report (March 2006) located at: http://www.energy.ca.gov/2006publications/CEC-400-2006-005/CEC-400-2006-005.PDF. Before using this data, refer to Chapter 7 of the CEUS report. The following are excerpts from the report.

Table 3: Overview of Energy Usage in the Statewide Service Area (Table 8-1 in the CEUS Report)

Building Type	Floor Stock (kft^2)	Annual Energy Intensities			Total Annual Usage	
		Electricity (kWh/ft^2)	Natural Gas (therms/ft^2)	Natural Gas (kBtu/ft^2)	Electricity (GWh)	Natural Gas (Mtherms)
All Commercial	4,920,114	13.63	0.26	25.99	67077	1278.60
Small Office (<30k ft2)	361,584	13.10	0.11	10.54	4738	38.10
Large Office (>=30k ft2)	660,429	17.70	0.22	21.93	11691	144.80
Restaurant	148,892	40.20	2.10	209.98	5986	312.60
Retail	702,053	14.06	0.05	4.62	9871	32.50
Food Store	144,209	40.99	0.28	27.60	5911	39.80
Refrigerated Warehouse	95,540	20.02	0.06	5.60	1913	5.30
Unrefrigerated Warehouse	554,166	4.45	0.03	3.07	2467	17.00
School	445,106	7.46	0.16	15.97	3322	71.10
College	205,942	12.26	0.34	34.24	2524	70.50
Health	232,606	19.61	0.76	75.53	4561	175.70
Lodging	270,044	12.13	0.42	42.40	3275	114.50
Miscellaneous	1,099,544	9.84	0.23	23.34	10817	256.60
All Offices	1,022,012	16.08	0.18	17.90	16430	182.90
All Warehouses	649,706	6.74	0.03	3.44	4380	22.40

Table 4: Electric Usage (GWh) by Building Type and End Use (Table 8-2 in the CEUS Report)

Building Type	Heat	Cool	Vent.	Refrig.	WH	Cook	Int. Ltg.	Ext. Ltg.	Office Equip.	Misc.	Air Comp.	Motors	Proc.	Total
All Commercial	1,087	10,017	8,000	9,014	611	2,805	19,265	3,916	4782	3924	204	2811	642	67,077
Small Office	72	943	467	208	90	38	1,386	343	793	283	1	79	36	4,739
Large Office	322	2358	2,019	268	80	77	2,945	324	2365	383	18	474	60	11,691
Restaurant	7	858	482	1,469	56	1,546	961	300	94	168	1	41	3	5,986
Retail	55	1553	1,267	726	96	157	4,246	644	343	483	37	201	64	9,871
Food Store	12	415	372	3,233	20	266	1,233	137	54	138	1	26	6	5,911
Refrigerated Warehouse	2	31	23	1284	3	3	262	33	17	55	4	174	22	1,913
Unrefrigerated Warehouse	20	183	156	154	26	12	1,223	145	131	215	9	162	32	2,467
School	56	520	429	225	43	78	1,281	330	206	110	1	37	7	3,322
College	159	393	423	95	25	55	790	188	148	100	2	119	28	2,524
Health	166	901	940	166	18	101	1,119	132	200	586	1	181	50	4,561
Lodging	114	650	483	244	9	185	945	165	46	301	0	128	6	3,275
Miscellaneous	104	1,212	941	942	145	287	2,874	1,175	386	1103	129	1190	330	10,817
All Offices	393	3,301	2,485	476	171	115	4,331	666	3157	666	19	553	95	16,430
All Warehouses	22	214	179	1,438	28	15	1,485	178	148	270	13	336	54	4,380

GHG Emissions Reduction and Cost Effectiveness: References for Calculating Energy End-Use, Electricity Demand, and GHG Emissions
Build It Green PCE Proposal

C. Greenhouse Gas Emissions

Table 5: Standardized Emission Factors for Electricity and Gas

	Emissions Factor (CO2e)	Emissions Factor(CO_2e)
Electricity[1] (PCE service)	0.14226 lbs/kWh	0.000064528 metric tons/kWh
Electricity[2] (state average)	0.588 lbs/kWh saved	0.000283 metric tons/kWh
Gas[3]	11.7 lbs/therm saved	0.0053 metric tons/therm

Energy Costs

	Average Statewide Residential	Average Statewide Commercial	Average Statewide Industrial
Electricity[4]	$ 0.15/kWh	$ 0.1418/kWh	$ 0.1054/kWh
Natural Gas[5]	$ 0.96/therm	$ 0.676/therm	$ 0.565/therm

[1] Peninsula Clean Energy staff estimates for 2017 EcoPlus service.
[2] California Energy Commission staff estimate.
[3] California Air Resources Board staff calculations.
[4] U.S. Energy Information Administration (EIA) 2012 summaries, tables 6 through 10. http://www.eia.gov/electricity/sales_revenue_price/.
[5] U.S. Energy Information Administration, www.eia.gov/dnav/ng/ng_pri_sum_dcu_SCA_a.htm.

Project Name: Community Resiliency: Solar to Storage at Faith Institutions
Applicant Organization: Regeneration Project, DBA CA Interfaith Power & Light
Key Partners:

- Member Congregations
- Acterra
- Luminalt
- RE-volv
- American Solar
- Grid Alternatives
- Resilient Bayview
- Greenworks Lending

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Proposal for Peninsula Clean Energy from California Interfaith Power & Light

Description of Project

Create Hubs for Community Climate Resiliency in San Mateo Faith Communities

This project will improve the Peninsula's resilience to climate change, energy outages and other emergencies by recruiting and equipping 3-5 faith institutions to be community hubs with clean energy back up power and cooling spaces open to all in need in the community.

Because faith institutions generally offer much more than worship services, providing space for everything from Girl Scout meetings to polling places to soup kitchens, they are uniquely visible, familiar and welcoming places for community members. In addition, the architectural style of houses of worship tend to make them naturally cooler on high heat days, which are occurring with increasing frequency as climate change intensifies.

These 3-5 faith institutions will be equipped with solar power, back up battery, at least two electric vehicle charging stations, space for at least 300 people to gather, a back-up water supply and first aid supplies.

California Interfaith Power & Light (CIPL) already has 21 member congregations in PCE territory. All of these congregations have committed to work with CIPL on a religious response to climate change; a few already have solar and EV charging. None that we know of have battery back up or have been identified as a site for emergency response. With this funding, we will work to identify, connect with and establish a working relationship with 3-5 faith institutions in San Mateo County that will become hubs of energy resiliency. This will be accomplished as a consequence of each institution either already having or installing rooftop solar, installing back-up battery storage and installing electric vehicle charging stations. These congregations will then encourage and support congregants in the installation of solar power and purchase of EVs. The back-up battery storage will enable these faith institutions to be positioned as important community hubs if there is an interruption in the electrical grid that services these communities. The storage can also be utilized to support PCE's load serving needs. Once this model program is established in these 3-5 faith institutions, the stage will be set to reach out to other faith institutions to participate.

Many parts of the religious community, including all our member congregations, are committed to responding to global warming as a moral issue. Engaging a congregation is not only a single influence, but rather has a multiplier effect as each member of the congregation sees and learns the benefits – environmental as well as financial – of investments in energy efficiency and clean power. This provides a means for the congregational leaders to influence and educate other congregants who may not have thought carbon reduction strategies held immediate benefits for them. This is why we see the involvement of congregations in the PCE program as providing multiplier effects.

California IPL is currently managing a comparable project with a grant from the San Francisco Department of the Environment to work with 10 diverse congregations in the city and help them measure their carbon footprints and make significant emissions reductions. Already we have conducted energy audits on all 10 and found that every one of them can become carbon neutral while achieve net savings on energy costs. Next we will be working with them on action plans and resources, from solar financing to EV charger installation, and we can apply some of what we learned and are learning to this project with congregations in San Mateo.

Objectives:

- Increase climate resilience and emergency preparedness in San Mateo
- Help 3-5 San Mateo faith institutions significantly reduce their carbon emissions, improve their climate resiliency, and become resources for their communities
- Create a model that can be expanded to faith institutions throughout the Bay Area and state
- Increase renewable energy production in San Mateo
- Provide energy storage such as batteries and EVs for times of peak solar
- Inspire and enable families to purchase home solar and EVs
- Reduce greenhouse gas emissions and air pollution

Partners and Roles:

Our partners are critical to the success of this proposal. Member congregations are committed organizations in the fight against climate change and are natural homes to community resilience. They will be ideal candidates for collaboration and be key liaisons to congregants living in vulnerable communities.

Our solar partners – Luminalt, RE-volv, American Solar, GRID Alternatives and Greenworks Lending – and Resilient Bayview are professionals who have implemented solar and climate resiliency projects throughout the region, hiring locally and offering a suite of financing options that allows neighborhoods to see resiliency.

Acterra is a partner that has funding for EV education and programs on the Peninsula and can partner with us to implement such programs to provide in-person experiences with EVs.

- We will work with our trusted solar partners to assess the ideal amount of solar and battery back-up to be installed on each house of worship. They will take the lead on installation.
- We will work with our partners to offer financing and funding to the congregations. There are many nuanced ways to fund solar projects on non-profit organizations who cannot, themselves, benefit from tax rebates. We will help them through that process and select the most appropriate partner for financing/funding.
- We will work with our 3-5 faith institutions to help them engage and inspire their members to purchase home solar and EVs.

Sequence of Activities:

1) Establish the ideal centers for community resiliency and assess faith institutions within those boundaries.
2) Create an application for interested congregations in the PCE territory to fill out; distribute to our membership and any other faith institutions that PCE might identify as good candidates.
3) Conduct one-on-one meetings with ideal communities and provide hands on support for congregations within vulnerable communities
4) Review applicants and identify the best in terms of location, diversity, leadership,

interest, capacity, physical attributes, etc. (PCE and other partners may be involved in the selection if interested)

5) Create MOU and sign with faith institutions, committing CIPL to work with them to become a Community Climate Resilience Hub
6) Develop programs, PR material for congregations to use to inform, educate, and inspire congregants and community members about what they are doing
7) Project manage, with faith institutions, solar + storage and EV installations
    a. Support in financing: Congregations, including CIPL member congregations, have a variety of means for raising funds to support projects benefiting the congregation and community. These can include standard financing mechanisms as well as unique variations and alternatives reflecting congregant willingness and desire to support their community. See more in Appendix A.
    b. Support for EV funding opportunities
8) Host a Neighborhood Emergency Preparedness community planning meeting at least one of the hubs
9) Conduct outreach for home solar and EV purchasing, such as tabling, Clean Car Demo Days, seminars
10) Work with our faith partners to plan and celebrate this effort with community ribbon cutting ceremonies.

Outcomes

We will work to accelerate GHG reductions and renewables by:

- Installing solar on each congregation with an expected average size of 83.33 kW, leading to recomputed PV production of 109,899/year, reducing 26.41 MT/yr (assumptions below)
- Installing 3-7 EV chargers, with clear and inviting signage, that will be available to the public that will allow and encourage residents to purchase and use EVs
- Organizing 3-5 EV Demo Days
- Implement and support 3-5 energy focused program such as:
    - Sermon from the pulpit
    - Environmental fair
    - Speaker event

We will work to deliver community benefits by:

- Establishing 3-5 faith institutions to become Community Climate Resilience Hubs
- Create hubs that have combined capacity to serve 2,000 people in the case of an emergency
- Educating 10,000 people in PCE territory about faith community climate resilience hubs
- Reducing electricity bills for faith communities and their members through solar installations

We will work to support PCE's load serving needs by:

- Providing funding and support for each faith institution to install battery storage that can be utilized in times of peak demand

We will work to deliver additional benefits by:

- Creating a program that is scalable to other faith institutions in San Mateo, the Bay Area and all of California
- Offer the materials developed to other congregations and faith communities
- Increase neighborhoods resiliency and provide safety in a time of climate insecurity

PCE Implementation Requirements

CIPL would welcome PCE's input on the most useful locations for the faith hubs. We would also appreciate, but not require, PCE's input into possible sources for donated or discounted battery back-up systems and water supply back-up systems.

Qualifications

Interfaith Power & Light has 18 years of experience working with faith communities from all major religions to address global warming. With a network of 20,000 congregations across the country and 40 state affiliates, IPL reaches millions of people of faith. IPL is the only religious environmental organization with boots on the ground working at the local level to engage people of faith in the climate movement.

CIPL was the founding entity and model for the national IPL campaign in 2000. Since then CIPL has grown to over 700 covenant-signing congregations and has been involved in every major climate related piece of legislation in California. With 21 San Mateo covenant-signing congregations and expertise in helping congregations reduce their carbon emissions through our Cool Congregations program, CIPL is uniquely positioned to organize and support San Mateo congregations to implement this program. These are identified in Table 1.

Table 1. CIPL Member Congregations in San Mateo County

Belmont - Good Shepherd Episcopal - St. Dorothy Stang Center	Menlo Park - St. Bede's Episcopal - Trinity Church	San Bruno - St. Elizabeth and Andrew's Episcopal
Daly City - Daly City United Methodist	Pacifica - Many Journeys MCC - St. Edmund's Episcopal	San Carlos - Church of the Epiphany
Foster City - St. Ambrose Episcopal	Portola Valley - Christ Church - Ladera Community	San Mateo - College Heights UCC - Congregational Church of San Mateo - Many Journey's MCC - Transfiguration Episcopal - Unitarian Universalists of San Mateo
Half Moon Bay - Community United Methodist - Holy Family Episcopal	Redwood City - Christ Episcopal - El Buen Pastor Good Shepard	

	Episcopal - First United Methodist - Unitarian Universalist Fellowship	

CIPL has implemented a similar program in San Francisco through the San Francisco Department of Environment (SFE) where CIPL has worked with 10 religious institutions to reduce their carbon footprints through a combination of energy efficiency and renewable energy investments.

CIPL has also worked with a congregation in San Francisco to obtain Transportation Fund for Clean Air (TFCA) funding to install multiple EV chargers.

CIPL has a Program Manager on staff who will be implementing this program. She has extensive experience working with congregations to implement energy efficiency and infrastructure programs at CIPL and other faith-based environmental organizations. Most recently, she managed a grant from the City and County of San Francisco to enable 10 congregations to develop roadmaps to carbon neutrality.

In addition, CIPL has steering committee members with expertise in San Mateo faith communities and enabling house of worship to become centers of resiliency. One member, Rabbi Marv Goodman was rabbi of Peninsula Sinai Congregation in Foster City until 2007. Since, he has been the Rabbi in Residence at the Jewish Community Federation and the Executive Director of the Northern CA Board of Rabbis.

Another steering committee member, G.L. Hodge, is a founder of Resilient Bayview and consults with non-profits on facilities capabilities and disaster preparedness, as they fulfill the needs of the surrounding community and neighbors. Both Hodge and Goodman will provide valuable volunteer assistance on this project.

CIPL will also bring on a fellow from a seminary located within San Mateo or from CIPL's Peninsula Interfaith Climate Action Network

Current technology exists for solar to storage/EV, enabling grid efficiencies and resilience.

Evaluation

We will evaluate the project success based on these metrics:

- kwH of energy produced through the solar panels
- number of home solar installations in congregants' homes
- number of ZEVs purchased by members and congregations
- kwH used to charge ZEVs/hour of day use
- number and capacity of solar storage installed
- number of days faith institutions use battery storage during to reduce their demand during the evening surge in grid-demand.
- Number of residents who can be serviced by the hubs in an emergency

Metrics and Assumptions

While each congregation and its building(s) is unique, several examples can be cited showing the range of achievable environmental and financial benefits from a PV system. Three of our examples are summarized in Table 2 and were obtained from CIPL's program in San Francisco. As indicated, financial payback for the PV system portion of investment is achieved in approximately 10 years or less.

Table 2. PV System Costs and Benefits for Three San Francisco Congregations

	Grace Cathedral	San Francisco Zen Center	St. Cecilia
System Size (kW) dc	141	39	70
Initial Investment [1]	$331,500	$78,500	$142,500
Annual Savings	$31,000	$12,600	$23,400
Simple Payback Period (yrs)	10.5	6.2	6.1
PV Production (kWh/yr)	173,000	55,500	101,000
CO2 equivalent reduction (metric tons/ year)	43	13.3	24.5

[1] After GoSolarSF Rebate

Information for Data Estimates and table

In advance of knowing which congregation we will work with, the size and energy consumption of their facility (both electricity and natural gas), and the solar potential of their facility, we cannot accurately estimate the amount of CO2 reductions at this proposal stage. However, we can provide a general estimate of CO2 reductions based on experience with other congregational solar PV Systems. Additional reductions are possible if their use and facility permit replacement of a gas-fueled heating system with an electric-powered heat pump. This possibility is not calculated here, and would be additional.

The information presented in Table 3 allows us to make these general estimates of carbon reduction resulting from our proposed effort. To do so, we make the following assumptions:

- After screening applications by interested congregations, we select three (3) to work with in detail.
- The 3-5 congregations and their houses of worship are of diverse size, we'll call them "small," "medium" and "large." Again this is merely an estimate as all may be small, or large, etc.
- PV system installation costs will be more-or-less similar to those of the San Francisco congregations with which we've worked; and installed costs per kW of smaller system are higher than larger systems.
- As we don't have any specific data on roof tilt or orientation, we utilize the same mix as found in our San Francisco congregations.

- We utilize the 2016 California Independent System Operator (CAISO) pounds of CO_2 generated per kilowatt-hour produced (0.5299), converted to metric tons (MT) at 2205 lbs / MT.

Table 3 shows the cost estimates and carbon reduction benefits from our proposed action. If we are successful at engaging more than 3 congregations in our effort, each added congregation would contribute (on average) the PV production and reduction in CO_2 emission identified.

Table 3. Possible PV System Costs and Benefits for Three Congregations

	Small	Medium	Large	Total (3)	Average
System Size (kW) dc	40	70	140	250	83
Initial Investment (no rebate)	$120,000	$194,000	$384,000		
PV Production (kWh/yr)	57,000	101,000	172,000	330,000	110,000
CO_2 equivalent reduction (metric tons/ year)	14	24	41	79	26

Budget

CA Interfaith Power & Light Community Resiliency - Solar to Storage at Faith Institutions

27-Jul-18

Community Pilots

		YEAR 1	TOTAL		STATUS*
REVENUE SOURCES	**SOURCE**				
Income #1	**Requested from PCE**		**$75,000**	38%	Requested
Income #2	Grants or in-kind donations of Battery Back-up systems (Tesla, American Solar)		**$25,000**	13%	Estimated
Income #3	Grants for EV charging stations (BAQMD, County Transportation Authority)		**$100,000**	50%	Estimated
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$200,000**		

REVENUE SUMMARY		
Total Requested	**$75,000**	38%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$125,000**	63%
TOTAL PROPOSAL REVENUE	**$200,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL	
Expense #1	Project Management		**$40,000**	20%
Expense #2	Advertising and recruiting faith institutions		**$3,000**	2%
Expense #3	Zero Emission Vehicle Demo Days		**$0**	0%
Expense #4	Mini-grants to participating faith institutions		**$5,000**	3%
Expense #5	Educational materials development and printing		**$2,000**	1%
Expense #6	Climate Fellow or intern		**$5,000**	3%
Expense #7	Media and promotion of success stories		**$8,000**	4%
Expense #8	Grants or in-kind donations of battery back-up systems		**$25,000**	13%
Expense #9	Grants for EV charging stations		**$100,000**	50%
Expense #10	Administration and overhead		**$12,000**	6%
TOTAL PROPOSAL EXPENSES		**$0**	**$200,000**	**100%**

Net Income - Expenses		**-**	**-**

Appendix A: Financing Models

The "Standard" financing mechanism include direct purchase, loans, leases and power purchase agreements (PPAs). Direct purchase is not typical for congregations as they do not typically have significant cash balances. A loan might be obtained from a commercial lender (bank) or from a pool of congregants. At times, the commercial bank approach is challenging as religious organizations don't often meet typical credit requirements; "crowdfunding" with a pool of congregants (and/or others) may prove more viable in these cases. When crowdfunding is used, loan specifics such as interest rate and payback period are negotiated for mutual benefit. (Legal and financial assistance is appropriate to structure these arrangements.) In the case of leases and PPAs, the arrangements often need to be carefully crafted to permit the capture of tax benefits while recognizing the non-profit nature of the congregation. CIPL has worked with RE-volv to organize the crowdfunding process and then the upfront cost in a lease-to-own model where the amount is paid back over time to fund other solar projects.

A unique variation on the PPA model has been developed for religious institutions and similar non-profits. CollectiveSun (www.CollectiveSun.com) of San Diego has developed a pre-paid PPA product legal in all states that can reduce ANY (their claim) installers bid for any nonprofit (or tax exempt organization) by 15%. They have worked with numerous congregations in many parts or the country; an extensive interview with CIPL about their support for congregations is found on CollectiveSun's homepage.

Many people believe Property Assessed Clean Energy (PACE) funding is not available to non-profit organizations such as religious congregations, such is not the case. CIPL has been working with GreenWorks Lending to help congregations access the financing to purchase the PV upfront and repay over 10-25 years with a competitive fixed interest rate.

Beyond these generally-available financing mechanisms, a few specific examples can be provided illustrating how these can be adapted reflecting the special congregation-congregant relationship within a church community.

- Congregants form an LLC to install a solar array and sell power through a PPA. In this Massachusetts example, five congregants formed a for-profit LLC to own and build a system on the church roof, selling the electricity produced back to the church (at a rate almost 25% lower than the utility-supplied electricity). Partners of the LLC received income from the purchased electricity, a variety of tax credits and benefits including depreciation of the system and Solar Renewable Energy Credit (SREC) payments. The system is being paid-off in less than 8 years, after which it is being donated to the church (with added tax benefit for LLC partners). The church is reducing its energy costs while substantially lowering its carbon emissions.
- "Selling" Panels to congregants to obtain a downpayment. Flagstaff (Arizona) Federated Community Church installed a 28 kW(dc) system on their 100-year old historic building. Following a series of energy efficiency measures, a study team reviewed the remaining electric charges and expected utility cost increases in the years ahead. After crunching numbers, they found a $135,000 loan for a PV

system could be repaid by annual savings on their existing ($10,000 - $12,000) annual electric bill: that is, there would be no increase in annual cost while emissions were further reduced.

A challenge, however, was raising the $40,000 down payment. This overcame this big challenge by “selling panels” to congregants at $250 each. Buyers were encouraged to place aluminum tags with a message on “their” panel to be read when replaced in the future.

- Donations toward a Memorial. In this case, a Michigan congregation raised over $59,000 to install a 20kW PV system as a memorial to a life-long church member and environmental activist. A memorial plaque was installed to recognize the congregant’s many contributions to the church and her environmental engagement.

Project Name:

RICAPS Measures for Electrification and Distributed Energy Resources

Aligning with Peninsula Clean Energy Strategic Objectives

Submitted by: DNV GL Energy Services USA Inc.
Key Partners: City/County Associated Governments of San Mateo (C/CAG) and County of San Mateo Office of Sustainability

Point of Contact: Betty Seto, Head of Department, DNV GL, 510-891-0446, Betty.Seto@dnvgl.com

August 3rd, 2018

1 DESCRIPTION OF PROJECT

DNV GL, with support from the County of San Mateo and City/County Associated Governments of San Mateo County (C/CAG), is pleased to submit this proposal for updating RICAPS Measures for Electrification and Distributed Energy Resources.

Launched in 2010, and with funding from the San Mateo County Energy Watch program, the Regionally Integrated Climate Action Planning Suite (RICAPS) program provides:

- A wide-range of tools and templates to assist member agencies in developing climate action plans in a cost-effective manner to address energy reductions and local renewable energy. Tools utilize transparent, regionally-consistent assumptions aligned with industry best practices.
- Individualized technical assistance to San Mateo County cities for use of tools and templates for climate and energy action planning, implementation, and municipal greenhouse gas emissions inventories.
- Countywide metrics and progress tracking for annual community-wide GHG inventory updates for all jurisdictions in the County, as well as regular reporting on energy consumption, energy efficiency program participation and associated energy savings
- Facilitation of monthly peer-to-peer knowledge sharing network. Topics include energy and climate best practices and opportunities for collaboration across county stakeholders including local governments, non-profits and the private sector. Past presentations can be found on the RICAPS website with our last in-person meeting hosted at PCE's office and focused on engaging cities on identifying priorities for new PCE programs.

The proposed project will specifically focus on updating the RICAPS Menu of Measures, which provides a prescribed list of potential strategies, policies and programs for local governments to select to include in their climate action plans (CAPs). The current Menu of Measures can be found on the RICAPS Tools Page under "Manual of Calculations."

The Menu of Measures is used by cities to engage with stakeholders on key actions for local governments to reduce GHG emissions and provides standardized methodologies for estimating emissions savings, energy savings, cost savings and other benefits. The current tool recommends approximately 40 measures for selection by local agencies, in a user-friendly Microsoft Excel file because they are effective and measurable for greenhouse gas reduction. Once data regarding a set of defined assumptions are entered, the worksheet automatically calculates the GHG emission reductions, and financial costs and benefits expected from the measure. Cities across San Mateo County have used the document as a selection and prioritization tool to choose the measures that are most appropriate for their community or government operations based on the score that is received by each measure.

The proposed project will focus on updating the Menu of Measures to include additional measures aligned with PCE priorities. The current tool focuses on energy efficiency and resource conservation, with minimal emphasis on renewable energy and alternatively fueled vehicles and does not currently include any measures related to electrification, zero net energy or other distributed energy resources (DERs) like battery storage or microgrids.

1.1 Objectives

A key priority for RICAPS is to support all jurisdictions in the County in developing new or updated CAPs that identify key strategies and actions to meet the state's more aggressive target of 40% below 1990 levels by 2030.

Compared to the state's 2020 target, the new 2030 target will require significantly new efforts by local jurisdictions to reduce emissions in their community in a cost-effective and equitable manner. While PCE has made a significant impact on electricity emissions across the County, the two key opportunities for emissions reductions by cities are related to:

- Electrification of natural gas end uses in buildings
- Shifting from petroleum-based transportation to electric vehicle technology

Primarily funded by PG&E, the RICAPS tools and templates were initially developed in 2012 and 2013 and do not sufficiently address new measures needed by local jurisdictions. PCE funding is critical at this juncture to support the 20 cities and County to incorporate the new measures related to electrification, and local distributed energy resources. According to DNV GL analysis, the cities and County cannot meet the 2030 state climate target without including some electrification measures in their CAPs.

PCE has the opportunity to leverage C/CAG and the County's funding from PG&E for the RICAPS program. The PCE funding would be used specifically to append to the core RICAPS program the additional necessary policy, programmatic and measures related to electrification and local distributed energy resources (DERs), and other measures aligned with PCE priorities.

1.2 Sequence of Activities

The CAP technical assistance for cities is well underway for developing roadmaps to achieve the state's 2030 climate target. To support these efforts, the RICAPS program has compiled the following *draft* list of potential new CAP measures for consideration for PCE funding. This represents an initial list and further input from PCE is expected and desired.

Buildings

- Electrification of new construction and existing buildings
    - Require all-electric new construction (or carbon neutral construction)
    - Require new accessory dwelling units (ADU's) to be all-electric
- Incentives for electric panel upgrades (solar, EVs, heat pump water heaters)
- ZNE municipal buildings policy
- Energy benchmarking requirements (time certain, or time of sale)
- Energy audit requirements (time certain, or time of sale)
- Energy efficiency requirements at time of lease (e.g., like Boulder's SmartRegs requiring all rental properties to meet EE requirements by specified date)

- Streamline permitting and promote opportunities for microgrids and distributed energy resources (DERs)
- Identify opportunities for solar+storage+EV and microgrid demonstration projects for community resilience hubs and grid-balancing
- Local workforce development related to energy efficiency, renewable energy and electrification of natural gas using equipment (e.g., contractor training for heat pump water heaters)

Transportation

- Require EV chargers installed in new construction
- Expand public EV infrastructure
- Increase EV charging for multi-unit dwelling units and workplaces
- Update EV parking policies and practices
- Develop EV outreach programs and resources
- Promote electric bikes and scooters to solve the last-mile challenge
- Seek to accommodate Lyft/Uber and move towards low/zero- emission transportation network company (TNCs) fleets
- Municipal policy to explore use of EVs

In order to fulfill the project and PCE objectives, the project will comprise of the following three tasks:

- **Task 1. Finalize selection of electrification and new energy-related measures (up to 8).** In this task, DNV GL will work with the County, C/CAG, PCE and local jurisdictions to gather input on which measures should be selected for inclusion in the updated Menu of Measures. Activities include:
    - **Web survey.** Through RICAPS, the cities have already been surveyed to identify which measures are of high, medium or low priority
    - **Technical assistance.** DNV GL is currently working with over 10 jurisdictions on stakeholder engagement and measure selection. Included in the handouts for consideration includes the above list of potential new measures to be added.
    - **Coordination meeting.** The project would seek to engage with PCE to review the preliminary list, and input received from cities in order to finalize selection of measures to be developed. If necessary, DNV GL may conduct a high-level qualitative screening of the list of potential measures to inform decision-making.
- **Task 2. Develop GHG and cost-benefit metrics for inclusion in the RICAPS Menu of Measures.** In this task, DNV GL will develop new calculation worksheets and guidance for cities for the selected new measures. Where necessary, DNV GL may also utilize PCE funding to update assumptions and calculations for other energy-related measures to reflect PCE's contributions and other key market trends.
- **Task 3. Incorporate new measures into the RICAPS Menu of Measures.** In this task, DNV GL will finalize and integrate the new calculation measure worksheets into the Menu of Measures, including posting to the RICAPS website and updating guidance to cities where necessary. This may include revisiting the RICAPS Users Guide. We will

also promulgate the availability of the updated Tools to all jurisdictions within San Mateo County and 7beyond.

1.3 Role of Partners

C/CAG, with support from the County, has been a driving force for energy and sustainability programs for local governments in the region. Through the Office of Sustainability, both the County and C/CAG are committed to overseeing DNV GL's delivery of the RICAPS program, including:

- Input and guidance on identifying and promulgating potential new measures to be added to the RICAPS suite of tools and resources.
- Coordination of CAP technical assistance with cities and the County
- Facilitation of the monthly RICAPS working group to engage all 20 cities and the County on energy and climate related initiatives, including the development of the new CAP measures
- Communication of RICAPS-related materials and action items for City input, including posting materials to the project website.

The Office of Sustainability, funded by C/CAG will provide staff time as matching funds for this project proposal to work with DNV GL. Therefore, all PCE funds will be directed to the technical development of the new measures.

2 OUTCOMES

2.1 Accelerates GHG reductions and renewables

This project delivers clear, quantifiable GHG reductions and promotes local renewable energy generation by empowering local governments across San Mateo County to take ownership of their own contributions to emissions reductions.

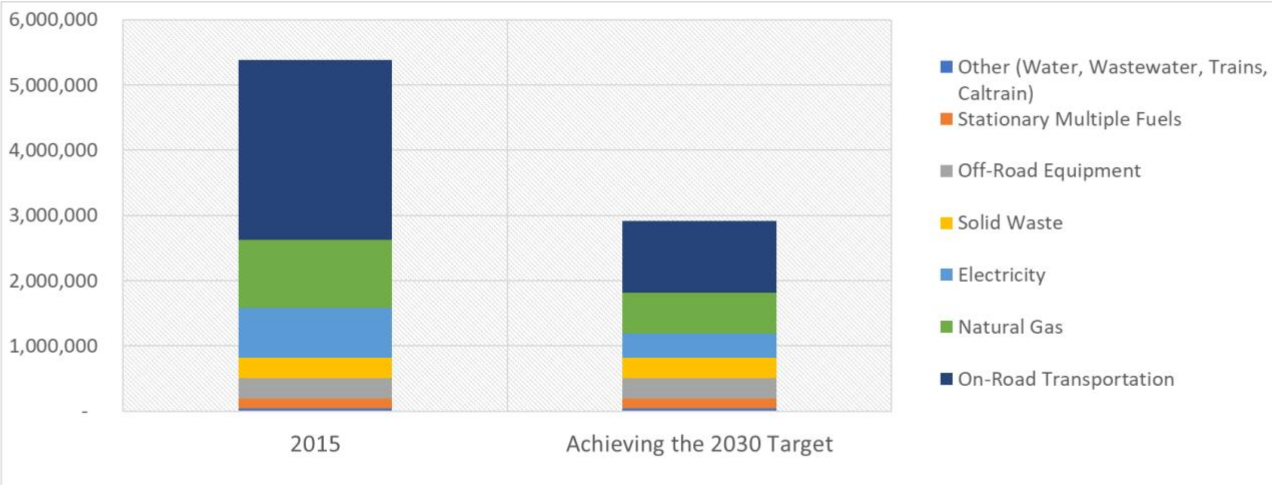
California SB 32 sets a statewide 2030 reduction goal of 40% below 1990 levels, which corresponds to a San Mateo countywide 2030 target level of emissions at ~3 million MTCO2e.

In 2015, San Mateo County emitted 5,380,000 MTCO2e with 70% of emissions related to on-road transportation and natural gas consumption. Therefore, supporting all 20 cities and the County in meeting the state's 2030 climate target represents a **reduction of ~2,380,000 MTCO2** from today's levels.

Accounting for PCE[1], Figure 1 shows that together on-road transportation and natural gas-related emissions must be reduced by nearly 55% to achieve the state's 2030 target from current 2015 levels.

[1] DNV GL estimates that emissions in 2015 related to electricity would have been reduced by ~50% countywide, were PCE to be fully implemented in 2015.

Figure 1. Comparison of 2015 Countywide Emissions with 2030 Target



The RICAPS program is designed to support cities with developing climate action plans through a stakeholder-driven process to achieve these reductions. The inclusion of the new proposed CAP measures related to electrification of natural gas in buildings and vehicles is critical and the cities cannot meet the ambitious 2030 state target without additional funding to support these efforts.

The project supports PCE's procurement goals related to 20 MW of new local power, 100% GHG-free power and 100% renewable energy by supporting city efforts by supporting cities directly with prioritizing the implementation of the following:

- Zero net energy buildings resulting in on-site local, renewable and GHG free solar PV
- Incentives for electric panel upgrades to support electrification
- Demonstration projects for solar+storage and microgrid demonstration projects for community resilience hubs
- Integrating electric vehicle charging infrastructure to match daytime electricity consumption and generation, in order to provide load-shaping support

The proposed project will assist San Mateo County local jurisdictions to include electrification and DERs when identifying the most cost-effective climate action measures. In the development of City of Palo Alto's Sustainability and Climate Action Plan (S/CAP), many of the proposed new RICAPS measures related to electrification were found to be cost-effective, including ZNE new buildings, electric vehicles, and residential heat pump water heaters.

2.2 Delivers community benefits

The RICAPS program currently provides technical support for cities to engage with citizen task forces and City Councils, and funding for the new proposed measures with ensure that the on-going climate planning efforts aligns with PCE priorities.

The proposed project will provide tangible benefits to low income and vulnerable communities in the following ways:

- **Directly serving disadvantaged communities.** In particular, the cities of Redwood City and San Mateo, as well as unincorporated County, have initiated CAP updates this year to explore opportunities to reach the state's 2030 target. Therefore, PCE funding related to electrification and distributed energy resources will particularly support these three jurisdictions with disadvantaged communities. Staff from the cities of East Palo Alto and South San Francisco also participate in RICAPS meetings and webinars when time permits.
- **Support local workforce development.** The possible list of new measures includes identifying how cities can play a larger role in local workforce development for energy efficiency, renewable energy and electrification of natural gas using equipment (e.g, contractor training for heat pump water heaters)
- **Protecting vulnerable populations.** The possible list of new measures includes ways for cities to make municipal and other community facilities more resilient through pilot opportunities for solar+storage and microgrid demonstration projects for community resilience hubs

In Figure 2, we demonstrate that the proposed project has the potential for maximum impact due to the fact that the RICAPS program reaches every local jurisdiction in the County through the lens of sustainability and climate action. Through this project, PCE will have the opportunity to suggest measures for each member jurisdiction to consider in their strategic planning for meeting the state's 2030 climate target.

Figure 2. Types of PCE Customers Assisted by Proposed Project

<table>
<tr><th>Community Benefits</th><th>Answer</th></tr>
<tr><td>Specify what types of PCE customers (residential, small business, large commercial) can be served</td><td rowspan="4">The proposed project would serve 100% of PCE customers, because the RICAPS program supports all cities and the County.</td></tr>
<tr><td>How many PCE customers can participate in the program given your stated budget</td></tr>
<tr><td>How many could potentially be served during a full-scale implementation?</td></tr>
<tr><td>Specify where in San Mateo County eligible customers are located. If your project favors one geographic area over others, please briefly explain why.</td></tr>
</table>

Finally, the project meets the PCE workforce policy by seeking to engage local businesses, apprentice and fellowship programs and ensuring fair compensation practices.

2.3 Supports PCE's load serving needs

The proposed project will directly engage local governments in identifying how they can help implement programs to both support their own GHG reduction goals and support PCE in balancing out energy demand throughout the day. The project will bring together City, County and PCE representatives to identify opportunities for local jurisdictions to implement climate action strategies aligned with PCE's objectives, including load-serving needs.

For instance, the possible list of measures includes private-public partnerships leveraging municipal facilities for solar+storage+EV and microgrid demonstration project to test out new technologies and configurations for grid-balancing. Furthermore, PCE has the opportunity to suggest other possible measures for inclusion in the RICAPS Menu of Measures that are of interest. This may include pilots for grid-integrated heat pump water heaters, managed electric vehicle charging strategies, as well as working with demand response providers (DRPs) and aggregators of distributed energy resources spanning automated demand response (autoDR), battery storage, and load-shifting.

2.4 Additional benefits

The project provides many benefits across San Mateo County, including:

- **Community resilience.** The project offers the opportunity for cross-departmental collaboration within city government to prioritize and implement projects such as solar+storage and microgrid demonstration projects for community resilience hubs.
- **Innovative.** The RICAPS program seeks to support innovation in energy and climate action at the City and County levels. The list of possible measures includes several leading edge opportunities for cities such as zero net energy buildings and policies, reach codes for EVs, solar+storage demonstration opportunities and new municipal policies to "lead by example." Leading cities are also explore new heat pump water heater programs, and opportunities to better monetize the "value stack" associated with battery storage and other DERs.
- **Scalable and replicable.** At its heart, the RICAPS program was developed to deliver climate action at scale across the County, and to provide replicable resources, tools and templates for local jurisdictions. The RICAPS Menu of Measures brings together a common methodology for estimating GHG reduction potential and cost-benefit analysis that each city can utilize and customize using their city-specific data (e.g., square footage of residential versus commercial buildings, population, etc). Through RICAPS, this tool will remain available to local jurisdictions well beyond the grant period.
- **Addresses program gaps in the region**. PCE funds are being requested to address the gap in funding available for fuel-switching/electrification and distributed energy resources (DERs) that exists under PG&E's ratepayer funded energy efficiency programs. No funds are currently available to incorporate these new measures into the RICAPS program, at a time when many local jurisdictions are now updating climate action plans to the 2030 planning horizon year.

The proposed project - RICAPS and the Menu of Measures – has been implemented for many years, with almost all jurisdictions having completed climate action plans for 2020. The key learnings and results are that cities and local jurisdictions need significant technical support to develop GHG emissions inventories, identify the best GHG reduction opportunities and conduct cost-benefit analysis to prioritize action.

Since the program is already available throughout PCE's service territory, the opportunities for expansion are to increase the reach within city government, including building staff capacity and support for PCE priorities.

The proposed project increases community resiliency by engaging local governments in identifying how clean energy technologies that increase local GHG-free renewable generation can be utilized for community resilience hubs. This potential measure would be discussed with cities across the County to determine familiarity and interest.

Finally, the proposed project is a prime example of how PCE can leverage an existing PG&E energy efficiency program to build on and complement existing efforts. Since the RICAPS Menu of Measures does not include any measures related to fuel-switching, the PCE funding would fill an important gap in the RICAPS program.

3 PCE IMPLEMENTATION REQUIREMENTS

PCE's role on the project will be to provide guidance and input to ensure that the updates to the RICAPS Menu of Measures aligns with PCE's objectives and success metrics. Table 1 provides a task-by-task summary of suggested PCE role.

Table 1. PCE Role and Implementation Requirements by Project Task

Activity	PCE Role and Implementation Requirement
Task 1. Determine list of electrification and new energy-related measures (up to 8)	Work with DNV GL, C/CAG and the County on finalizing the selection of up to 8 new RICAPS measures aligned with PCE objectives
Task 2. Develop GHG and cost-benefit metrics for inclusion in the RICAPS Menu of Measures	Review (as desired) calculation methodologies and provide input on assumptions
Task 3. Incorporate new measures into the RICAPS Menu of Measures	Minimal. Review final work product.

The PCE implementation requirements are expected to be within PCE's capabilities. PCE staff should plan for coordination calls (1-2 per month, at most) and provide input and approval for the final list of measures to be included in the RICAPS Menu of Measures.

The project minimizes administrative burdens on PCE, as most of the work and coordination will be conducted by DNV GL and County OoS staff. Since PCE would be providing additional funds to append the RICAPS program, much of the other work related to RICAPS is already funded and can proceed with minimal PCE involvement.

The project will help build PCE capacity by providing additional access to sustainability staff at member jurisdictions who are tasked with implementing energy and climate-related projects at their respective agencies.

4 QUALIFICATIONS

DNV GL brings unique qualifications working at the intersection of PG&E ratepayer funded energy efficiency programs, city sustainability and climate action, and community choice aggregation programs (CCAs). Since 2010, DNV GL has served as the prime contractor to the City/County Association of Governments of San Mateo (C/CAG) and the County to deliver the technical assistance and meeting facilitation components of the RICAPS program.

Our qualifications include:

- **Award-winning RICAPS program providing technical expertise with climate planning, GHG accounting, zero net energy, and open data tracking.** Over the past 3 years, the RICAPs program has supported San Mateo County jurisdictions to winning over 50 Spotlight and Full Beacon Awards given out by the Institute of Local Governments (ILG). In 2016, the RICAPS program was recognized by the U.S. Environmental Protection Agency with a certificate for Innovative Partnership for its work bringing together sustainability staff across the entire county to support regional collaboration for climate and energy action.
- **Statewide and national climate action planning expertise, including experience with innovative approaches for achieving carbon neutral cities leveraging electrification and DER.** DNV GL's unique expertise includes advancing low carbon development goals across the nation and internationally. For instance, DNV GL is leading several work streams including the Heat Pump and Electrification Guidebook for Green Cities California as well as providing microgrid community resilience hub feasibility assessments for City of Seattle. In 2017, DNV GL developed electrification roadmaps for the cities of Boulder, CO and Burlington, VT.
- **Established relationships and unsurpassed knowledge of San Mateo County jurisdictions, staff and elected officials and countywide stakeholders.** Since 2010, DNV GL has served as the technical consultant for the RICAPS program to develop the initial set of climate action planning tools, templates and methodology that serves as the foundation for RICAPS today. Our knowledge of these tools, the methodologies and the development path means that DNV GL is uniquely poised to efficiently update the suite of tools.
- **Proven track record working with community choice aggregators (CCAs).** DNV GL recently completed a clean energy asset baseline study for Silicon Valley Clean Energy, and is supporting Sonoma Clean Power with the California Energy Commission (CEC) funded "Lead Locally" project that brings an innovative clean energy market place across Sonoma and Mendocino counties.

The project will be done with existing staff within DNV GL and supported by Office of Sustainability staff. As our project partners, the County and C/CAG will continue to provide unsurpassed countywide coordination for both the San Mateo County Energy Watch program and RICAPS.

5 EVALUATION

Figure 3 explains our approach to evaluating success, including quantifying specific desired outcomes towards the benefits expected to be delivered.

Figure 3. Approach for Evaluating Success.

Desired outcome	Metric for Success
Cities and county engaged in identifying new measures to be funded by PCE	At least 18 cities/county provide input on selection of measures to be added to RICAP Menu of Measures
Cities and county utilize new measures in developing 2030 climate action plans	At least 6 cities select one or more new measures into 2030 climate action plan within 1 year At least 10 cities select one or more new measures within 2 years.
Cities and county explore reach codes related to ZNE or EV	At least 2 cities begin developing reach code related to 2019 code update

6 METRICS AND ASSUMPTIONS

DNV GL utilized the following calculation methodology and assumptions to estimate the necessary GHG emissions reductions needed to achieve the state's 2030 climate targets from current 2015 levels:

- Total County Reductions Needed (MTCO2e) = 2015 San Mateo County GHG Emissions Inventory – 2030 Target Level of 40% below 1990 levels
- 1990 GHG Emissions Baseline is extrapolated based on San Mateo County's 2005 GHG emissions inventory and assuming that was 15% above 1990 levels.

Potential GHG reductions associated with electrification county-wide:

- Emissions factor for electricity followed PCE guidance, but instead of using the statewide average electricity emissions factor, we utilized PG&E's specific emissions factor for 2015.
- The main assumption is that the other sectors GHG emissions would roughly stay the same or be immaterial (e.g., potential increases in wastewater treatment related emissions), so the calculation held all other sectors constant.

For cost-effectiveness, the assumptions were as follows:

- Heat pump water heaters (HPWH) assumed marginal cost of equipment relative to tanked natural gas water heaters and replacement on burn-out. Key assumptions include an energy factor (EF) of 2.35 for HPWH
- Electric vehicles cost-effectiveness looked at EVs relative to comparable gasoline-fueled vehicles and included federal and state tax credits. The costs also assumed installation of at-home level 2 chargers. Average lifespan of electric vehicles was assumed at 10 years.
- All-electric new construction includes both residential and commercial building types and relying on rooftop PV to provide 100% of energy needs and relying on air source heat pumps and heat pump hot water heaters to provide all space and water heating needs.

DNV GL Energy Services USA Inc.
RICAPS Measures for Electrification and Distributed Energy Resources
8/3/18
Community Pilots

		YEAR 1	TOTAL		STATUS*
REVENUE SOUR(SOURCE					
Income #1	**Requested from PCE**		**$74,725**	29%	Requested
Income #2	San Mateo County Energy Watch - RICAPS CAP Technical Support for Cities		**$184,780**	71%	Received
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$259,505**		

REVENUE SUMMARY		
Total Requested	**$74,725**	29%
Total Pledged	**$0**	0%
Total Received	**$184,780**	71%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$259,505**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Limited travel (mileage) for meetings with PCE and County of San Mateo		**$200**	0%	
Expense #2	DNV Staff, next tab		**$74,725**	100%	
Expense #3			**$0**	0%	
Expense #4			**$0**	0%	
Expense #5			**$0**	0%	
Expense #6			**$0**	0%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$0**	**$74,925**	**100%**	

Net Income - Expenses	-	**184,580**

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

2018-2019 DNV GL Hourly Rates

Classification	Staff Names	Rate
Principal Consultant	Betty Seto	$210
Senior Consultant	Sarah Isabel Moe	$175
Consultant	Ben Butterworth, Tara Jank	$155
Senior Analyst	Lauren Taymor	$145
Administrative Support	TBD	$110

	Betty Seto	Ben Butterworth	Sarah Isabel Moe	Tara Jankowski	Lauren Taymor	
	Project Sponsor	Project Manager	Outreach Manager	Support	Support	
	$210	$155	$175	$155	$145	Total
Task 1. Determine list of electrification and new measures	20	25	20		10	$ 13,025
Task 2. Develop GHG and cost-benefit metrics	20	150	10	80	40	$ 47,400
Task 3. Incorporate new measures into RICAPS Menu	15	40	10	10	10	$ 14,100
Direct expenses (primarily mileage)						$ 200
TOTAL						$ 74,725

Notes: Rates provided here are valid through June 30, 2019

COUNTY OF SAN MATEO
COUNTY MANAGER'S OFFICE
OFFICE OF SUSTAINABILITY

Jim Eggemeyer
Director

County Government Center
455 County Center, 4th Floor
Redwood City, CA 94063
www.green.smcgov.org

August 3, 2018

Rafael Reyes
Peninsula Clean Energy
2075 Woodside Road
Redwood City, California 94061

Dear Mr. Reyes:

The County of San Mateo is pleased to submit this Letter of Support for DNV GL's application for PCE funding to round out the RICAPS Measures for Electrification and Distributed Energy Resources. We hope that PCE will consider this key opportunity to "insert" its priorities into the successful RICAPS tool and technical assistance model San Mateo County cities use to write their climate action plans. As you know, the County has supported the RICAPS program since 2010 and we remain committed to supporting all 20 cities and unincorporated county in updating local strategies and programs for deep emissions reductions.

Given that the original RICAPS Menu of Measures was developed in 2012 and 2013, we recognize that the current list of measures for our member jurisdictions needs additions and revisions to meet current needs, especially since PCE did not exist at that time. We strongly support DNV GL's application to incorporate new measures into the RICAPS program that reflects the needs of local jurisdictions to reduce and shift fossil fuel consumption to electric supply in buildings and transportation.

PCE has the unprecedented opportunity to amplify existing work funded through RICAPS that provides climate action technical assistance that will impact all communities across the County. Our local cities need support in meeting the state's 2030 targets, and the RICAPS assistance provides the vehicle to do so, but needs (currently) unavailable funding to incorporate new strategies related to electrification, load-shifting and equitable access to reliable, clean energy.

We thank you for considering this project and the tremendous impact it will have to empowering our local jurisdictions to take ownership of specific policies and programs that reduce emissions and support PCE in its mission.

Sincerely,

Jim Eggemeyer

Jim Eggemeyer
Director, Office of Sustainability

cc: Kim Springer, Program Manager

OFFICE OF SUSTAINABILITY
COUNTY OF SAN MATEO

COUNTY OF SAN MATEO CALIFORNIA

C/CAG

CITY/COUNTY ASSOCIATION OF GOVERNMENTS OF SAN MATEO COUNTY

Atherton • Belmont • Brisbane • Burlingame • Colma • Daly City • East Palo Alto • Foster City • Half Moon Bay • Hillsborough • Menlo Park • Millbrae • Pacifica • Portola Valley • Redwood City • San Bruno • San Carlos • San Mateo • San Mateo County •South San Francisco • Woodside

August 3, 2018

Rafael Reyes
Peninsula Clean Energy
2075 Woodside Road
Redwood City, California 94061

Dear Mr. Reyes:

As the Executive Director of the City/County Association of Governments of San Mateo County (C/CAG), I am pleased to submit this Letter of Support for DNV GL's application for PCE funding to round out the RICAPS Measures for Electrification and Distributed Energy Resources. We hope that PCE will consider this as a key opportunity to align its goals with the RICAPS which is a successful tool used by San Mateo County cities in writing their climate action plans. As you know, C/CAG along with the County of San Mateo has supported the RICAPS program since 2010 and we remain committed to supporting all 20 cities and unincorporated county in updating local strategies and programs for deep emissions reductions.

Given that the original RICAPS Menu of Measures was developed in 2012 and 2013, prior to the formation of PCE, we recognize that the current list of measures for our member jurisdictions can benefit from updates. We strongly support DNV GL's application to incorporate new measures into the RICAPS program that reflects the needs of local jurisdictions to reduce and shift fossil fuel consumption to electric supply in buildings and transportation.

PCE has the unprecedented opportunity to amplify existing work funded through RICAPS that provides climate action technical assistance benefiting all communities across the County. Our local cities need support in meeting the state's 2030 targets, and the RICAPS assistance provides the vehicle to do so. The RICAPS tool needs to incorporate new strategies related to electrification, load-shifting and equitable access to reliable and clean energy.

We thank you for considering this project and the tremendous impact it will have to empowering our local jurisdictions to take ownership of specific policies and programs that reduce emissions and support PCE in its mission.

Sincerely,

Sandy Wong
Executive Director

Calculating Total GHG Reductions Needed Countywide to Meet State 2030 Target

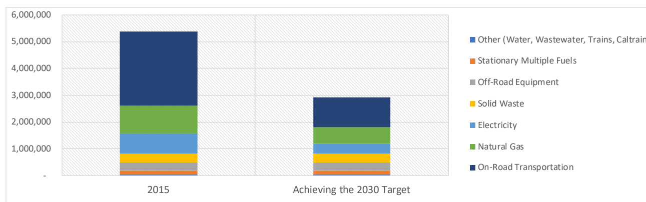
			COUNTY TOTAL	Atherton	Belmont	Brisbane	Burlingame	Colma	Daly City	East Palo Alto	Foster City	Half Moon Bay	Hillsborough	Menlo park	Millbrae	Pacifica	Portola Valley	Redwood City	San Bruno	San Carlos	San Mateo	South San Francisco	Uninc. County	Woodside
Energy	Residential Energy	Electricity	242,105	9,219	9,867	1,574	11,340	382	26,655	6,816	11,345	4,497	9,554	13,494	7,836	12,445	3,179	26,972	13,865	12,389	35,370	17,637	1,234	6,435
		Natural Gas	589,476	19,042	22,882	3,298	26,890	800	56,262	14,478	21,814	8,835	22,455	31,842	17,445	28,744	7,690	53,722	26,631	26,497	73,724	38,861	75,636	11,927
	Commercial/Industrial Energy	Electricity	402,795	2,821	8,106	9,583	29,470	3,591	21,120	7,142	22,987	6,362	1,234	39,081	8,904	7,005	1,171	70,616	18,498	20,847	56,465	41,114	25,438	1,241
		Natural Gas	447,652	3,136	7,356	6,380	29,337	2,235	21,444	4,927	16,260	13,004	762	56,396	15,598	4,979	2,643	64,105	12,960	16,192	51,850	70,672	45,466	1,950
	Direct Access	Electricity	117,904	0	2,430	2,873	8,835	1,077	6,332	2,141	6,892	1,907	0	11,716	2,669	2,100	0	21,171	5,546	6,250	16,928		19,036	0
	Stationary Sources	Multiple Fuels	144,128	7	55	2,920	6	1,667	306	16	1,082	56	8	34,130	101	25	0	16,573	1,602	173	10,171		75,222	8
Transportation	Local Roads	Local Roads-Gasoline	849,488	19,112	30,614	17,151	53,526	9,788	64,127	14,259	39,132	7,182	14,417	44,909	27,411	40,600	7,193	89,900	31,743	41,808	101,454	179,122	5,707	10,332
		Local Roads-Diesel	114,328	2,588	4,146	2,323	7,249	1,326	8,684	1,931	5,299	973	1,952	6,082	3,712	5,498	974	12,175	4,299	5,662	13,739	24,257	60	1,399
	State Highways	State Highways-Gasoline	1,581,777	5,625	40,048	81,648	121,825	5,196	159,652	57,616	81,326	16,490	5,800	116,820	44,510	40,247	139	150,163	100,350	52,189	279,464		155,782	66,886
		State Highways-Diesel	214,210	762	5,423	11,057	16,498	704	21,621	7,803	11,013	2,233	785	15,820	6,028	5,450	19	20,336	13,590	7,068	37,846		21,097	9,058
	Off-Road Equipment (Residential)	Off-Road Equipment (Residential)	313,651	2,376	7,683	5,548	25,146	2,283	20,942	3,339	12,387	4,488	1,924	24,494	6,514	6,217	1,374	50,669	12,070	13,912	47,326	37,680	25,659	1,618
	Rail	CalTrain	18,532	601	1,203	2,339	2,473							1,403	1,069			1,515	1,337	1,582	3,742	734	535	
		Freight Trains	1,969	77	155	301								180	137			195	172	203	481		69	
Solid Waste	Solid Waste Disposal	Landfilled Waste	90,893	1,079	2,117	870	4,839	299	9,317	2,133	2,236	2,974	1,062	4,693	2,029	3,095	398	9,995	4,622	6,237	11,260	15,030	5,608	1,001
		ADC	3,870	86	39	2	203	6	383	7	102	903	106	208	39	108	48	284	10	145	632	9	382	171
	Solid Waste Landfills	Landfills	222,553	0	0	4,681	204		55,710	0	0	633	0	17,352	0	1,618	0	0	0	0	4,524	7,291	130,540	
Wastewater	Wastewater Treatment	Wastewater Treatment	17,744	170	619	126	852	34	2,643	693	711	277	286	789	1,550	836	107	1,892	499	700	2,261	773	1,796	130
Water	Water Use	Water Use	7,157	117	235	56	316	19	766	165	326	123	243	529	196	225	74	894	304	257	959	537	583	232
			5,380,235	5,380,235																				

		Atherton	Belmont	Brisbane	Burlingame	Colma	Daly City	East Palo Alto	Foster City	Half Moon Bay	Hillsborough	Menlo park	Millbrae	Pacifica	Portola Valley	Redwood City	San Bruno	San Carlos	San Mateo	South San Francisco	Uninc. County	Woodside
2005 Baseline	5,873,637	72,731	167,648	158,096	355,221	33,620	542,958	136,027	265,777	77,191	70,916	468,344	150,643	180,923	33,011	640,161	280,531	267,237	809,619	455,619	587,190	120,173

	COUNTY TOTAL
Categories from Above (Columns B+C)	**2015 Emissions (MTCO2e)**
Residential Electricity	242,105
Residential Natural Gas	589,476
C&I Electricity	402,795
C&I Natural Gas	447,652
DA Electricity	117,904
Stationary Multiple Fuels	144,128
Local Roads-Gasoline	849,488
Local Roads-Diesel	114,328
State Highways-Gasoline	1,581,777
State Highways-Diesel	214,210
Off-Road Equipment (Residential)	313,651
CalTrain	18,532
Freight Trains	1,969
Landfilled Waste	90,893
ADC	3,870
Landfills	222,553
Wastewater Treatment	17,744
Water Use	7,157
	5,380,235

	COUNTY TOTAL		
Abbreviated Category	**2015 Emissions (MTCO**	**Reduction needed**	**2030 Target**
Other (Water, Wastewater, Train	45,403		45,403
Stationary Multiple Fuels	144,128		144,128
Off-Road Equipment	313,651		313,651
Solid Waste	317,317		317,317
Electricity	762,804		371,645
Natural Gas	1,037,129	40%	622,277
On-Road Transportation	2,759,804	60%	1,103,922
	5,380,235		
State Target	2,995,555		2,918,342
Reductions needed from 2015	2,384,680		
		Reduction needed in combined category	
NG and Transportation	3,796,933	55%	1,726,199

	2015	What's needed to hit target of 2,995,555 MTCO2 **Achieving the 2030 Target**
Other (Water, Wastewater, Trains, Caltrain)	45,403	45,403
Stationary Multiple Fuels	144,128	144,128
Off-Road Equipment	313,651	313,651
Solid Waste	317,317	317,317
Electricity	762,804	371,645
Natural Gas	1,037,129	622,277
On-Road Transportation	2,759,804	1,103,922
	5,380,235	**2,918,342**



Estimate PCE impact on electricity emissions in 2015 (hypothetical)

2015 Real Data

Service Provider	Electricity Consumption (kWh/Year)	Emissions (MT CO2e/Year)	Emission Factor (MT CO2e/kWh)
PG&E	3,808,556,798	644,900	0.000169
PCE	0	0	0.000065
Direct Acces	458,544,215	117,904	0.000257
TOTAL	**4,267,101,013**	**762,804**	**0.000179**

2015 PCE Scenario

Service Provider	Electricity Consumption (kWh/Year)	Emissions (MT CO2e/Year)	Emission Factor (MT CO2e/kWh)
PG&E	76,171,136	12,898	0.000169
PCE	3,732,385,662	240,843	0.000065
Direct Acces	458,544,215	117,904	0.000257
TOTAL	**4,267,101,013**	**371,645**	**0.000087**

PCE Impact on Electricity-Related GHG Emissions

(Hypothetical to 2015 county-wide electricity consumption)

51% reduction

Assumptions

% PCE + PGE Load That is PCE	98%	June 2017 data from PCE
% PCE + PGE Load That is PG&E	2%	June 2017 data from PCE
PCE ECOplus Emission Factor (MT CO2e/kWh)	0.000107	June 2017 data from PCE
PCE EC100 Factor (MT CO2e/kWh)	0.00000	June 2017 data from PCE
PCE ECOplus Partcipation Rate	98%	June 2017 data from PCE
PCE ECO100 Partcipation Rate	2%	June 2017 data from PCE
PCE Weight Emisison Factor (MT Co2e/kWh)	0.000105	Calculated

-0.36781

City of Palo Alto Sustainability and Climate Action Plan (S/CAP) calculations of cost-effectiveness ($/MTCO2e reduced)

Summary of Natural Gas Levers, Strategies and Actions

Remaining emissions -

Sector	Strategy Code	Goal	Strategy	Strategic Target	Annual adoption rate	Level	Target Year	NPV	Capital Costs (Discounted)	MTCO2e Saved in Target Year	$/MTCO2e	Notes
								Negative = costs	Positive = costs		Positive = costs	
							TOTAL	($949,978,849)	$2,125,199,783	305,836		
							TOTAL (without Balanced Community)	$398,252,257	$776,968,678			
							TOTAL (without Balanced Community or offsets)	$398,817,749	$2,124,634,291			#VALUE = means offsets turned off
Electrifying our City	NG-INF-1	New Utility Business Models (UoF?)	Identify utility business model to support carbon neutrality	Ongoing								
Electrifying our City	NG-INF-2	Distributed local energy generation	Increase local distributed generation in Palo Alto	18% annual consumption produced locally	1.2%	18%	2030	$145,843,176	$114,240,561	-	N/A	
Electrifying our City	NG-RES-1	Electrifying our Homes	Convert residential natural gas water heaters to electric water heating	100% Conversion to electric water heaters	4.7%	70%	2030	$7,310,398	$11,459,862	13,596	-$35	
Electrifying our City	NG-RES-2	Electrifying our Homes	Convert residential space heating to electric space heating	100% Conversion to electric space heaters	4.0%	60%	2030	($25,679,965)	$56,621,571	23,307	$165	
Electrifying our City	NG-COMM-1	Electrifying our Businesses	Convert commercial natural gas water heaters to electric water heating	100% Conversion to electric water heaters	3.3%	50%	2030	($4,347,184)	$6,879,182	21,188	$44	
Electrifying our City	NG-COMM-2	Electrifying our Businesses	Convert commercial space heating to electric space heating	100% Conversion to electric space heating technologies	3.3%	50%	2030	($2,088,469)	$2,989,178	15,891	$19	
Electrifying our City	NG-COOK-1	Commercial Cooking - Electrification	Convert commercial cooking to new electric cooking equipment	50% conversion to non-natural gas fuel for commercial cooking	2.7%	40%	2030	($351,475)	$194,206	11,300	$29	Relatively cost-effective, but significant market barriers
Electrifying our City	NG-COOK-2	Commercial Cooking - Energy Efficiency	Increase energy efficiency related to commercial cooking	50% reduction of natural gas usage for commercial			2030					
Electrifying our City	NG-GAS-1	No New Gas Hookups	Reduce natural gas usage in new construction and major remodels	No new natural gas hookups	6.7%	100%	2030	$122,217,929	$107,531,323	14,025	-$670	Most cost-effective due to long-stream of GHG savings, and low incremental cost
Electrifying our City	NG-OFF-1	Carbon Offsets	Make natural gas supply carbon neutral	Utilize offsets for remaining natural gas emissions	0.0%	0%	2030	($565,492.21)	$565,492	-	-	
Electrifying our City	NG-OFF-2	Biogas Offsets	Make natural gas supply carbon neutral	Utilize biogas for remaining natural gas emissions	0.0%	0%	2030	-	-	-	-	
Rethinking Mobility	T-FAC-1	Expanding facilities and services	Build out bike network for all ages and abilities	Ensure all households and employment sites have safe access (within 1/4 mile) to a citywide network of low-stress bikeways (increasing bicycle mode share to 15%)	3%	40%	2030	($6,939,949)	$6,939,949	8,432	$94	Costs of building protected bike lanes (assume 53 miles of protected bike lanes at 100% implementation) No benefits quantified = perhaps we should quantify the fuel savings of not driving
Rethinking Mobility	T-FAC-2	Expanding facilities and services	Expand transit facilities and services	Ensure all households and employment sites have safe access (within 1/4 mile) to a network of high frequency transit line (< 15 min. wait), with sufficient capacity during peak periods to accommodate increased demand generated by the full suite of S/CAP pricing and TDM strategies).	4%	60%	2030	($690,389)	$690,389	19,197	$4	Costs of expanded Palo Alto shuttle (2 new routes and expanded service) No benefits quantified = perhaps we should quantify the fuel savings of not driving
Rethinking Mobility	T-FAC-3	Expanding facilities and services	Facilitate shared transport	Increase average vehicle ridership (AVR) for trips to and from Palo Alto	4%	60%	2030	($1,677,258)	$1,677,258	6,365	$48	Costs of curb markings (assume 19 sites designed for ride-sharing and transportation networks) No benefits quantified = perhaps we should quantify the fuel savings of not driving
Rethinking Mobility	T-INC-1	Creating the right incentives	Provide Eco-Pass / universal transit access	Increase transit ridership and mode share for commute and non-commute trips	0%	100%	2030	$31,351,856	$ 283,596,160	8,395	-$427	Costs of a univeral transit pass for all residents and employees (at 100% implementation Benefits of fewer parking spaces needed (avoided costs of parking garages)
Rethinking Mobility	T-INC-2	Creating the right incentives	Utilize parking pricing and management approaches	Reduce surplus of unused parking, through shared parking, such that peak period occupancy reaches 85-90%, as downtown develops.	3%	50%	2030	$40,916,484	$4,546,276	19,417	-$27	Benefits of parking revenue to the City (focused on requiring paid parking in commercial / downtown areas) Costs of parking program taken from parking revenues
Rethinking Mobility	T-LU-1	Land Use Development	Adopt a "Balanced Community" approach for growth	Adopt plan that accommodates sufficient development to achieve a balance of jobs and housing within the City and its sphere of influence	6%	5%	2030	($1,348,231,106)	$1,348,231,106	2,890	$53,376	Costs of housing (assumed increase in housing in Palo Alto, quantified cost at $1,393 per square feet) No benefits quantified, but perhaps we should quantify the fuel savings)
Rethinking Mobility	T-EV-1	Electrifying transportation	Convert vehicles in Palo Alto to EVs	100% of vehicles purchased by Palo Alto residents are electric vehicles	7%	90%	2030	$92,952,596	$179,037,272	35,055	-$42	
Rethinking Mobility	T-EV-2	Electrifying transportation	Convert all vehicles to EVs	100% of vehicles entering Palo Alto are electric vehicles	3%	50%	2030			54,158	-$42	assume it is the same as T-EV-1
Rethinking Mobility	T-OFF-1	Transportation offsets	Purchase offsets	Procure high quality carbon offsets	100%	100%	2030	$0	$0.00	-	#DIV/0!	
Solid Waste	SW-1	Policy and Outreach	Establish Zero Waste Goal and Supporting Policies	Establish zero solid waste as ordinance (90% or better by 2021; 95% by 2035)	Target diversion rate	95%	2030			52,621		
Solid Waste	SW-2	Government Infrastructure	Enhance government infrastructure for waste diversion and resource recovery	Develop infrastructure for local composting and energy recovery from commercial organics (anaerobic digestion at RWQCP)			2030				supporting	
Solid Waste	SW-3	Community Programs for Waste Management	Develop or enhance programs for waste diversion and resource recovery	Develop residential food scrap diversion/composting program, and enhance commercial organics program to divert food waste to energy recovery			2030				supporting	
Water	W-1	Policy and Outreach	Strengthen policies for community-wide water conservation and water efficiency	Set aggressive water conservation goals in the 2015 UWMP. Implement UWMP water conservation measures (Demand Management Measures)			2030					
Water	W-2	Government Infrastructure and Supply	Supplement SFPUC water supply with new sources of potable water	Implement the City's 2008 Recycled Water Facility Plan and the City's Emergency Water Supply and Storage project for develop City's groundwater resources as supplemental supply during droughts			2030					

City of Palo Alto Sustainability and Climate Action Plan (S/CAP) calculations of marginal abatement cost

Strategy Code	Description	MTCO2e Avoided in 2030 for City of Palo Alto	Marginal abatement cost $/Ton (negative = savings)
NG-GAS-1	Encourage all-electric new buildings	11900	$ (670.35)
T-INC-1	Provide universal transit passes	7600	$ (427.21)
T-EV-1	Electrify Palo Alto-based vehicles	25200	$ (42.28)
T-EV-2	Electrify inbound vehicles	29800	$ (42.28)
NG-RES-1	Electrify residential water heating	13600	$ (34.55)
T-INC-2	Implement parking pricing	18400	$ (26.78)
T-FAC-2	Expand transit options	19200	$ 4.11
NG-COMM-2	Electrify space heating in businesses	15900	$ 19.02
NG-COOK-1	Electrify commercial cooking	11300	$ 29.41
NG-COMM-1	Electrify water heating in businesses	21200	$ 44.31
T-FAC-3	Grow ridesharing services and mobility apps	6400	$ 47.94
T-FAC-1	Expand bicycle infrastructure	8400	$ 94.15
NG-RES-2	Electrify residential space heating	23300	$ 165.02
T-LU-1	Increase zero-impact, mixed use housing	2900	$ 53,375.58

City of Palo Alto Council Adopts the Sustainability and Climate Action Plan (S/CAP) Framework
https://www.cityofpaloalto.org/news/displaynews.asp?NewsID=3775

Calculations were conducted from a societal perspective assuming community-scale implementation

City of Palo Alto Sustainability and Climate Action Plan (S/CAP) calculations

Strategy Implementation Plan

Code:	NG-GAS-1
Lever	No New Gas Hookups
Strategy	Reduce natural gas usage in new construction and major remodels
Description	Natural gas usage inthe new construction (and major remodels) must be reduced along with existing buildings. Restrictions on natural gas usage in the new construction sector should be tied to California's zero net energy goals.
Strategic Target	100% Net Zero Commercial and Residential Buildings by Target Year
Year	2030

Strategic Targets (Scenario Inputs)

Percent of Residential Required to be Net Zero	100%	Choose Percent Required to be Net Zero
Percent of Commercial Required to be Net Zero	100%	Choose Percent Required to be Net Zero

Financial Analysis: Overall

NPV of Hitting Goal by Target Year	$122,217,929
Total Capital Cost (No Discounting)	$137,664,422
Total Capital Cost (Discounting)	$102,166,900
MTCO2E Saved in Selected Target Year	14,025
Cumulative MTCO2E Avoided	182,319
Abatement Cost ($/MTCO2e avoided)	($670)
Additional Electric Load by Target Year (kWh)	15,045,374

Description of Methodology	This measures assumes that X% of new commercial construction and Y% of new residential construciton are built to a net zero standard - relying on rooftop PV to provide 100% of energy needs and relying on air source heat pumps and heat pump hot water heateres to provide all space and water heating needs.

Financial Analysis: Technologies Implemented

Technology	Total Built	Total Capital Cost (w/ Discounting)	NPV
Net Zero Commercial Square Footage	4,917,727	$63,185,974	$95,057,134
Net Zero Residential Housing Units	4,734	$38,980,926	$27,160,795

Flows

Action #	Implementation Actions: Policy to reduce transaction costs of fuel switching	Lead	Key Partner(s)	Target Year
1	Implement financial incentives for zero net energy homes and businesses.	Utilities	UAC, Council	2015
2	Participation in PACE financing programs for renewable energy and energy efficiency projects	Development Services	Utilities, Council	2015
3				
4				
5				

Systems

Action #	Implementation Actions: Policies to reduce installation of gas water and space heaters	Lead	Key Partner(s)	Target Year
1	Implement an interim reach code	Development Services	Council, UAC	2015
2	Require Zero Net Energy by 2019 for residential	Development Services	Council, UAC	2019
3	Establish policy of no new gas connections for new construction, additions, or major remodels	Development Services	Council, UAC	2020
4				
5				

Behavior

Action #	Implementation Actions: Education and Outreach	Lead	Key Partner(s)	Target Year
1	Establish an educational and outreach program related to the benefits of all-electric homes.	Utilities, Communications	UAC	2016
2				
3				

Assumptions and Calculations

No new large, high DHW load commercial facilities
HPHW and Heat Pump space heating replaces gas BAU in every case
No batteries are required, and is assumed grid handles storage
EVs are not considered in this calculation
New residential based on Placeworks assumption of 2,720 new homes by 2030. Assume even uptake of 181 units per year
New commercial based on Placeworks assumption of 15,482 new jobs by 2039. Adjust against existing non-res sqft assumptions and assume even uptake per year

Investment Cost Calculations

Commercial PV	
Multiple Replacement Multiplier	1.0
Total Incremental Capital Cost of Hitting Target (No Discounting)	$85,007,125
Annual Incremental Capital Cost of Hitting Target (No Discounting)	$5,667,142
Present Value of Total Incremental Capital Cost of Hitting Target (Discounting)	($63,009,477)
Commercial HPHW	
Multiple Replacement Multiplier	1.1
Total Incremental Capital Cost of Hitting Target (No Discounting)	$238,116
Annual Incremental Capital Cost of Hitting Target (No Discounting)	$15,874.37
Present Value of Total Incremental Capital Cost of Hitting Target (Discounting)	($176,497)
Commercial PV + HPHW	
Presevent Value of Total Incremental Capital Cost of Hitting Target	($63,185,974)
Residential PV	
Multiple Replacement Multiplier	1.0
Total Incremental Capital Cost of Hitting Target (No Discounting)	$50,127,193
Annual Incremental Capital Cost of Hitting Target (No Discounting)	$3,341,812.85
Present Value of Total Incremental Capital Cost of Hitting Target (Discounting)	($37,155,570)
Residential HPHW	
Multiple Replacement Multiplier	1.1
Total Incremental Capital Cost of Hitting Target (No Discounting)	$2,291,988
Annual Incremental Capital Cost of Hitting Target (No Discounting)	$208,362.59
Present Value of Total Incremental Capital Cost of Hitting Target (Discounting)	($1,825,356)
Residential PV + HPHW	
Presevent Value of Total Incremental Capital Cost of Hitting Target	($38,980,925.53)
Combined Commercial and Residential	
Total Incremental Capital Cost of Hitting Target (No Discounting)	$137,664,422
Total Incremental Capital Cost of Hitting Target (Discounting)	$102,166,899.60

Investment Benefit Calculations

Commercial PV		
Life of Solar PV System (Years)	25	http://www.cityofpaloalto.org/civicax/filebank/documents/29949
Cumulative Lifespan of Solar PV Systems (Years)	40	Calculation
Lifetime Electricity Cost of Hitting Target (No Discounting)	($284,252,723)	
Annual Electricity Cost of Hitting Target (No Discounting)	($7,106,318.07)	
Presevent Value of Lifetime Electricity Cost of Hitting Target (Discounting)	$140,653,746.73	FOR INFORMAITON ONLY
Commercial HPHW		
Life of HPHW System (Years)	13	CPAU Study
Cumulative Lifespan of HPHW System (Years)	28	Calculation
Lifetime Electricity Cost of Hitting Target (No Discounting)	$7,241,669	
Annual Electricity Cost of Hitting Target (No Discounting)	$258,631.05	
Present Value of Lifetime Electricity Cost of Hitting Target (Discounting)	($4,309,585.58)	FOR INFORMAITON ONLY
Commercial BAU		
Life of Standard Gas Water Heater (Years)	13	CPAU Study
Cumulative Lifespan of Gas Water Heaters (Years)	28	
Lifetime BAU Gas + Electricity Cost Avoided (No Discounting)	$265,905,913	
Annual BAU Gas + Electricity Cost Avoided (No Discounting)	$9,496,639.73	
Present Value of Lifetime BAU Gas + Electricity Cost Avoided (Discounting)	$158,243,108.24	
Policy vs. BAU		
Present Value of Energy Costs Savings from Hitting Target ($)	$158,243,108	
Residential PV		
Life of Solar PV System (Years)	25	
Cumulative Lifespan of Solar PV Systems (Years)	45	
Lifetime Electricity Cost of Hitting Target (No Discounting)	($145,033,941)	
Annual Electricity Cost of Hitting Target (No Discounting)	($3,222,976.46)	
Presevent Value of Lifetime Electricity Cost of Hitting Target (Discounting)	$66,780,200.27	FOR INFORMAITON ONLY
Residential HPHW		
Life of HPHW System (Years)	13	
Cumulative Lifespan of HPHW System (Years)	33	
Lifetime Electricity Cost of Hitting Target (No Discounting)	$16,441,389	
Annual Electricity Cost of Hitting Target (No Discounting)	$498,223.91	
Present Value of Lifetime Electricity Cost of Hitting Target (Discounting)	($9,041,591.00)	FOR INFORMAITON ONLY
Residential BAU		
Life of Standard Gas Water Heater (Years)	13	
Cumulative Lifespan of Gas Water Heaters (Years)	33	
Lifetime BAU Gas + Electricity Cost Avoided (No Discounting)	$120,273,275	
Annual BAU Gas + Electricity Cost Avoided (No Discounting)	$3,644,644.69	
Present Value of Lifetime BAU Gas + Electricity Cost Avoided (Discounting)	$66,141,720.34	
Policy vs. BAU		
Present Value of Energy Costs Savings from Hitting Target ($)	$66,141,720.34	
Commercial Emissions Avoided		
Commercial MTCO2e Avoided in Target Year	6,166	
Commercial MTCO2e Avoided Cumulatively	80,154	
Residential Emissions Avoided		
Residential MTCO2e Avoided in Target Year	7,859	
Residential MTCO2e Avoided Cumulatively	102,165	
Total MTCO2e Avoided in Target Year	14,025	
Total MTCO2e Avoided Cumulatively	182,319	

Net Present Value Calcualtion

Commercial NPV of Hitting Target	$95,057,134
Residential NPV of Hitting Target	$27,160,795
Total NPV of Hitting Target	$122,217,929

Additional Electric Load

Commercial: Additional Electric Load by Target Year (kWh)	8,262,166
Residential: Additional Electric Load by Target Year (kWh)	6,783,208
Total Additional Electric Load by Target Year (kWh)	15,045,374

Savings Streams Data Inputs

New Residential Units/Year	316	Placeworks Scenario 4
New Commercial Square Footage/Year	327,848	Placeworks Scenario 4
Target Year	2030	
Years to Reach Target	15	

Assumed % decrease/yr 3% due to energy efficiency (BAU code)

Commercial: Net Zero Energy Savings Streams

NOTE: BAU forecasts only applicable to the targeted percent of new commercial construction

Commercial

Year	Year Number	New Commercial Square Footage	BAU Annual Gas Use of New Commercial Square Footage (therms)	BAU Cumulative Annual Gas Use of New Commercial Square Footage (therms)	BAU: Lifeime Gas Use of New Commercial Square Footage (therms)	BAU: Lifetime Gas Cost of New Commercial Square Footage ($)
2016	1	327,848	93,972	93,972	1,221,632	$1,389,032
2017	2	327,848	91,622	185,594	1,191,091	$1,458,219
2018	3	327,848	89,273	274,867	1,160,551	$1,515,111
2019	4	327,848	86,924	361,791	1,130,010	$1,553,681
2020	5	327,848	84,575	446,366	1,099,469	$1,598,571
2021	6	327,848	82,225	528,591	1,068,928	$1,614,906
2022	7	327,848	79,876	608,467	1,038,387	$1,620,609
2023	8	327,848	77,527	685,994	1,007,847	$1,614,990
2024	9	327,848	75,177	761,171	977,306	$1,616,403
2025	10	327,848	72,828	833,999	946,765	$1,611,217
2026	11	327,848	70,479	904,478	916,224	$1,605,618
2027	12	327,848	68,129	972,607	885,683	$1,571,339
2028	13	327,848	65,780	1,038,387	855,143	$1,545,561
2029	14	327,848	63,431	1,101,818	824,602	$1,516,169
2030	15	327,848	61,082	1,162,900	794,061	$1,475,001
2031	16	0	0	0	0	$0
2032	17	0	0	0	0	$0
2033	18	0	0	0	0	$0
2034	19	0	0	0	0	$0
2035	20	0	0	0	0	$0

Year	BAU: Annual Electricity Use of New Commercial Square Footage (kWh)	BAU: Liftime Electricity Use of New Commercial Square Footage (kWh)	BAU Lifetime Electricity Cost of New Commercial Square Footage ($)	BAU Lifetime Electricity and Natural Gas Cost of New Commercial Square Footage	Commercial Policy: New Commercial Square Footage Impacted by Policy	Commercial Policy: Incremental Cost per HPWH ($)	Commercial Policy: Incremental Cost Per Commercial Square Foot of HPWH ($/Sq Ft)	Commercial Policy: Total Incremental Cost of HPWH ($)	Commercial Policy: Annual HPHW EUI (kWh/sqft/yr)	Commercial Policy: Total Annual HPHW Electricity Use (kWh)
2016	4,819,372	120,484,305	$13,813,970	$15,203,001	327,848	$550	$0.05	$18,029	0.84	276,653.36
2017	4,819,372	120,484,305	$14,625,426	$16,083,644	327,848	$550	$0.05	$18,029	0.84	276,653.36
2018	4,819,372	120,484,305	$15,413,215	$16,928,326	327,848	$550	$0.05	$18,029	0.84	276,653.36
2019	4,819,372	120,484,305	$15,839,092	$17,392,773	327,848	$550	$0.05	$18,029	0.84	276,653.36
2020	4,819,372	120,484,305	$15,839,088	$17,437,659	327,848	$550	$0.05	$18,029	0.84	276,653.36
2021	4,819,372	120,484,305	$15,839,090	$17,453,995	327,848	$550	$0.05	$18,029	0.84	276,653.36
2022	4,819,372	120,484,305	$15,971,210	$17,591,819	327,848	$550	$0.05	$18,029	0.84	276,653.36
2023	4,819,372	120,484,305	$16,200,640	$17,815,630	327,848	$550	$0.05	$18,029	0.84	276,653.36
2024	4,819,372	120,484,305	$16,321,960	$17,938,363	327,848	$550	$0.05	$18,029	0.84	276,653.36
2025	4,819,372	120,484,305	$16,445,707	$18,056,924	327,848	$243	$0.02	$7,974	0.84	276,653.36
2026	4,819,372	120,484,305	$16,649,368	$18,254,986	327,848	$243	$0.02	$7,974	0.84	276,653.36
2027	4,819,372	120,484,305	$16,945,144	$18,516,483	327,848	$243	$0.02	$7,974	0.84	276,653.36
2028	4,819,372	120,484,305	$17,246,335	$18,791,896	327,848	$243	$0.02	$7,974	0.84	276,653.36
2029	4,819,372	120,484,305	$17,563,202	$19,079,371	327,848	$243	$0.02	$7,974	0.84	276,653.36
2030	4,819,372	120,484,305	$17,886,041	$19,361,042	327,848	$243	$0.02	$7,974	0.84	276,653.36
2031	0	0	$0	$0	0	$228	$0.02	$0	0.84	0.00
2032	0	0	$0	$0	0	$214	$0.02	$0	0.84	0.00
2033	0	0	$0	$0	0	$201	$0.02	$0	0.84	0.00
2034	0	0	$0	$0	0	$188	$0.02	$0	0.84	0.00
2035	0	0	$0	$0	0	$177	$0.02	$0	0.84	0.00

Year	Commercial Policy: Total Lifetime HPHW Electricity Use (kWh)	Commercial Policy: Total Lifetime HPHW Electricity Cost ($)	Commercial Policy: Installed Cost of Solar PV Per Watt ($/W)	Commercial Policy: PV Capacity Per Square Foot Required to Meet Electricity Demand (W/Sq Ft)	Commercial Policy: Total Installed Cost of Solar PV ($)	Commercial Policy: Annual Installed PV Capacity (kW)	Commercial Policy: Annual Electricity Produced by Newly Installed PV Capacity (kWh)	Commercial Policy: Lifetime Electricity Produced by Newly Installed PV Capacity (kWh)	Commercial Policy: Lifetime Cost of Electricity Produced by Newly Installed PV Capacity ($)	Commercial Policy: Lifetime Electricity Cost of HPWH and PV ($)	Total Incremental Cost of Installing HPWH and PV ($)	BAU vs. Commercial Policy: Total Lifetime Energy Savings
2016	3,596,494	$412,351	$3.24	10.923	$11,603,089	3,581	5,646,837	141,170,915	($16,185,766)	($15,773,414)	$11,621,118	$30,976,416
2017	3,596,494	$436,573	$2.68	10.923	$9,590,619	3,581	5,646,837	141,170,915	($17,136,545)	($16,699,972)	$9,608,647	$32,783,616
2018	3,596,494	$460,089	$2.21	10.923	$7,927,196	3,581	5,646,837	141,170,915	($18,059,595)	($17,599,505)	$7,945,225	$34,527,832
2019	3,596,494	$472,802	$1.83	10.923	$6,552,283	3,581	5,646,837	141,170,915	($18,558,592)	($18,085,791)	$6,570,311	$35,478,564
2020	3,596,494	$472,802	$1.51	10.923	$5,415,837	3,581	5,646,837	141,170,915	($18,558,588)	($18,085,787)	$5,433,866	$35,523,446
2021	3,596,494	$472,802	$1.25	10.923	$4,476,500	3,581	5,646,837	141,170,915	($18,558,590)	($18,085,788)	$4,494,529	$35,539,783
2022	3,596,494	$476,746	$1.24	10.923	$4,457,466	3,581	5,646,837	141,170,915	($18,713,394)	($18,236,649)	$4,475,495	$35,828,468
2023	3,596,494	$483,594	$1.24	10.923	$4,438,513	3,581	5,646,837	141,170,915	($18,982,216)	($18,498,622)	$4,456,541	$36,314,252
2024	3,596,494	$487,216	$1.23	10.923	$4,419,640	3,581	5,646,837	141,170,915	($19,124,367)	($18,637,151)	$4,437,669	$36,575,514
2025	3,596,494	$490,909	$1.23	10.923	$4,400,847	3,581	5,646,837	141,170,915	($19,269,361)	($18,778,451)	$4,408,821	$36,835,375
2026	3,596,494	$496,989	$1.22	10.923	$4,382,135	3,581	5,646,837	141,170,915	($19,507,989)	($19,011,000)	$4,390,109	$37,265,986
2027	3,596,494	$505,818	$1.22	10.923	$4,363,502	3,581	5,646,837	141,170,915	($19,854,549)	($19,348,731)	$4,371,476	$37,865,214
2028	3,596,494	$514,808	$1.21	10.923	$4,344,948	3,581	5,646,837	141,170,915	($20,207,453)	($19,692,644)	$4,352,922	$38,484,540
2029	3,596,494	$524,267	$1.21	10.923	$4,326,473	3,581	5,646,837	141,170,915	($20,578,725)	($20,054,458)	$4,334,447	$39,133,828
2030	3,596,494	$533,904	$1.20	10.923	$4,308,077	3,581	5,646,837	141,170,915	($20,956,993)	($20,423,089)	$4,316,051	$39,784,131
2031	0	$0	$1.20	10.923	$0	0	0	0	$0	$0	$0	$0
2032	0	$0	$1.19	10.923	$0	0	0	0	$0	$0	$0	$0
2033	0	$0	$1.19	10.923	$0	0	0	0	$0	$0	$0	$0
2034	0	$0	$1.18	10.923	$0	0	0	0	$0	$0	$0	$0
2035	0	$0	$1.18	10.923	$0	0	0	0	$0	$0	$0	$0

	2036	21	0	0	0	0	$0	0	0	$0	$0	0	$166	$0.02	$0	0.84	0.00	0	$0	$1.17	10.923	$0	0	0	0	$0	$0	$0	$0
	2037	22	0	0	0	0	$0	0	0	$0	$0	0	$156	$0.02	$0	0.84	0.00	0	$0	$1.17	10.923	$0	0	0	0	$0	$0	$0	$0
	2038	23	0	0	0	0	$0	0	0	$0	$0	0	$146	$0.01	$0	0.84	0.00	0	$0	$1.16	10.923	$0	0	0	0	$0	$0	$0	$0
	2039	24	0	0	0	0	$0	0	0	$0	$0	0	$137	$0.01	$0	0.84	0.00	0	$0	$1.16	10.923	$0	0	0	0	$0	$0	$0	$0
	2040	25	0	0	0	0	$0	0	0	$0	$0	0	$129	$0.01	$0	0.84	0.00	0	$0	$1.15	10.923	$0	0	0	0	$0	$0	$0	$0
	2041	26	0	0	0	0	$0	0	0	$0	$0	0	$121	$0.01	$0	0.84	0.00	0	$0	$1.15	10.923	$0	0	0	0	$0	$0	$0	$0
	2042	27	0	0	0	0	$0	0	0	$0	$0	0	$113	$0.01	$0	0.84	0.00	0	$0	$1.14	10.923	$0	0	0	0	$0	$0	$0	$0
	2043	28	0	0	0	0	$0	0	0	$0	$0	0	$106	$0.01	$0	0.84	0.00	0	$0	$1.14	10.923	$0	0	0	0	$0	$0	$0	$0
	2044	29	0	0	0	0	$0	0	0	$0	$0	0	$100	$0.01	$0	0.84	0.00	0	$0	$1.13	10.923	$0	0	0	0	$0	$0	$0	$0
	2045	30	0	0	0	0	$0	0	0	$0	$0	0	$93	$0.01	$0	0.84	0.00	0	$0	$1.13	10.923	$0	0	0	0	$0	$0	$0	$0
	2046	31	0	0	0	0	$0	0	0	$0	$0	0	$88	$0.01	$0	0.84	0.00	0	$0	$1.12	10.923	$0	0	0	0	$0	$0	$0	$0
	2047	32	0	0	0	0	$0	0	0	$0	$0	0	$82	$0.01	$0	0.84	0.00	0	$0	$1.12	10.923	$0	0	0	0	$0	$0	$0	$0
	2048	33	0	0	0	0	$0	0	0	$0	$0	0	$77	$0.01	$0	0.84	0.00	0	$0	$1.11	10.923	$0	0	0	0	$0	$0	$0	$0
	2049	34	0	0	0	0	$0	0	0	$0	$0	0	$72	$0.01	$0	0.84	0.00	0	$0	$1.11	10.923	$0	0	0	0	$0	$0	$0	$0
	2050	35	0	0	0	0	$0	0	0	$0	$0	0	$68	$0.01	$0	0.84	0.00	0	$0	$1.10	10.923	$0	0	0	0	$0	$0	$0	$0
TOTALS			4,917,727	1,162,900	9,961,002	15,117,699		72,290,583			$265,905,913	4,917,727			$210,102		4,149,800		$7,241,669	#REF!		$85,007,125		84,702,549		-$284,252,723	-$277,011,053	$85,217,227	
														2050	$295,133							$163,467,346							
														2030	$202,128							$80,699,048							
														2025	$162,258							$58,881,143							

Residential: Net Zero Energy Savings Streams

NOTE: BAU forecasts only applicable to the targeted percent of new residential construction

Residential

	Year	Year Number	New Residential Housing Units	BAU Annual Gas Use of New Residential Housing Units (therms)	BAU Cumulative Annual Gas Use of New Residential Housing Units (therms)	BAU: Lifetime Gas Use of New Resiential Housing Units (therms)	BAU: Lifetime Gas Cost of New Resiential Housing Units ($)	BAU: Annual Electricity Use of New Resiential Housing Units (kWh)	BAU: Liftime Electricity Use of New Resiential Housing Units (kWh)	BAU Lifetime Electricity Cost of New Resiential Housing Units ($)	BAU Lifetime Electricity and Natural Gas Cost of New Resiential Housing Units	Residential Policy: New Residential Housing Units Impacted by Policy	Residential Policy: Incremental Cost per HPWH ($)	Residential Policy: Incremental HPWH Cost Per Housing Unit ($/Housing Unit)	Residential Policy: Total Incremental Cost of HPWH ($)	Residential Policy: Annual Electricity Use of HPWH (kWh)	Residential Policy: Total Annual HPHW Electricity Use (kWh)	Residential Policy: Total Lifetime HPHW Electricity Use (kWh)	Residential Policy: Total Lifetime HPHW Electricity Cost ($)	Residential Policy: Installed Cost of Solar PV Per Watt ($/W)	Residential Policy: Annual Electricity Demand Per Housing Unit (kWH)	Residential Policy: Total Annual Electricity Demand (kWh)	Residential Policy: PV Capacity Per Housing Unit (kW)	Residential Policy: Total Installed Cost of Solar PV ($)	Residential Policy: Annual Installed PV Capacity (kW)	Residential Policy: Annual Electricity Produced by Newly Installed PV Capacity (kWh)	Residential Policy: Lifetime Electricity Produced by Newly Installed PV Capacity (kWh)	Residential Policy: Lifetime Cost of Electricity Produced by Newly Installed PV Capacity ($)	Residential Policy: Lifetime Electricity Cost of HPWH and PV ($)	Total Incremental Cost of Installing HPWH and PV ($)	BAU vs. Residential Policy: Total Lifetime Energy Savings
	2016	1	316	119,777	119,777	1,557,100	$2,004,033	1,729,100	43,227,494	$4,956,192	$6,960,224	316	$550	$550	$173,535	1,927	608,106	7,905,380	$960,202	$3.99	8,839	2,789,420	5.61	$7,058,463	1,769	2,789,420	69,735,494	($8,470,198)	($7,509,996)	$7,231,998	$14,470,221
	2017	2	316	116,782	236,559	1,518,172	$2,071,198	1,729,100	43,227,494	$5,247,327	$7,318,525	316	$550	$550	$173,535	1,927	608,106	7,905,380	$992,115	$3.28	8,839	2,789,420	5.61	$5,804,086	1,769	2,789,420	69,735,494	($8,751,717)	($7,759,602)	$5,977,621	$15,078,126
	2018	3	316	113,788	350,347	1,479,245	$2,153,056	1,729,100	43,227,494	$5,529,971	$7,683,027	316	$550	$550	$173,535	1,927	608,106	7,905,380	$1,048,698	$2.70	8,839	2,789,420	5.61	$4,772,627	1,769	2,789,420	69,735,494	($9,250,844)	($8,202,147)	$4,946,162	$15,885,174
	2019	4	316	110,794	461,141	1,440,317	$2,210,782	1,729,100	43,227,494	$5,682,767	$7,893,549	316	$550	$550	$173,535	1,927	608,106	7,905,380	$1,080,781	$2.22	8,839	2,789,420	5.61	$3,924,471	1,769	2,789,420	69,735,494	($9,533,864)	($8,453,083)	$4,098,007	$16,346,632
	2020	5	316	107,799	568,940	1,401,390	$2,261,770	1,729,100	43,227,494	$5,682,766	$7,944,536	316	$550	$550	$173,535	1,927	608,106	7,905,380	$1,080,781	$1.82	8,839	2,789,420	5.61	$3,227,044	1,769	2,789,420	69,735,494	($9,533,864)	($8,453,083)	$3,400,579	$16,397,619
	2021	6	316	104,805	673,745	1,362,462	$2,289,987	1,729,100	43,227,494	$5,682,766	$7,972,753	316	$550	$550	$173,535	1,927	608,106	7,905,380	$1,080,781	$1.50	8,839	2,789,420	5.61	$2,653,558	1,769	2,789,420	69,735,494	($9,533,864)	($8,453,083)	$2,827,093	$16,425,836
	2022	7	316	101,810	775,555	1,323,535	$2,317,109	1,729,100	43,227,494	$5,730,169	$8,047,278	316	$550	$550	$173,535	1,927	608,106	7,905,380	$1,090,099	$1.48	8,839	2,789,420	5.61	$2,626,265	1,769	2,789,420	69,735,494	($9,616,057)	($8,525,958)	$2,799,800	$16,573,236
	2023	8	316	98,816	874,371	1,284,607	$2,315,397	1,729,100	43,227,494	$5,812,484	$8,127,881	316	$550	$550	$173,535	1,927	608,106	7,905,380	$1,097,599	$1.47	8,839	2,789,420	5.61	$2,599,253	1,769	2,789,420	69,735,494	($9,682,219)	($8,584,620)	$2,772,789	$16,712,501
	2024	9	316	95,822	970,193	1,245,680	$2,309,412	1,729,100	43,227,494	$5,856,011	$8,165,423	316	$550	$550	$173,535	1,927	608,106	7,905,380	$1,106,008	$1.45	8,839	2,789,420	5.61	$2,572,519	1,769	2,789,420	69,735,494	($9,756,399)	($8,650,390)	$2,746,055	$16,815,814
	2025	10	316	92,827	1,063,020	1,206,752	$2,301,050	1,729,100	43,227,494	$5,900,409	$8,201,459	316	$243	$243	$76,754	1,927	608,106	7,905,380	$1,114,586	$1.44	8,839	2,789,420	5.61	$2,546,060	1,769	2,789,420	69,735,494	($9,832,062)	($8,717,476)	$2,622,815	$16,918,936
	2026	11	316	89,833	1,152,853	1,167,825	$2,291,919	1,729,100	43,227,494	$5,973,479	$8,265,398	316	$243	$243	$76,754	1,927	608,106	7,905,380	$1,117,013	$1.42	8,839	2,789,420	5.61	$2,519,874	1,769	2,789,420	69,735,494	($9,853,473)	($8,736,460)	$2,596,628	$17,001,859
	2027	12	316	86,838	1,239,691	1,128,897	$2,242,420	1,729,100	43,227,494	$6,079,598	$8,322,018	316	$243	$243	$76,754	1,927	608,106	7,905,380	$1,136,909	$1.41	8,839	2,789,420	5.61	$2,493,956	1,769	2,789,420	69,735,494	($10,028,985)	($8,892,076)	$2,570,710	$17,214,093
	2028	13	316	83,844	1,323,535	1,089,970	$2,203,615	1,729,100	43,227,494	$6,187,659	$8,391,274	316	$243	$243	$76,754	1,927	608,106	7,905,380	$1,157,171	$1.40	8,839	2,789,420	5.61	$2,468,305	1,769	2,789,420	69,735,494	($10,207,716)	($9,050,546)	$2,545,060	$17,441,820
	2029	14	316	80,849	1,404,384	1,051,042	$2,160,060	1,729,100	43,227,494	$6,301,345	$8,461,405	316	$243	$243	$76,754	1,927	608,106	7,905,380	$1,178,472	$1.38	8,839	2,789,420	5.61	$2,442,918	1,769	2,789,420	69,735,494	($10,395,616)	($9,217,145)	$2,519,672	$17,678,550
	2030	15	316	77,855	1,482,239	1,012,115	$2,101,351	1,729,100	43,227,494	$6,417,174	$8,518,525	316	$243	$243	$76,754	1,927	608,106	7,905,380	$1,200,174	$1.37	8,839	2,789,420	5.61	$2,417,792	1,769	2,789,420	69,735,494	($10,587,062)	($9,386,887)	$2,494,546	$17,905,412
	2031	16	0	0	0	0	$0	0	0	$0	$0	0	$228	$228	$0	1,927	0	0	$0	$1.35	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2032	17	0	0	0	0	$0	0	0	$0	$0	0	$214	$214	$0	1,927	0	0	$0	$1.34	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2033	18	0	0	0	0	$0	0	0	$0	$0	0	$201	$201	$0	1,927	0	0	$0	$1.32	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2034	19	0	0	0	0	$0	0	0	$0	$0	0	$188	$188	$0	1,927	0	0	$0	$1.31	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2035	20	0	0	0	0	$0	0	0	$0	$0	0	$177	$177	$0	1,927	0	0	$0	$1.30	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2036	21	0	0	0	0	$0	0	0	$0	$0	0	$166	$166	$0	1,927	0	0	$0	$1.28	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2037	22	0	0	0	0	$0	0	0	$0	$0	0	$156	$156	$0	1,927	0	0	$0	$1.27	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2038	23	0	0	0	0	$0	0	0	$0	$0	0	$146	$146	$0	1,927	0	0	$0	$1.26	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2039	24	0	0	0	0	$0	0	0	$0	$0	0	$137	$137	$0	1,927	0	0	$0	$1.25	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2040	25	0	0	0	0	$0	0	0	$0	$0	0	$129	$129	$0	1,927	0	0	$0	$1.23	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2041	26	0	0	0	0	$0	0	0	$0	$0	0	$121	$121	$0	1,927	0	0	$0	$1.22	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2042	27	0	0	0	0	$0	0	0	$0	$0	0	$113	$113	$0	1,927	0	0	$0	$1.21	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2043	28	0	0	0	0	$0	0	0	$0	$0	0	$106	$106	$0	1,927	0	0	$0	$1.19	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2044	29	0	0	0	0	$0	0	0	$0	$0	0	$100	$100	$0	1,927	0	0	$0	$1.18	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2045	30	0	0	0	0	$0	0	0	$0	$0	0	$93	$93	$0	1,927	0	0	$0	$1.17	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2046	31	0	0	0	0	$0	0	0	$0	$0	0	$88	$88	$0	1,927	0	0	$0	$1.16	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2047	32	0	0	0	0	$0	0	0	$0	$0	0	$82	$82	$0	1,927	0	0	$0	$1.15	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2048	33	0	0	0	0	$0	0	0	$0	$0	0	$77	$77	$0	1,927	0	0	$0	$1.13	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2049	34	0	0	0	0	$0	0	0	$0	$0	0	$72	$72	$0	1,927	0	0	$0	$1.12	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
	2050	35	0	0	0	0	$0	0	0	$0	$0	0	$68	$68	$0	1,927	0	0	$0	$1.11	0	0	0.00	$0	0	0	0	$0	$0	$0	$0
TOTALS			4,734	1,482,239	12,696,350	19,269,107		25,936,497			$120,273,275	#REF!	#REF!	#REF!	$2,022,343		9,121,592	118,580,698	$16,441,389	#REF!	132,589	41,841,297		$50,127,193				-$145,033,941	-$128,592,552	$52,149,535	

	Year Number	New Residential Housing Units	BAU Annual Gas Use of New Residential Housing Units (therms)	BAU Cumulative Annual Gas Use of New Residential Housing Units (therms)
2016	1	316	119,777	119,777
2017	2	316	116,782	236,559
2018	3	316	113,788	350,347
2019	4	316	110,794	461,141
2020	5	316	107,799	568,940
2021	6	316	104,805	673,745
2022	7	316	101,810	775,555
2023	8	316	98,816	874,371
2024	9	316	95,822	970,193
2025	10	316	92,827	1,063,020
2026	11	316	89,833	1,152,853
2027	12	316	86,838	1,239,691
2028	13	316	83,844	1,323,535
2029	14	316	80,849	1,404,384
2030	15	316	77,855	1,482,239
2031	16	316	74,861	1,557,100
2032	17	316	71,866	1,628,966
2033	18	316	68,872	1,697,837
2034	19	316	65,877	1,763,715
2035	20	316	62,883	1,826,598
2036	21	316	59,888	1,886,486
2037	22	316	56,894	1,943,380
2038	23	316	53,900	1,997,280
2039	24	316	50,905	2,048,185
2040	25	316	47,911	2,096,096
2041	26	316	44,916	2,141,012
2042	27	316	41,922	2,182,934
2043	28	316	38,927	2,221,861
2044	29	316	35,933	2,257,794
2045	30	316	32,939	2,290,733
2046	31	316	29,944	2,320,677
2047	32	316	26,950	2,347,627
2048	33	316	23,955	2,371,582
2049	34	316	20,961	2,392,543
2050	35	316	17,967	2,410,510
		11,045	2,410,510	54,079,266

	Year Number	New Commercial Square Footage	BAU Annual Gas Use of New Commercial Square Footage (therms)	BAU Cumulative Annual Gas Use of New Commercial Square Footage (therms)
2016	1	327,848	93,972	93,972
2017	2	327,848	91,622	185,594
2018	3	327,848	89,273	274,867
2019	4	327,848	86,924	361,791
2020	5	327,848	84,575	446,366
2021	6	327,848	82,225	528,591
2022	7	327,848	79,876	608,467
2023	8	327,848	77,527	685,994
2024	9	327,848	75,177	761,171
2025	10	327,848	72,828	833,999
2026	11	327,848	70,479	904,478
2027	12	327,848	68,129	972,607
2028	13	327,848	65,780	1,038,387
2029	14	327,848	63,431	1,101,818
2030	15	327,848	61,082	1,162,900
2031	16	327,848	58,732	1,221,632
2032	17	327,848	56,383	1,278,015
2033	18	327,848	54,034	1,332,049
2034	19	327,848	51,684	1,383,733
2035	20	327,848	49,335	1,433,069
2036	21	327,848	46,986	1,480,054
2037	22	327,848	44,637	1,524,691
2038	23	327,848	42,287	1,566,978
2039	24	327,848	39,938	1,606,916
2040	25	327,848	37,589	1,644,505
2041	26	327,848	35,239	1,679,744
2042	27	327,848	32,890	1,712,634
2043	28	327,848	30,541	1,743,175
2044	29	327,848	28,192	1,771,367
2045	30	327,848	25,842	1,797,209
2046	31	327,848	23,493	1,820,702
2047	32	327,848	21,144	1,841,846
2048	33	327,848	18,794	1,860,640
2049	34	327,848	16,445	1,877,085
2050	35	327,848	14,096	1,891,181

City of Palo Alto Sustainability and Climate Action Plan (S/CAP) calculations

Strategy Implementation Plan

Lever	Reduce carbon intensity of vehicular travel	
Strategy Code:	**T-EV-1**	
Strategy	**Convert vehicles in Palo Alto and surrounding region to EVs**	
Description	Since the city receives 100% of its electricity from renewable resources, taking steps to encourage all new vehicles purchased to be EVs would significantly reduce emissions associated with on-road vehicles.	
Strategic Target	90%	By EV Replacement Target Year (auto-generated from row 12)
Target Year	2030	**Select Target Year on "Summary of SCAP Strategies" tab**

Strategic Targets (Scenario Inputs)

Percent of Non-EV Vehicles Replaced by Target Year	90%	**Enter % targets for each Target Year**

Financial Analysis: Overall

NPV of Hitting Goal by Target Year	$92,952,596
Total Capital Cost (No Discounting)	$282,039,867
Total Capital Cost (Discounting)	$209,055,234
MTCO2E Saved in Selected Target Year	122,423
Cumulative MTCO2E Avoided	2,198,582
Abatement Cost ($/MTCO2e avoided)	($42)
Additional Electric Load by Target Year (kW)	378,897

Financial Analysis: Technologies Implemented

Technology	Total Deployed	Present Value of Cost	NPV
Electric Vehicles	53,568	($179,037,272)	$8,184.65
Level II at-home Chargers	33,748	($30,017,963)	

Flows, Structures, Behaviors

Flows

Action #	Implementation Actions:	Lead	Key Partner(s)	Target Year ?
1	Implement sales tax refund for EVs purchased by Palo Alto residents	Finance	Council	
2	Bulk purchase program for electric vehicles with City fast tracking infrastructure approval.	NGO	Utilities, Council, UAC	2018
3	Palo Alto kickstart/X Prize campaign	NGO and funding agencies	Council	2017
4	Sales tax refund for EV purchased in Palo Alto by Palo Alto residents (8% reduction)	Finance	Palo Alto Auto Dealers	2018

Structure

Action #	Implementation Actions:	Lead	Key Partner(s)	Target Year
1	Support and incentivize public EV charging infrastructure through reduced permitting and parking fees		EV charging station companies	2017
2	Support and incentivize private EV charging infrastructure through reducing permitting fees/streamlining process			
3	Develop and implement EV charging infrastructure plan for city			
4	Investigate options for community-scale bulk purchasing of EVs		EV manufacturers/dealers	
5	Incentivize automakers to design improved EVs through kickstarter campaign (similar to Automotive X Prize)	NGO and funding agencies		
6	Require electric vehicle supply equipment (EVSE) for all new residential/commercial construction			
7	Collaborate with and promote EV charging apps (e.g. PlugShare)		PlugShare	2016
8	Designate certain roads/thoroughfares as EV-only	Moved to T-DM-2 Roadmap		
9	Require EVSE for all new construction	Development Services	Contractors, Architects	2017
10	Require EVSE for additions and remodels	Development Services	Contractors, Architects	2017
11	Smart phone apps to provide real-time traffic information, and provide reservation services and map of available EV charging stations. Tie in with PA business advertising and incentives.	Information Services	Business Groups, Chamber of Commerce.	2018

Behavior

Action #	Implementation Actions:	Lead	Key Partner(s)	Target Year
1	Engage with EV car dealerships to simplify sales process and promote EV educational resources			2016
2	City fleet vehicles lead the way: electric school buses, garbage trucks, etc	Public works		2019
3	Develop behavior-change campaign(s) to encourage residents and employees to purchase EV's, utilize public charging stations.			2016
4	Monitor purchases of EV's, installation of charging stations, to determine whether uptake is meeting targets. Adjust targets and behavior change campaigns accordingly.			2018
			Purchasing	2017

Energy/Cost Assumptions, Calculations, and References/Data

Item: | Number: | Data Source:

Item	2015	2020	2025	2030	2035	2040	2045	2050	
VMT (Business As Usual-PA Residents)	551,624,942	579,125,591	596,142,869	612,949,944	634,681,639	655,917,799	680,889,367	706,897,114	Data from GHG projections workbook. Excludes commuters who live outside of Palo Alto.
Total Cars Owned in Palo Alto	52,147	53,679	55,285	56,815	58,746	60,534	62,368	64,258	
Total Cars Purchased Per Year in Palo Alto	5,215	5,368	5,528	5,682	5,875	6,053	6,237	6,426	

Target Year	Total Cars Purchased by Target Year	BAU EVs Purchased by Target Year	EVs Purchased (Result of Policy) by Target Year
2025	53,704	10,091	43,613
2030	81,722	22,202	59,520
2050	202,926	119,727	83,200

Investment Cost Calculations

Cost Calculations for Replacement Vehicles

Number of Replacement Vehicles	53,568
Average Miles Traveled Lifetime Per New EV	125,000
Lifetime Miles Traveled By Replacement Evs	6,696,053,108
Average Price Premium Per Replacement Vehicle	$8,185
Bulk Purchase Discount	10%
Average Price Premium Per Replacement Vehicle w/ Discount	$7,366
Federal Tax Credit	$7,500
Year Federal Tax Credit Expires	2020
Weighted Federal Tax Credit 2016-Target year	$2,143
California State Rebate	$2,500
Year California StateTax Credit Expires	2020
Weighted California State Tax Credit 2016-Target year	$714.29
Net Price Premium Per Replacement Vehicles	$4,509
Total Price Premium For Replacement Vehicles	$241,542,138.12
Annual Price Premium for Replacement Vehicles	$16,102,809.21
Average Lifespan of Individual Electric Vehicle (years)	10
Time to Reach Target (years)	15
Cumulative Lifespan of all Electric Vehicles (years)	25
PV of Purchasing Electric Vehicles	**($179,037,272)**

Cost Calculations for At-home Vehicle Chargers

Number of At-Home Level II Chargers	33,748
Total Cost of At-Home Level II Chargers	$40,497,729
Annual Cost of At-Home Level II Chargers	$2,699,848.61
PV of Purchasing At-Home Level II Chargers	**($30,017,962.89)**

Cost Calculations for Replacement Vehicles and At-Home Vehicle Chargers

Total Technology Cost (No Discounting)	$282,039,867.31
Present Value of Total Technology Cost	**($209,055,234)**

Investment Benefit Calculations

Total Lifetime Energy Savings from EV Purchases (No Discounting)	$483,302,851
Annual Energy Savings from EV Purchases (No Discounting)	$19,332,114
Present Value of Energy Savings from EV Purchases	$302,007,830.82

Investment Benefit Calculations

NPV of Hitting Goal: EV Purchases Scenario	$92,952,596

References and Data Sources

Source/Description	Source URL Link	Data		
Evs in Palo Alto in 2014 (cars)	CPAU (Shiva)	1,062		
Average EV Grid Draw (kW)	http://www.chargepoint.com/evs	10		
Cost per Level II at Home Charger	http://blog.rmi.org/blog_2014_04_29_pulling_back_the_veil_on_ev_charging_station_costs	$1,200		
Percent of Homes with Level II at Home Charger	Estimate	70%		
Average Inflation-Adjusted California Gas Prices (2002-2012)	http://energyalmanac.ca.gov/gasoline/gasoline_cpi_adjusted.html	$2.95		
Palo Alto population 2015	Estimate from GHG Scenarios Spreadsheet	66,345	52,147	0.020365439
Palo Alto population 2020	Estimate from GHG Scenarios Spreadsheet	68,294		
Palo Alto population 2025	Estimate from GHG Scenarios Spreadsheet	70,337		
Palo Alto population 2030	Estimate from GHG Scenarios Spreadsheet	72,284		
Palo Alto population 2035	Estimate from GHG Scenarios Spreadsheet	74,741		
Palo Alto population 2040	Estimate from GHG Scenarios Spreadsheet	77,015		
Palo Alto population 2045	Estimate from GHG Scenarios Spreadsheet	79,348		
Palo Alto population 2050	Estimate from GHG Scenarios Spreadsheet	81,753		
Average Cars per capita in United States	http://data.worldbank.org/indicator/IS.VEH.NVEH.P3	0.786		
Federal Tax Credit for Electric Vehicles	http://www.irs.gov/Businesses/Plug-In-Electric-Vehicle-Credit-%28IRC-30-and-IRC-30D%29	$7,500		
California State Rebate for Electric Vehicles	https://energycenter.org/clean-vehicle-rebate-project	$2,500		
CAFE Fuel Efficiency Increase (1990 - 2013)	http://www.epa.gov/otaq/fetrends.htm	1.30%		
Average Annual Gas Price Increase	http://www.eia.gov/forecasts/steo/realprices/	1.49%		
kWh per gallon of gasoline	http://www.afdc.energy.gov/fuels/fuel_comparison_chart.pdf	33.70		
Assumed bulk purchase discount for purchasing Evs	?	10%		
Percent of Cars on Road that are Evs by 2050	https://books.google.com/books?id=yBF1AgAAQBAJ&pg=PA110&lpg=PA110&dq=Percent+Electric+Vehicles+by+2050&source=bl&ots=94RrFShwLI&sig=0zfSF_kQg3EDC2wWhiFkFFPd7t4&hl=en&sa=X&ei=qPwrVfS6A8ehsAH35IDQBA&ved=0CCUQ6AEwAQ#v=onepage&q=Percent%20Electric%20Vehicles%20by%202050&f=false	59%		

Year	Percent of New Car Sales that are EV	Annual Growth EV Sales	Source
2012	0.40%		http://www.eia.gov/todayinenergy/detail.cfm?id=19131
2013	0.60%	50.0%	http://www.eia.gov/todayinenergy/detail.cfm?id=19131
2014	0.70%	16.7%	http://www.eia.gov/todayinenergy/detail.cfm?id=19131
Average		33.3%	
Percent of Cars on Roat that are Evs (baseline)	2.0%		http://www.eia.gov/todayinenergy/detail.cfm?id=19131

Vehicle Type	Percent of New Vehicle Purchases	Best Selling Make/Model	Non-EV Combined MPG	Non-EV Price	EV Make/Model Equivalent	EV Combined MPG	EV Price	Price Premium
Large Car	2.2%	Toyota Avalon	21	$17,860	Hypothetical Large Sedan EV	73	$27,642	$9,782
Van	5.5%	Toyota Sienna	19	$17,860	Hypothetical Van EV	66	$27,642	$9,782
SUV	7.1%	Ford Explorer	19	$17,860	Hypothetical SUV EV	66	$27,642	$9,782
Luxury Car	7.5%	Lexus ES 350	24	$17,860	Tesla Model S	89	$27,642	$9,782
Pickup	13.7%	Ford F-150	17	$17,860	Hypothetical Pickup EV	59	$27,642	$9,782
Crossovers	26.9%	Toyota Rav4	25	$17,860	Toyota Rav4 EV	76	$27,642	$9,782
Middle Car	18.6%	Toyota Camry	27	$17,860	Hypothetical Mid-Size EV	94	$27,642	$9,782
Small Car	18.5%	Honda Civic	31	$17,860	Nissan Leaf	114	$27,642	$9,782

Average Price of Gasoline Vehicle	$17,860
Weighted Average Price Premium for EVs	$9,782
Average Price of Electric Vehicle	$27,642
Federal Tax Credit	$7,500
California Clean Vehicle Rebate	$2,500
Total Tax Credit/Rebate	$10,000
Assumed Bulk Purchase Discount	10%
Weighted Average Price with Credit/Rebate/Discount	-$1,196.20
Weighted Average MPG for Non-EV Vehicles:	24.47
Weighted Average MPG for Evs	83.81
Average Electric Vehicle Price Premium:	154.8%
Average Electric Vehicle Increased MPG	348.75%

Year Range	Target Year	Price Adjustment to Account fo Decreasing Price of EVS Over Time	Weighted Average Price Premium for EVs (factoring in decreasing price of EVs over time)	
2016-->2025	2025	88.5%	$8,655	CEC Electric Vehicle Demand Forecast
2016-->2030	2030	83.7%	$8,185	CEC Electric Vehicle Demand Forecast
2016-->2050	2050	74.6%	$7,300	CEC Electric Vehicle Demand Forecast

8%	Annual EV Premium Price Decrease

Year	Year Number	Leaf Price Premium	Average Projected Cost EV Compact Vehicle	BAU % of Total Vehicles that are Evs	Total VMT (both EV and non-EV)	Total BAU EV VMT	Total BAU Non-EV VMT	Percent of BAU Non-EV VMT Miles Replaced with EV VMT Resulting from Policy	Δ Annual EV VMT Resulting from Policy
2016	1	$9,782	$27,642	2.04%	551,624,942	11,234,084	540,390,858	6%	32,423,451
2017	2	$8,999	$26,859	3.71%	557,125,072	20,680,146	536,444,926	12%	64,373,391
2018	3	$8,279	$26,139	5.39%	562,625,202	30,310,507	532,314,695	18%	95,816,645
2019	4	$7,617	$25,477	7.06%	568,125,332	40,125,165	528,000,167	24%	126,720,040
2020	5	$7,008	$24,868	8.74%	573,625,461	50,124,121	523,501,340	30%	157,050,402
2021	6	$6,447	$24,307	10.41%	579,125,591	60,307,375	518,818,216	36%	186,774,558
2022	7	$5,931	$23,791	12.09%	582,529,047	70,421,462	512,107,585	42%	215,085,186
2023	8	$5,457	$23,317	13.76%	585,932,502	80,649,591	505,282,911	48%	242,535,797
2024	9	$5,020	$22,880	15.44%	589,335,958	90,991,763	498,344,195	54%	269,105,865
2025	10	$4,619	$22,479	17.12%	592,739,413	101,447,978	491,291,436	60%	294,774,861
2026	11	$4,249	$22,109	18.79%	596,142,869	112,018,235	484,124,634	66%	319,522,258
2027	12	$3,909	$21,769	20.47%	599,504,284	122,693,931	476,810,353	72%	343,303,454
2028	13	$3,597	$21,457	22.14%	602,865,699	133,482,261	469,383,438	78%	366,119,081
2029	14	$3,309	$21,169	23.82%	606,227,114	144,383,226	461,843,889	84%	387,948,866
2030	15	$3,044	$20,904	25.49%	609,588,529	155,396,824	454,191,705	90%	408,772,535
2031	16	$2,801	$20,661	27.17%	612,949,944	166,523,056	446,426,888	90%	0
2032	17	$2,577	$20,437	28.84%	617,296,283	178,046,003	439,250,281	90%	0
2033	18	$2,370	$20,230	30.52%	621,642,622	189,714,586	431,928,036	90%	0
2034	19	$2,181	$20,041	32.19%	625,988,961	201,528,806	424,460,155	90%	0
2035	20	$2,006	$19,866	33.87%	630,335,300	213,488,663	416,846,637	90%	0
2036	21	$1,846	$19,706	35.54%	634,681,639	225,594,156	409,087,482	90%	0
2037	22	$1,698	$19,558	37.22%	638,928,871	237,808,399	401,120,471	90%	0
2038	23	$1,562	$19,422	38.90%	643,176,103	250,164,958	393,011,145	90%	0
2039	24	$1,437	$19,297	40.57%	647,423,335	262,663,833	384,759,502	90%	0
2040	25	$1,322	$19,182	42.25%	651,670,567	275,305,023	376,365,543	90%	0
2041	26	$1,217	$19,077	43.92%	655,917,799	288,088,530	367,829,269	90%	0
2042	27	$1,119	$18,979	45.60%	660,912,113	301,354,998	359,557,115	90%	0
2043	28	$1,030	$18,890	47.27%	665,906,426	314,788,815	351,117,611	90%	0
2044	29	$947	$18,807	48.95%	670,900,740	328,389,981	342,510,759	90%	0
2045	30	$872	$18,732	50.62%	675,895,053	342,158,496	333,736,558	90%	0
2046	31	$802	$18,662	52.30%	680,889,367	356,094,360	324,795,007	90%	0
2047	32	$738	$18,598	53.97%	686,090,916	370,309,426	315,781,490	90%	0
2048	33	$679	$18,539	55.65%	691,292,466	384,698,785	306,593,680	90%	0
2049	34	$624	$18,484	57.32%	696,494,015	399,262,438	297,231,577	90%	0
2050	35	$574	$18,434	59.00%	706,897,114	417,069,297	289,827,817	90%	0
									3,510,326,392

Year	Δ Annual Non-EV VMT Resulting from Policy	Δ Vehicle Lifetime EV VMT resulting from policy	Δ Vehicle Lifetime Non-EV VMT resulting from policy	BAU Non-EV MPG	BAU Lifetime Gallons Gasoline Consumed	Δ Lifetime Gallons Gasoline resulting from policy	Gas Price Per Gallon (inflation adjusted)	Δ Lifetime Gas Cost resulting from policy ($)	EV MPG
2016	-32,423,451	446,403,541	-446,403,541	24.47	18,245,128	-18,245,128	$2.95	-$53,877,862	84
2017	-64,373,391	446,403,541	-446,403,541	24.79	18,010,985	-18,010,985	$3.00	-$53,978,916	85
2018	-95,816,645	446,403,541	-446,403,541	25.11	17,779,847	-17,779,847	$3.04	-$54,080,160	86
2019	-126,720,040	446,403,541	-446,403,541	25.43	17,551,675	-17,551,675	$3.09	-$54,181,594	87
2020	-157,050,402	446,403,541	-446,403,541	25.76	17,326,432	-17,326,432	$3.13	-$54,283,218	88
2021	-186,774,558	446,403,541	-446,403,541	26.10	17,104,079	-17,104,079	$3.18	-$54,385,032	89
2022	-215,085,186	446,403,541	-446,403,541	26.44	16,884,579	-16,884,579	$3.23	-$54,487,038	91
2023	-242,535,797	446,403,541	-446,403,541	26.78	16,667,896	-16,667,896	$3.28	-$54,589,235	92
2024	-269,105,865	446,403,541	-446,403,541	27.13	16,453,994	-16,453,994	$3.32	-$54,691,623	93
2025	-294,774,861	446,403,541	-446,403,541	27.48	16,242,838	-16,242,838	$3.37	-$54,794,204	94
2026	-319,522,258	446,403,541	-446,403,541	27.84	16,034,390	-16,034,390	$3.42	-$54,896,977	95
2027	-343,303,454	446,403,541	-446,403,541	28.20	15,828,618	-15,828,618	$3.47	-$54,999,942	97
2028	-366,119,081	446,403,541	-446,403,541	28.57	15,625,487	-15,625,487	$3.53	-$55,103,101	98
2029	-387,948,866	446,403,541	-446,403,541	28.94	15,424,963	-15,424,963	$3.58	-$55,206,453	99
2030	-408,772,535	446,403,541	-446,403,541	29.32	15,227,011	-15,227,011	$3.63	-$55,310,000	100
2031	0	0	0	29.70	0	0	$3.69	$0	102
2032	0	0	0	30.08	0	0	$3.74	$0	103
2033	0	0	0	30.47	0	0	$3.80	$0	104
2034	0	0	0	30.87	0	0	$3.85	$0	106
2035	0	0	0	31.27	0	0	$3.91	$0	107
2036	0	0	0	31.68	0	0	$3.97	$0	109
2037	0	0	0	32.09	0	0	$4.03	$0	110
2038	0	0	0	32.51	0	0	$4.09	$0	111
2039	0	0	0	32.93	0	0	$4.15	$0	113
2040	0	0	0	33.36	0	0	$4.21	$0	114
2041	0	0	0	33.79	0	0	$4.27	$0	116
2042	0	0	0	34.23	0	0	$4.34	$0	117
2043	0	0	0	34.68	0	0	$4.40	$0	119
2044	0	0	0	35.13	0	0	$4.47	$0	120
2045	0	0	0	35.58	0	0	$4.53	$0	122
2046	0	0	0	36.05	0	0	$4.60	$0	123
2047	0	0	0	36.52	0	0	$4.67	$0	125
2048	0	0	0	36.99	0	0	$4.74	$0	127
2049	0	0	0	37.47	0	0	$4.81	$0	128
2050	0	0	0	37.96	0	0	$4.88	$0	130
	-3,510,326,392	6,696,053,108	-6,696,053,108						

Year	Δ Lifetime EV "gallons" consumed resulting from Policy (equivalent gallons)	Δ Lifetime EV Electricity use Resulting from Policy (kWh)	Δ Lifetime EV Electricity Costs resulting from policy($)	Δ Lifetime Gasoline Costs Resulting from Policy ($)	Δ Energy Costs Resulting from Policy ($)	BAU Lifetime Emissions from Vehicles Purchased in Year (MT CO2e)	Lifetime Emissions Avoided Resulting from Policy (MT CO2e)
2016	5,326,635	179,507,613	$21,803,316	-$53,877,862	-$32,074,546	160,192	160,192
2017	5,258,278	177,203,962	$21,523,510	-$53,978,916	-$32,455,406	158,136	158,136
2018	5,190,797	174,929,873	$21,953,480	-$54,080,160	-$32,126,681	156,107	156,107
2019	5,124,183	172,684,969	$22,907,729	-$54,181,594	-$31,273,865	154,104	154,104
2020	5,058,424	170,468,873	$23,305,593	-$54,283,218	-$30,977,625	152,126	152,126
2021	4,993,508	168,281,217	$23,006,509	-$54,385,032	-$31,378,524	150,174	150,174
2022	4,929,425	166,121,636	$22,711,262	-$54,487,038	-$31,775,776	148,247	148,247
2023	4,866,165	163,989,769	$22,613,090	-$54,589,235	-$31,976,144	146,344	146,344
2024	4,803,717	161,885,261	$22,476,482	-$54,691,623	-$32,215,141	144,466	144,466
2025	4,742,070	159,807,760	$22,358,029	-$54,794,204	-$32,436,174	142,612	142,612
2026	4,681,214	157,756,920	$22,242,272	-$54,896,977	-$32,654,705	140,782	140,782
2027	4,621,139	155,732,399	$22,004,649	-$54,999,942	-$32,995,294	138,975	138,975
2028	4,561,836	153,733,859	$22,109,179	-$55,103,101	-$32,993,922	137,192	137,192
2029	4,503,293	151,760,966	$22,214,411	-$55,206,453	-$32,992,043	135,431	135,431
2030	4,445,501	149,813,392	$22,332,996	-$55,310,000	-$32,977,004	133,693	133,693
2031	0	0	$0	$0	$0	0	0
2032	0	0	$0	$0	$0	0	0
2033	0	0	$0	$0	$0	0	0
2034	0	0	$0	$0	$0	0	0
2035	0	0	$0	$0	$0	0	0
2036	0	0	$0	$0	$0	0	0
2037	0	0	$0	$0	$0	0	0
2038	0	0	$0	$0	$0	0	0
2039	0	0	$0	$0	$0	0	0
2040	0	0	$0	$0	$0	0	0
2041	0	0	$0	$0	$0	0	0
2042	0	0	$0	$0	$0	0	0
2043	0	0	$0	$0	$0	0	0
2044	0	0	$0	$0	$0	0	0
2045	0	0	$0	$0	$0	0	0
2046	0	0	$0	$0	$0	0	0
2047	0	0	$0	$0	$0	0	0
2048	0	0	$0	$0	$0	0	0
2049	0	0	$0	$0	$0	0	0
2050	0	0	$0	$0	$0	0	0
					-$483,302,851		#######

Target Year	Δ Annual EV VMT Resulting from Policy	Non-EV MPG	Gallons of Gas	MT CO2e	Average Annual VMT Per EV	Number of Evs on Road by Target Year Resulting from Policy	Additional Electric Load by Target Year (kW)
2025	294,774,861	27.48	10,725,677	94,171	10,783	27,337	273,367
2030	408,772,535	29.32	13,943,402	122,423	10,788	37,890	378,897
2050	0	37.96	0	0	11,001	0	0

http://www.arb.ca.gov/msei/downloads/emfac2014/emfac2014-vol3-technical-documentation-052015.pdf Section 3.3.3.3.1

EMFAC 2014 assumptions

Model year	% of new car sales electric	Total cars owned in Palo Alto	Turnover each year	BAU Evs bought Palo Alto	BAU Cumulative Evs	%	
2014	2.10%	52,147	5,215	1,062			
2015	3.50%	52,147	5,215	183	1,245	2%	
2016	3.60%	52,147	5,215	188	1,432	3%	
2017	3.70%	52,147	5,215	193	1,625	3%	
2018	7.30%	52,147	5,215	381	2,006	4%	
2019	10.10%	52,147	5,215	527	2,533	5%	
2020	12.70%	52,147	5,215	662	3,195	6%	
2021	15.30%	52,147	5,215	798	3,993	8%	
2022	17.60%	52,147	5,215	918	4,910	9%	
2023	19.90%	52,147	5,215	1,038	5,948	11%	
2024	22%	52,147	5,215	1,147	7,095	14%	
2025	23.90%	52,147	5,215	1,246	8,342	16%	
2026	23.90%	52,147	5,215	1,246	9,588	18%	
2027	23.90%	52,147	5,215	1,246	10,834	21%	
2028	23.90%	52,147	5,215	1,246	12,081	23%	
2029	23.90%	52,147	5,215	1,246	13,327	26%	
2030	23.90%	52,147	5,215	1,246	14,573	28%	BAU assumes for Palo Alto

City of Palo Alto Sustainability and Climate Action Plan (S/CAP) calculations

Strategy Implementation Plan

Code:	NG-RES-1	
Lever	**Residential Space/Water Heating - Electrification**	
Strategy	Convert residential natural gas water heaters to electric water heating	
Description	For existing homes, identify and implement actions to reduce fuel switching costs, require upgrades at key leverage points (e.g., time-of-sale) and make it easy for the community to find appropriate products for their needs.	
Strategic Target	70%	By Water Heater Replacement Target Year (auto-generated from rows 13-15)
Selected Target Year	2030	**Select Target Year on "Summary of SCAP Strategies" tab**

Strategic Targets (Scenario Inputs)

Percent of Residential Buildings Replacing Gas Water Heater with Electric Water Heater by Target Year	70%	**Choose Percent Conversion Achieved by Target Year**

Financial Analysis: Overall

NPV of Hitting Goal by Target Year	$7,310,397.71
Total Capital Cost (No Discounting)	$15,460,689.27
Total Capital Cost (Discounting)	$11,459,862.22
MTCO2E Saved in Selected Target Year	24,757
Cumulative MTCO2E Avoided	211,585
Abatement Cost ($/MTCO2e avoided)	($35)
Additional Electric Load by Target Year (kWh)	2,764,512

Description of Methodology	Assume 100% of households have a gas water heater that is replaced with an electric heat pump water heater by the target year.

Financial Analysis: Technologies Implemented

Technology	Total Deployed	Presevent Value of Cost	NPV
Heat Pump Electric Water Heaters	20,290	-$11,459,862	$7,310,397.71

Flows, Structures, Behaviors

Action #	Implementation Actions: Reduce transaction costs of electric water heater	Lead	Key Partner(s)	Target Year
1	Review tariffs for residences to reduce anticipated rate increases with fuel switching	Utilities	Council and UAC	2014
2	Develop program plan for electric water heater replacements, and create effective financial incentives for replacement of gas with electric water heaters	Utilities	UAC, Council	2015
3	Evaluate program effectiveness. Increase financial incentives if needed.	Utilities	UAC, Council	2017

Action #	Implementation Actions: Increase energy efficiency of homes	Lead	Key Partner(s)	Target Year
1	Develop voluntary time-of-sale requirement for energy upgrades	Development Services	Council, UAC	2017
2	Develop mandatory time-of-sale requirement for energy upgrades	Development Services	Council, UAC	2019
3	Require all water heaters be replaced with electric water heaters at end of life	Development Services	Council, UAC	2021

Action #	Implementation Actions: Education and Outreach	Lead	Key Partner(s)	Target Year
1	Develop Information services on electric water heaters	Utilities	CPA Information Services	2015
2	Engage vendors, landlords, real estate community regarding incentives and water heater replacement targets.	Utilities	CPA Information Services	2015
3	Establish consumer friendly information services for residents regarding fuel switching including website and 24-hour hotline for electric water heaters	Utilities	CPA Information Services	2017

Energy/Cost Assumptions, Calculations, and References/Data Sources

Item:	Number:	Data Source:
Annual Energy Use of Standard Gas Water Heater (therms/year)	249	CPAU Study
Annual Energy Use of Standard Gas Water Heater After 100% Implementation of Water Efficiency Measures (therms/year)	224	CPAU Study
Life of Standard Gas Water Heater (years)	13	CPAU Study
Households in Palo Alto	28,546	Assumptions Tab
Percent Reduction in Total Annual Energy Demand for Residential Water Heating From Implementation of Efficiency Measures	10%	Estimate
Total Number of Residential Water Heaters in Palo Alto to be Replaced	19,982	Calculation
Total Number of Residential Water Heaters Replacements by Target Year (Multiple Replacements Included)	20,290	Calculation
Annual Energy Use of Heat Pump Electric Water Heater (kwh/year)	1,927	CPAU Study
Life of Heat Pump Electric Water Heater (years)	13	CPAU Study
Life of Solar Water Heater with Electric Backup (years)	20	CPAU Study
Target Year	2030	Linked to Top of Spreadsheet
Years to Reach Target	15	Calculation
Total Number of Water Heaters Needing to Be Replaced To Hit Goal	20,290	Calculation

Investment Cost Calculations

Installed Cost of Base Case Standard Gas Water Heater	$871	CPAU Study
Installed Cost of Heat Pump Electric Water Heater (EF = 2.35)	$1,633	CPAU Study
Base Cost of Replacement: Standard Gas Water Heaters (No Discounting)	$17,672,257.68	Calculation
Cost of Hitting Target by Replacing w/ Heat Pump Electric Water Heaters (EF = 2.35) (No Discounting)	$33,132,946.95	Calculation
Total Incremental Cost of Hitting Target by Replacing w/ Heat Pump Electric Water Heaters (No Discounting)	$15,460,689	Calculation
Annual Base Cost of Replacement: Standard Gas Water Heaters (No Discounting)	$1,178,150.51	Calculation
Annual Cost of HittingTarget by Replacing w/ Heat Pump Electric Water Heaters (EF = 2.35) (No Discounting)	$2,208,863.13	Calculation
Present Value of Base Cost of Replacement: Standard Gas Water Heaters	($13,099,134)	Calculation
Present Value of Cost of Hitting Target by Replacing w/ Heat Pump Electric Water Heaters (EF = 2.35)	($24,558,996)	Calculation
Present Value of Additional Cost of Hitting Target by Replacing w/ Heat Pump Electric Water Heaters (EF = 2.35)	($11,459,862)	Calculation

Investment Benefits Calculations

Total Lifetime Energy Cost Savings from Swtiching to Heat Pump Electric Water Heaters (No Discounting)	$31,540,856	Calculation
Annual Energy Cost Savings from Swtiching to Heat Pump Electric Water Heaters (No Discounting)	$1,126,459	Calculation
Cumulative Lifespand of All Water Heaters (Years)	28	Calculation
Present Value of Energy Cost Savings from Swtiching to Heat Pump Electric Water Heaters	$18,770,259.92	Calculation

Net Present Value Calcualtion

NPV of Hitting Goal: Heat Pump Electric Water Heaters Scenario	$7,310,397.71	Calculation

Additional Electric Load Calcualtions

Additional Electric Load in Target Year from Switching to Heat Pump Electric Water Heaters (kWh)	2,764,512	Calculation

Heat Pump Electric Water Heaters Savings Streams

Year	Year Number	Multiple Replacement Multiplier	Annual Number of Water Heaters Replaced	Annual kWh Used by Heat Pump Water Heaters (kWh)	Lifetime kWh Used by Heat Pump Water Heaters (kWh)	Lifetime therms Avoided from Base Case Standard Gas Water Heaters	Lifetime Cost of kWh Used by Heat Pump Water Hears ($)	Lifetime Savings of Therms Avoided from Base Case Standard Gas Water Heaters($)	Lifetime Net Energy Savings from Switching from Gas Water Heaters to Heat Pump Water Heaters	Lifetime Emissions From Therms Avoided from Base Case Standard Gas Water Heater (MT CO2e)	Annual Gas Savings due to Newly Installed Electrification (therms)	Annual Gas Savings due to Newly Installed Efficiency (therms)	Cumulative Annual Gas Savings due to Efficiency and Electrification (therms)	Cumulative Annual MTCO2e Avoided due to Efficiency and Electrification (MTCO2e)
2016	1	1	1,332	2,567,047	33,371,606	3,880,943	$4,053,375	$5,029,364	$975,989	20,577	298,534	33,170	331,705	1,759
2017	2	1	1,332	2,567,047	33,371,606	3,880,943	$4,053,375	$4,994,887	$941,512	20,577	298,534	33,170	663,409	3,517
2018	3	1	1,332	2,567,047	33,371,606	3,880,943	$4,188,095	$5,294,657	$1,106,562	20,577	298,534	33,170	995,114	5,276
2019	4	1	1,332	2,567,047	33,371,606	3,880,943	$4,426,950	$5,648,753	$1,221,803	20,577	298,534	33,170	1,326,818	7,035
2020	5	1	1,332	2,567,047	33,371,606	3,880,943	$4,562,388	$5,956,964	$1,394,577	20,577	298,534	33,170	1,658,523	8,793
2021	6	1	1,332	2,567,047	33,371,606	3,880,943	$4,562,388	$6,263,640	$1,701,252	20,577	298,534	33,170	1,990,227	10,552
2022	7	1	1,332	2,567,047	33,371,606	3,880,943	$4,562,388	$6,522,976	$1,960,588	20,577	298,534	33,170	2,321,932	12,311
2023	8	1	1,332	2,567,047	33,371,606	3,880,943	$4,601,721	$6,794,359	$2,192,638	20,577	298,534	33,170	2,653,636	14,070
2024	9	1	1,332	2,567,047	33,371,606	3,880,943	$4,633,382	$6,995,076	$2,361,694	20,577	298,534	33,170	2,985,341	15,828
2025	10	1	1,332	2,567,047	33,371,606	3,880,943	$4,668,881	$7,195,026	$2,526,145	20,577	298,534	33,170	3,317,045	17,587
2026	11	1	1,332	2,567,047	33,371,606	3,880,943	$4,705,089	$7,400,230	$2,695,142	20,577	298,534	33,170	3,648,750	19,346
2027	12	1	1,332	2,567,047	33,371,606	3,880,943	$4,715,335	$7,616,561	$2,901,225	20,577	298,534	33,170	3,980,454	21,104
2028	13	1	1,332	2,567,047	33,371,606	3,880,943	$4,799,326	$7,709,030	$2,909,705	20,577	298,534	33,170	4,312,159	22,863
2029	14	1.1	1,435	2,764,512	35,938,653	4,179,477	$5,260,615	$8,449,736	$3,189,122	22,160	321,498	35,722	4,669,379	24,757
2030	15	1.2	1,537	2,961,977	38,505,699	4,478,011	$5,740,125	$9,203,028	$3,462,903	23,742	344,462	38,274	5,052,115	26,786
2031	16	1.2	0	0	0	0	$0	$0	$0	0	0	0	0	0
2032	17	1.3	0	0	0	0	$0	$0	$0	0	0	0	0	0
2033	18	1.4	0	0	0	0	$0	$0	$0	0	0	0	0	0
2034	19	1.5	0	0	0	0	$0	$0	$0	0	0	0	0	0
2035	20	1.5	0	0	0	0	$0	$0	$0	0	0	0	0	0
2036	21	1.6	0	0	0	0	$0	$0	$0	0	0	0	0	0
2037	22	1.7	0	0	0	0	$0	$0	$0	0	0	0	0	0
2038	23	1.8	0	0	0	0	$0	$0	$0	0	0	0	0	0
2039	24	1.8	0	0	0	0	$0	$0	$0	0	0	0	0	0
2040	25	1.9	0	0	0	0	$0	$0	$0	0	0	0	0	0
2041	26	2.0	0	0	0	0	$0	$0	$0	0	0	0	0	0
2042	27	2.1	0	0	0	0	$0	$0	$0	0	0	0	0	0
2043	28	2.2	0	0	0	0	$0	$0	$0	0	0	0	0	0
2044	29	2.2	0	0	0	0	$0	$0	$0	0	0	0	0	0
2045	30	2.3	0	0	0	0	$0	$0	$0	0	0	0	0	0
2046	31	2.4	0	0	0	0	$0	$0	$0	0	0	0	0	0
2047	32	2.5	0	0	0	0	$0	$0	$0	0	0	0	0	0
2048	33	2.5	0	0	0	0	$0	$0	$0	0	0	0	0	0
2049	34	2.6	0	0	0	0	$0	$0	$0	0	0	0	0	0
2050	35	2.7	0	0	0	0	$0	$0	$0	0	0	0	0	0
			20,290		508,275,232	59,109,745	$69,533,431	$101,074,287	$31,540,856	313,400			39,906,605	211,585

Target Year	MT CO2e Avoided in Target Year
2025	15,828
2030	24,757
2050	0

Case Studies and Examples

2018 Community Pilots Call for Proposals: Disadvantaged Community Car Sharing Pilot

Envoy Technologies Inc.

ENVOY™

TO: Peninsula Clean Energy (PCE)

FROM: Envoy Technologies Inc.

RE: 2018 Community Pilots Call for Proposals: Disadvantaged Community Car Sharing Pilot

8/3/2018

Introduction

Envoy Technologies Inc. ("Envoy") is pleased to submit this *Disadvantaged Community Car Sharing Pilot Proposal* ("Proposal") under PCE's 2018 Community Pilots Call for Proposals. Envoy requests **$70,160** in funding from PCE, and will provide match funding to the amount of **$70,160** in the form of equipment and in-kind services.

Under this pilot, Envoy will deploy 3 pure electric vehicles (EVs) to be used for car sharing within a disadvantaged community in San Mateo County. Envoy will focus on deployment in support of designated low-to-moderate income areas, affordable housing communities, other areas defined as disadvantaged (based on further input and consensus from PCE stakeholders). Envoy will leverage the "Community Vulnerability Index," and work with stakeholders, to identify ideal locations for deployment, and will deploy the car sharing service for no less than 18 months. Envoy is also prepared to extend or expand this Pilot, depending on the program's success.

Envoy discusses how the proposed Pilot fits within the evaluation criteria:

1. Accelerating GHG Reductions and Renewables

Envoy's unique pilot will not be duplicative of current California Public Utility Commission or utility offerings. Envoy's all-electric fleet, will lead to direct GHG emissions reductions, and increased utilization of renewables. Each Envoy (1 vehicle, per month) generally creates over 30 individual rides and approximately 300 to 500 e-miles. This equates to the need for 95 kWhs to 160 kWhs per month In petroleum reduction, an Envoy would displace at minimum approximately 12 gallons of gasoline when compared to the newest data on the average vehicle fuel economy of 24.7 miles per gallon for new vehicles (link). Hence, a fleet of 3 Envoys will displace 36 gallons per month, 432 gallons per year, and 628 gallons of gasoline over the life of the project (18 months). This translates to a reduction of more than 2397.6 lbs of CO_2 as the result of this project (link) over this 18 months.

In other words, an investment of $70,160 by PCE would result in an estimated 2397.6 lbs of CO_2 reduction. Over the life of 10 years, this translates to a total 10-year GHG Benefit Metric Tons CO_2 of 7.250, (or 15,984 lbs of CO_2). Envoy will ensure that program participants are enrolled in PCE's 100% RE offering, to maximize the GHG reduction benefits from this offering, and will deploy level 2 charging with networking capability to ensure communication compatibilities.

2. Delivers Community Benefits

In addition to providing access to EVs directly in DACs, among LMI households, and in affordable housing, the proposed car sharing Pilot will provide additional societal benefits, including vehicle ownership and reduction of miles traveled, as well as reduced parking congestion and demand. Car sharing also builds a sense of shared use and community. Envoy vehicles also serve as a promotional tool, and are uniquely branded. While funds under this pilot cannot be leveraged for marketing, education, and outreach (ME&O) activities, Envoy proposes to identify synergistic promotional opportunities with community organizations that are implementing public good campaigns and experiential events. In other words, Envoy vehicles provide the ideal platform for co-branding and shared advertising between Envoy and PCE, and serve as mobile educational platforms. In compliance with this funding, Envoy commits to supporting PCE workforce policy, and to serving customers across PCE's geography.

3. Supports PCE'S Load Serving Needs

This pilot will seek to deploy fleet EVs only in locations that are enrolled in PCE's 100% RE offering, and will deploy level 2 charging with networking capability, and as such will be able to communicate with (and respond to) grid conditions. This alignment will directly support PCE's objective to reach 100% renewables by 2025 by matching supply and load.

4. Can be executed within PCE capacity and builds PCE capabilities

Qualifications. Envoy is currently deploying its car sharing model under two key arrangements, and will leverage these experiences and subject-matter expertise to inform the Pilot's execution. First, in 2017, Envoy was awarded a grant from the California Energy Commission to focus on EV fleet deployment specifically in disadvantaged communities (DACs) across two regions in California. Pursuant to this program, Envoy is deploying approximately 60 EVs in the affordable housing sector. Second, on June 13, 2018, Electrify America (EA) announced that Envoy was selected as one of three recipients of funding to provide shared mobility services in Sacramento, EA's first designated "Green City." Under this program, Envoy will deploy 152 EVs and corresponding infrastructure, with the majority of the deployment targeting support to low income families, and DACs. These two programs will allow for Envoy to launch more than 210 EVs by mid-2019, and given its current pipeline, Envoy anticipates that it will launch upwards of eight hundred EVs by the end of 2019. Accordingly, Envoy has registered as an opt-in party to the California Air Resources Board's Low Carbon Fuel Standard program, and is actively seeking collaboration across state programs via grants and incentives.

PCE Implementation Requirements. Envoy seeks to essentially dovetail execution of this Pilot within existing capacity, and as such anticipates that the program will be managed in collaboration with PCE staff.

5. Additional Benefits

Evaluation. In supplement to the benefits of car sharing, Envoy's unique technology approach provides detailed impact assessments. Our data can differentiate vehicles, log travel patterns, and measure kWhs and e-miles. This data provides sophisticated insight into real-time EV fleet utilization, as well as the local e-mobility needs of specific communities. Envoy will seek to work with PCE to release of anonymized and aggregated data to inform practices and mobility planning efforts. These, and other, data-sharing activities will support community resilience and embolden innovative, scalable and replicable mobility approaches in the region.

6. Credentials and Approach

See response to 4.

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Conclusion

Envoy appreciates the opportunity to submit our credentials. Envoy is prepared to work with PCE and other stakeholders on the implementation of this pilot, and is eager to further discuss the deployment of 3 pure EVs and their attendant EVSE with you.

Thank you.

Sincerely,

Aric Ohana

Aric Ohana

Co-Founder

Envoy

Envoy Technologies
Disadvantaged Community Car Sharing Pilot
8/3/18
Community Pilots

REVENUE SOURCE	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**		**$70,161**	50%	Requested
Income #2	Envoy Technologies Inc. (equipment match)		**$70,161**	50%	
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$140,321**		

REVENUE SUMMARY		
Total Requested	**$70,161**	100%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$70,161**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	See "Envoy Detialed Cost Estimates" Tab		**$70,161**	100%	
Expense #2			**$0**	0%	
Expense #3			**$0**	0%	
Expense #4			**$0**	0%	
Expense #5			**$0**	0%	
Expense #6			**$0**	0%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$0**	**$70,161**	**100%**	

Net Income - Expenses	-	**70,161**

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Vehicles Deployed: 3 EVs	Initial Duration: 18 Months	
	Cost Per Unit	**Total Cost**
Hardware		
Vehicles (EV Purchase/Lease)	$26,000.00	$78,000.00
Vehicle Insurance	$170.00	$510.00
EVSE Purchase	$2,250.00	$6,750.00
EVSE Insurance	$555.00	$1,665.00
EVSE Installation	$15,000.00	$45,000.00
EVSE Marketing / Branding (Charger Decals)	$300.00	$900.00
Vehicle Hardware Purchase	$661.38	$1,984.14
Vehicle Hardware Install	$145.00	$435.00
Activation / Configuration of Cloud	$322.90	$968.70
Experiential		
Vehicle Branding Production	$117.50	$352.50
Vehicle Branding Installation	$179.00	$537.00
Seat Covers Production	$0.00	$0.00
Seat Covers Install	$0.00	$0.00
Marketing Materials	$322.90	$968.70
Parking Signage	$200.00	$600.00
Operation & Maintenance		
Registration fees	$450.00	$1,350.00
Maintenance	$100.00	$300.00
	Sub Total	**$140,321.04**
	PCE Ask:	$70,160.52
	Envoy Match:	70160.52

A ROADMAP FOR MUNICIPAL GREEN FLEETS

Supporting San Mateo County jurisdictions in reducing greenhouse gas emissions from fleet operations

SUBMITTED BY:

JIM EGGEMEYER, DIRECTOR

COUNTY OF SAN MATEO OFFICE OF SUSTAINABILITY

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OFFICE OF SUSTAINABILITY

COUNTY OF SAN MATEO

Description of Project

Objectives

Jurisdictions within San Mateo County are poised to transition their municipal fleets to clean fuel vehicles. Reducing greenhouse gas emissions from municipal fleets takes more planning and analysis than purchasing electric vehicles on an as needed basis. To use taxpayer dollars wisely, have a large greenhouse gas emission impact, and work efficiently, it's imperative for local government staff to analyze existing fleet, strategically upgrade vehicles and deploy cost-effective strategies to reduce reliance on single occupant vehicles for government business. To streamline this transition from having on demand internal combustion vehicles for government business to having a suite of clean transportation options, it is necessary to plan diligently. Currently, the planning process can not only slow jurisdictions down in their effort to green their fleets, but it can lead to inaction as planning is time consuming and costly. The County of San Mateo Office of Sustainability is proposing to develop a clean fuel fleet toolkit for local governments. In addition to creating a toolkit of resources, the County proposes providing technical assistance to San Mateo County jurisdictions in working through the toolkit planning documents to set the jurisdiction up for a transition traditional internal combustion and diesel fleet vehicles to cleaner alternatives, such as those powered by electricity and renewable diesel.

There are many barriers for local governments when it comes to addressing greenhouse gas emissions from fleet vehicles. Barriers include:

- Inconsistent information on clean fuel technologies and large variety of fleet vehicle types
- Lack of existing infrastructure to accommodate clean fueling
- Potential large upfront investment cost
- Inability to demonstrate lifecycle cost savings
- Limited staff capacity
- Focus on short term fleet management and meeting demand
- Uncertainty on which vehicles to start transition with to have largest impact

To address these barriers, the County of San Mateo's Office of Sustainability proposes creating a toolkit that San Mateo County jurisdictions can leverage to support the following improvements to their municipal fleet:

- Phasing out internal combustion vehicles
- Procuring electric vehicles
- Installing electric vehicle charging infrastructure
- Incorporating bicycles and electric bicycles into fleet
- Utilize Fleet Management Software and Tools
- Fueling with renewable diesel for heavy duty vehicles

Laying the groundwork and providing the technical assistance to help jurisdictions make informed decisions about where to spend their fleet improvement budget will allow local governments to be efficient with their fleet budgets, expedite the process, reduce staff time and create political will. During Phase I of the proposal, a digital toolkit will be created which will consist of a complete packet of resources that jurisdictions could customize to make the process of greening their fleet simple.

The toolkit would include the following resources:

- Customizable “Clean Municipal Fleet Action Plan”
- Complete list of strategies for cleaning fleet
- Template language for municipal resolution
- Lifecycle Cost Analysis on several vehicle types
- Purchasing guidelines
- Infrastructure installation guidelines

Creating a toolkit of resources will ensure that fleet transition can happen in a timely and consistent manner across San Mateo County. In addition, the toolkit aims to save staff time, reduce confusion, and ultimately, support jurisdictions in meeting their climate action and economic goals.

Upon completion of the toolkit, the Office of Sustainability will commence Phase II of the proposal. Phase II includes assisting interested jurisdictions in completing the process and analysis necessary to find the best clean fleet approach for their operations. In response to an initial survey conducted with all 21 jurisdictions (20 cities and 1 County government) in the County of San Mateo, five jurisdictions expressed interest in immediate support on improving fuel economy and reducing greenhouse gas emissions from fleet vehicles. In the case of the County fleet, the Office of Sustainability has worked extensively with the Department of Public Works to provide technical support around procuring electric vehicles, transitioning diesel vehicles to renewable diesel, and adding bicycles for County employee business use.

The goal of this project is to provide jurisdictions with comprehensive analysis and ready-to-go templates that will reduce the soft costs of fleet transition. Jurisdictions will be able to use the toolkit of resources to know where they should start and the loading order of upgrades needed for their fleet. The remaining burden would be the actual infrastructure and vehicle upgrades that can be addressed through capital improvement funding, state and regional grant funding, and strategies outlined in the toolkit. Pilot jurisdictions will receive additional support with creating a clean vehicle roadmap and implementing jurisdiction specific strategies with technical assistance from the County. As Phase III of this project, the funding provided by this grant will support the purchase of one electric vehicle and five electric bicycles for the County’s fleet.

Roles of Partners

The resources included in the toolkit will be drafted in extensive coordination with jurisdictions within San Mateo County. The Office of Sustainability will interview City Fleet Managers and Sustainability Coordinators to learn about their respective priorities to ensure that all proper plans and templates are drafted. It is important that this toolkit is comprehensive and applicable to multiple fleet permutations. The Office of Sustainability will also engage local electric vehicle dealerships, bicycle vendors, community advocates, technical experts and jurisdictions that are paving the way across the Bay Area to learn about best practices and opportunities for developing green fleets.

Post toolkit development, the Office of Sustainability staff will partner with a maximum of four jurisdictions to support the transition of their fleet vehicles. The Office of Sustainability has selected four jurisdictions as it aligns with the budget for the grant. Expanding on existing city partnerships to collaborate with City Fleet Managers will be a critical piece of rolling out Phase II.

The Office of Sustainability will partner with several internal County Departments to implement the final phase of the grant. Departments include the County Manager, Board of Supervisors, Public Works, Budget and Performance, and Human Resources.

Sequence of Events

Phase I: Toolkit Development

Task 1.1: Stakeholder Engagement

The Office of Sustainability will engage stakeholders to better understand barriers to reducing greenhouse gas emissions from municipal fleets. In addition, stakeholders will be asked to share what resources including analysis, process documents, and templates are needed to upgrade their fleet to align with climate action goals.

Task 1.2: Creation of Toolkit

The Office of Sustainability will create a toolkit of resources needed for a jurisdiction to decide on how to reduce greenhouse gas emissions from their fleet. Resources will include guides on how to analyze municipal fleet utilization, identifying appropriate strategies to achieve the largest climate impact with the amount of capital and bandwidth a jurisdiction has, and preparing a jurisdiction up to implementation of greening their fleet.

Phase 2: Piloting Toolkit with Local Jurisdictions

Task 2.1: Identifying Local Governments within San Mateo County to receive technical assistance

The Office of Sustainability staff will contact stakeholders from Task 1.1 to identify jurisdictions most in need of technical support in greening their fleets. The Office of Sustainability will also consider willingness to implement plan once created and available staff time at selected jurisdiction. If interest for more than four jurisdictions is received, the Office of Sustainability will work with PCE to decide which jurisdictions to provide support to.

Task 2.2: Provide Technical Assistance to Selected Jurisdictions

The Office of Sustainability will facilitate the completion of a Clean Fuel Fleet Roadmap plan as per the template created as a part of the toolkit. The Office of Sustainability will provide technical assistance in completing the corresponding analysis and templates to bring selected jurisdictions to implementation of a clean fuel fleet strategy.

Task 2.3: Support County of San Mateo Fleet in implementing clean fuel fleet strategies

Leverage past studies completed by the Office of Sustainability on County Fleet to implement recommended strategy of purchasing one electric vehicle and five electric bicycles for employee use at County Center Fleet.

Task 2.4: Evaluation

The Office of Sustainability will capture feedback from jurisdictions that have used the toolkit to refine content. The Office of Sustainability will track the outcome of jurisdictions' efforts with the toolkit to assess how resources supported implementation.

Phase 3: Wide distribution of Municipal Fleet Toolkit

Task 3.1: Making toolkit available to San Mateo County jurisdictions

The Office of Sustainability will post completed toolkit package onto its public website. The Office of Sustainability will share with jurisdictions through various outreach channels that resources are available to be leveraged to support taking climate action at a municipal level through their fleets. The Office of Sustainability will provide a cover sheet and instructions for using the toolkit, and will be available to offer additional guidance and support as needed and as staffing allows.

Outcomes

Accelerates GHG reductions and renewables

This proposal aims to acceleration GHG reductions and renewables by leveraging available clean energy technologies for the transportation sector. Electric transportation strategies will not be recommended or deployed if they cannot be fueled using PCE's ECO100 fuel mix or on-site solar. This supports the development of expanding renewable energy to meet the needs of the transportation sector.

For GHG reductions, the proposal will result in immediate emission reductions by replacing County of San Mateo fleet trips with an electric vehicle and with a fleet of electric bicycles. More difficult to extrapolate is the long-lasting impact of transitioning all municipal fleets in San Mateo County to fleets that are powered by renewable electricity, renewable diesel, and through proper sizing and management avoid single occupant trips. This proposal would lay the groundwork for the planning and delivery of this new fleet paradigm. Cleaner fleets would significantly reduce government operation GHG emissions while changing user perspectives on what the transportation of the future can be.

Delivers community benefits

The creation of a toolkit to support the advancement of clean energy municipal fleet technologies will provide several community benefits. Clean fuel vehicles allow for trips to be taken without contributing to air pollution. Local government staff that use fleet vehicles are often driving to locations within their jurisdictions and are contributing to air pollution in their community. Reducing tailpipe emission from municipal vehicles will reduce the amount of air pollution experienced in the community.

Government operations, including municipal fleets, are funded either directly or indirectly by taxpayer dollars. The toolkit will have a focus on creating a loading order of fleet improvements that favors cost-effective upgrades. Ultimately, Jurisdictions will be using the toolkit not just to ascertain an environmentally friendly solution for their fleet, but they will be using it to identify cost and process efficiencies that will have a positive impact on how local dollars are spent.

Municipal fleet managers may also learn the intricacies of managing and maintaining alternative fuel vehicles that will develop the workforce around clean transportation solutions. In addition, local dealerships and vendors will be leveraged when possible.

Expanding on municipal fleets, this toolkit could be used for large corporate accounts interested in reducing greenhouse gas emissions associated with their fleet. While the initial proposal includes direct support to municipalities, the project could be expanded and leveraged by any business that owns and operates a fleet.

Under the budget provided through this grant there is capacity to create a toolkit for widespread use without limitations. Technical assistance may only be offered to four jurisdictions under the current budget ask. Future funding could allow for support to be given to all 20 cities. After prioritizing municipalities, there would be an opportunity to outreach to and provide support to corporations that maintain a fleet. Jurisdictions within the vulnerability index will receive priority during pilot.

Supports PCE's load serving needs

One of the strategies outlined in this proposal would be leveraging electric vehicles for municipal fleets. Electric vehicles can support grid harmonization as they can be charged during times of excess supply and deployed during times solar energy is not available on the grid. There is also the capacity to use an electric vehicle as a battery for the solar energy coming from the grid through vehicle-to-grid integration. The vehicle can operate in discharge mode that can transfer stored solar electricity back into the grid when solar is not available. The opportunities for using stored energy for travel or to generate power for other critical facilities in the event of emergency makes our communities more resilient. In the long term, charging EVs during the day can trigger pricing signals to change how and when communities use electricity on a broader scale.

Additional Benefits

Beyond the environmental and cost saving benefits to local jurisdictions, developing a plan to reduce vehicle emissions and implementing the plan has many additional positive benefits. Reducing dependence on traditional petroleum based fuel allows jurisdictions to have more flexibility when it comes to fueling.

The intent of a toolkit is to not just go through the process for our own agency, but to have resources available for all local governments. Conversations with fleet management have led to the idea to create resources for fleet managers to leverage. Through our own process, we have seen how exhausting it can be for fleet managers to balance their day to day duties of managing a fleet and responding to demands from other departments. It can be outside of their scope of work to introduce a clean fuel transition plan. Having resources for fleet managers to use to analyze their fleet and design a plan of action will lessen their burden and ultimately make it more likely for those who have power to make fleet changes to act. Gaps in programming for municipalities make it difficult to patchwork together funding and support to fully examine and implement greenhouse gas reducing strategies in municipal fleets. Current utility programs provide for funding for charging infrastructure and the Bay Area Air Quality Management District intermittently offers grants to upgrade older diesel vehicles, but opportunities are limited and jurisdictions must apply quickly and already know exactly their plan for upgrading vehicles to apply.

In addition, jurisdictions that explore fleet opportunities are leading by example and can pave the way for corporations and other agencies to transform their fleets. The widespread transition of fleets could revolutionize EV markets, balance the grid, and provide for a resilient transportation network. Fleets that incorporate EVs and electric bicycles will also be exposing new technologies to their staff who will be test driving clean fuel technologies each time they travel for business.

PCE Implementation Requirements

PCE's role in implementing this project would be minimal. PCE may be contacted to provide electricity rate schedules to support the completion of lifecycle cost analyses. In addition, if PCE has knowledge that can be shared relative to municipal customers transitioning their vehicle fleets, it may support the County during the pilot phase of the program.

This program complements PCE's existing EV program as it addresses municipal fleets which is not covered under any existing PCE offering. PCE could leverage the toolkit as a dynamic resource for municipalities and fully integrate municipal fleet improvements into the program portfolio providing necessary support to local governments. The proposed program would additionally alleviate PCE's administrative burden as an electricity provider since this proposal aims to level electricity supply and demand.

Qualifications

Since its inception in July 2014, the Office of Sustainability has been on the leading edge of clean energy solutions to benefit San Mateo County residents. Projects include the creation of Peninsula Clean Energy, governance in the Bay Area Regional Energy Network, and development of EV charging infrastructure and County employee charging program, EV Charge Up. The Office of Sustainability takes pride in the community partnerships its formed to support GHG reduction.

No additional staff will need to be hired to complete the outlined scope. Existing staff with experience working on energy programs, specifically EV Charge Up, will be selected to staff project.

Evaluation

The Office of Sustainability finds immense value in frequent evaluation of the success of the proposed project. The proposed project aims to create a dynamic resource for many while providing technical support to a pilot group. The format of this project allows for evaluation of toolkit before creation, during and after. Success for the toolkit means that the necessary research, scoping and templates are crafted. Feedback from users of the toolkits (fleet managers, sustainability staff, elected officials, etc.) will be the indication on whether the toolkit is a success. Feedback will be captured in a survey before creating tools to ask why jurisdictions need to support a fleet transition and a survey will be deployed after using the toolkit to capture feedback on what outcomes came from using the toolkit.

Another opportunity to evaluate success will be in quantifying the greenhouse gas emissions from any fleet improvement project implemented as per planning process provided by the toolkit.

Metrics and Assumptions

Please see corresponding excel workbook for metrics and assumptions.

Budget

Please see corresponding excel workbook for budget calculations.

County of San Mateo Office of Sustainability
Evaluating Municipal Fleets for Electrification
8/3/18
Community Pilots

REVENUE SOURCE	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	Requested from PCE	$75,000	**$75,000**	94%	Requested
Income #2	Office of Sustainability General Fund	$4,770	**$4,770**	6%	Received
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$79,770**	**$79,770**		

REVENUE SUMMARY		
Total Requested	**$75,000**	94%
Total Pledged	**$0**	0%
Total Received	**$4,770**	6%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$79,770**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service in years?
Expense #1	Office of Sustainability Staff Hours, Resource Conservation Specialist II, $91.75 per hour	$28,626	**$28,626**	36%	
Expense #2	Office of Sustainability Staff Hours, Resource Conservation Manager, $118.15 per hour	$6,144	**$6,144**	8%	
Expense #3	Purchase of one electric vehicle for County fleet (vehicle selection would be based on competitive process)	$35,000	**$35,000**	44%	15 years
Expense #4	Purchase of five electric bicycles and docking infrastructure	$10,000	**$10,000**	13%	15 years
Expense #5			**$0**	0%	
Expense #6			**$0**	0%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$79,770**	**$79,770**	**100%**	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Metric	Count	Units	Comment
Current Emissions (2016)			
Vehicle Fleet	4,626	MT CO2e	According to 2016 Government Operations Climate Action Plan
GHG Emissions Avoided			
Replacing 15% of County trips with EV bicycles and vehicles	693.8752	MT CO2e	15% of County motorpool trips are under 5 miles which would make these trips easily replaced with EV vehicles or bicycles.
Switching from regular diesel to renewable diesel	800	MT CO2e	Calculated by EV Charge Up program staff in support of County Public Works dielsel transition

Total emissions avoided each year	**1,494**	**Mt CO2/year**

Instructions: Fill in the "Vehicle Fleet Energy Raw Data" table below. The "Vehicle Fleet Energy & Emissions Summary Data" table will automatically

Vehicle Fleet Energy & Emissions Summary Data

Fuel Type	Fuel Consumption Units	Fuel Consumption	Emissions (MT CO2E)
Biodiesel: B-10	Gallons	0	0
Biodiesel: B-100	Gallons	0	0
Biodiesel: B-2	Gallons	0	0
Biodiesel: B-20	Gallons	0	0
Biodiesel: B-5	Gallons	0	0
Diesel	Gallons	88,234	906.50
Electricity	kWh	0	0
Ethanol: E-10	Gallons	0	0
Ethanol: E-100	Gallons	0	0
Ethanol: E-85	Gallons	8,006	10.73
Hybrid Gasoline	Gallons	36,851	327.62
Gasoline	Gallons	366,765	3,300.47
Natural Gas	Gallons	255	1
Propane	Gallons	869	5.01
		Total Vehicle Fleet Emissions:	4,551.7

Note: Assumed that all vehicles labeled in original data as "Diesel/unleaded" consumed diesel fuel.

Vehicle Fleet Energy Raw Data

Vehicle Category Description	Department	Fuel Type	Annual Fuel Consumed Non-electric Vehicles (Gallons)	Annual Fuel Consumed Electric Vehicles (kWh)
AV Agriculture Pest Control Vehicle	1260D Agricultural Commissioner/Sealer	Gasoline	4,031.4	
AV Cargo Van/Truck/SUV	1260D Agricultural Commissioner/Sealer	Gasoline	2,779.4	
AV Cargo Van/Truck/SUV	1300D Assessor-County Clerk-Recorder	Gasoline	157.1	
AV Cargo Van/Truck/SUV	1700D Human Resources Department	Ethanol: E-85	1,816.8	
AV Cargo Van/Truck/SUV	1700D Human Resources Department	Gasoline	786.3	
AV Cargo Van/Truck/SUV	1800D Information Services Department	Gasoline	2,574.9	
AV Cargo Van/Truck/SUV	2200D Superior & Municipal Courts	Gasoline	579.6	
AV Cargo Van/Truck/SUV	3000D Sheriff's Office	Diesel	483.9	
AV Cargo Van/Truck/SUV	3000D Sheriff's Office	Gasoline	16,019.7	
AV Cargo Van/Truck/SUV	3200D Probation Department	Gasoline	1,567.9	
AV Cargo Van/Truck/SUV	3300D Coroner's Office	Gasoline	2,473.4	
AV Cargo Van/Truck/SUV	3800D Planning and Building	Gasoline	297.3	
AV Cargo Van/Truck/SUV	3900D Parks Department	Diesel	1,221.1	
AV Cargo Van/Truck/SUV	3900D Parks Department	Ethanol: E-85	816.7	
AV Cargo Van/Truck/SUV	3900D Parks Department	Gasoline	22,329.1	
AV Cargo Van/Truck/SUV	3980D Coyote Point Marina	Diesel	16.0	
AV Cargo Van/Truck/SUV	3980D Coyote Point Marina	Gasoline	420.0	
AV Cargo Van/Truck/SUV	4500D Department of Public Works	Ethanol: E-85	629.1	
AV Cargo Van/Truck/SUV	4500D Department of Public Works	Gasoline	8,739.0	
AV Cargo Van/Truck/SUV	5000D Health System	Gasoline	1,558.0	
AV Cargo Van/Truck/SUV	7000D Human Services Agency	Ethanol: E-85	868.5	
AV Cargo Van/Truck/SUV	7000D Human Services Agency	Propane	134.8	
AV Cargo Van/Truck/SUV	7000D Human Services Agency	Gasoline	1,965.3	
AV Compact Vehicle	7000D Human Services Agency	Gasoline	283.8	
AV Hybrid Gasoline Cargo Van/Truck/SUV	1800D Information Services Department	Hybrid Gasoline	112.7	
AV Hybrid Gasoline Cargo Van/Truck/SUV	3000D Sheriff's Office	Hybrid Gasoline	206.2	
AV Hybrid Gasoline Cargo Van/Truck/SUV	3200D Probation Department	Hybrid Gasoline	148.3	
AV Hybrid Gasoline Cargo Van/Truck/SUV	3900D Parks Department	Hybrid Gasoline	488.1	
AV Hybrid Gasoline Cargo Van/Truck/SUV	4500D Department of Public Works	Hybrid Gasoline	25.4	
AV Hybrid Gasoline Cargo Van/Truck/SUV	5000D Health System	Hybrid Gasoline	315.4	

AV Hybrid Gasoline Compact Vehicle	1260D Agricultural Commissioner/Sealer	Hybrid Gasoline	1,497.2	
AV Hybrid Gasoline Compact Vehicle	3000D Sheriff's Office	Hybrid Gasoline	239.9	
AV Hybrid Gasoline Compact Vehicle	3200D Probation Department	Hybrid Gasoline	1,546.1	
AV Hybrid Gasoline Compact Vehicle	3700D County Library	Hybrid Gasoline	142.9	
AV Hybrid Gasoline Compact Vehicle	4500D Department of Public Works	Hybrid Gasoline	52.0	
AV Hybrid Gasoline Compact Vehicle	5000D Health System	Hybrid Gasoline	4,763.2	
AV Hybrid Gasoline Compact Vehicle	7000D Human Services Agency	Hybrid Gasoline	7,335.1	
AV Hybrid Gasoline Mid-Size Vehicle	2510D District Attorney's Office	Hybrid Gasoline	3,275.9	
AV Hybrid Gasoline Mid-Size Vehicle	3000D Sheriff's Office	Hybrid Gasoline	996.8	
AV Hybrid Gasoline Mid-Size Vehicle	3200D Probation Department	Hybrid Gasoline	1,545.7	
AV Hybrid Gasoline Mid-Size Vehicle	3300D Coroner's Office	Hybrid Gasoline	230.4	
AV Hybrid Gasoline Mid-Size Vehicle	5000D Health System	Hybrid Gasoline	482.5	
AV Large Truck	1260D Agricultural Commissioner/Sealer	Diesel	211.8	
AV Large Truck	3000D Sheriff's Office	Diesel	769.3	
AV Large Truck	3000D Sheriff's Office	Gasoline	646.8	
AV Large Truck	3700D County Library	Diesel	1,327.9	
AV Large Truck	3900D Parks Department	Diesel	6,852.1	
AV Large Truck	3900D Parks Department	Gasoline	2,013.2	
AV Large Truck	4000D Office of Sustainability	Diesel	629.4	
AV Large Truck	4500D Department of Public Works	Diesel	888.6	
AV Large Truck	4500D Department of Public Works	Gasoline	3,517.4	
AV Large Truck	5000D Health System	Diesel	418.9	
AV Large Truck	5000D Health System	Gasoline	1,182.1	
AV Large Truck	7000D Human Services Agency	Diesel	25.0	
AV Mid-Size Vehicle	2510D District Attorney's Office	Ethanol: E-85	484.8	
AV Mid-Size Vehicle	2510D District Attorney's Office	Gasoline	1,048.1	
AV Mid-Size Vehicle	3000D Sheriff's Office	Gasoline	2,392.9	
AV Mid-Size Vehicle	3200D Probation Department	Ethanol: E-85	1,059.5	
AV Mid-Size Vehicle	3200D Probation Department	Gasoline	5,141.9	
AV Mid-Size Vehicle	3300D Coroner's Office	Gasoline	750.5	
AV Mid-Size Vehicle	5000D Health System	Gasoline	343.5	
AV Passenger Van	3000D Sheriff's Office	Gasoline	7,041.9	
AV Passenger Van	3200D Probation Department	Gasoline	4,454.1	
AV Passenger Van	3900D Parks Department	Gasoline	931.8	
AV Passenger Van	4500D Department of Public Works	Gasoline	304.2	
AV Passenger Van	5000D Health System	Gasoline	1,425.5	
AV Passenger Van	7000D Human Services Agency	Gasoline	1,063.3	
AV Patrol-Law Enforcement Vehicle	3000D Sheriff's Office	Gasoline	71,285.7	
DIRECT BILL VEHICLES ALL COST	1240D Public Safety Communications	Gasoline	821.5	
DIRECT BILL VEHICLES ALL COST	2510D District Attorney's Office	Hybrid Gasoline	301.3	
DIRECT BILL VEHICLES ALL COST	3000D Sheriff's Office	Diesel	1,876.1	
DIRECT BILL VEHICLES ALL COST	3000D Sheriff's Office	Hybrid Gasoline	850.6	
DIRECT BILL VEHICLES ALL COST	3000D Sheriff's Office	Natural Gas	8.0	
DIRECT BILL VEHICLES ALL COST	3000D Sheriff's Office	Gasoline	75,430.4	
DIRECT BILL VEHICLES ALL COST	3580D Fire Protection Services	Diesel	1,603.7	
DIRECT BILL VEHICLES ALL COST	3580D Fire Protection Services	Propane	33.2	
DIRECT BILL VEHICLES ALL COST	3580D Fire Protection Services	Gasoline	3,382.7	
DIRECT BILL VEHICLES ALL COST	3700D County Library	Gasoline	160.0	
DIRECT BILL VEHICLES ALL COST	3800D Planning and Building	Hybrid Gasoline	705.3	
DIRECT BILL VEHICLES ALL COST	3900D Parks Department	Diesel	171.4	
DIRECT BILL VEHICLES ALL COST	4500D Department of Public Works	Diesel	2,221.5	
DIRECT BILL VEHICLES ALL COST	4500D Department of Public Works	Hybrid Gasoline	80.1	
DIRECT BILL VEHICLES ALL COST	4500D Department of Public Works	Gasoline	391.1	
DIRECT BILL VEHICLES ALL COST	5000D Health System	Diesel	2,509.4	
DIRECT BILL VEHICLES ALL COST	5000D Health System	Hybrid Gasoline	1,170.2	
DIRECT BILL VEHICLES ALL COST	5000D Health System	Natural Gas	24.0	
DIRECT BILL VEHICLES ALL COST	5000D Health System	Propane	128.1	

DIRECT BILL VEHICLES ALL COST	5000D Health System	Gasoline	2,643.6	
DIRECT BILL VEHICLES ALL COST	Peninsula Library System	Gasoline	5,301.6	
DRIVER TRAINING HMB	3000D Sheriff's Office	Gasoline	3,672.7	
FORKLIFTS	4500D Department of Public Works	Natural Gas	195.1	
FORKLIFTS	4500D Department of Public Works	Gasoline	2.5	
GENERATOR SET / LESS THAN 50 HP	4500D Department of Public Works	Diesel	4.0	
GENERATOR SET LARGE	3000D Sheriff's Office	Diesel	94.0	
GENERATOR SET LARGE	4500D Department of Public Works	Diesel	1,773.6	
GENERATOR SET LARGE	4500D Department of Public Works	Gasoline	99.2	
LARGE EQUIPMENT (BIT)	4500D Department of Public Works	Diesel	615.6	
LG EQUIPT (BACKHOES,GRADERS, MOWERS	4500D Department of Public Works	Diesel	6,296.1	
LG EQUIPT (BACKHOES,GRADERS, MOWERS	4500D Department of Public Works	Propane	12.0	
LG EQUIPT (BACKHOES,GRADERS, MOWERS	4500D Department of Public Works	Gasoline	157.0	
OIL TRAILERS, CRACK SEALERS	4500D Department of Public Works	Diesel	48.6	
OIL TRAILERS, CRACK SEALERS	4500D Department of Public Works	Natural Gas	27.6	
OIL TRAILERS, CRACK SEALERS	4500D Department of Public Works	Propane	417.4	
OIL TRAILERS, CRACK SEALERS	4500D Department of Public Works	Gasoline	293.2	
PV Cargo Van/Truck/SUV	4500D Department of Public Works	Ethanol: E-85	82.6	
PV Cargo Van/Truck/SUV	4500D Department of Public Works	Gasoline	5,924.1	
PV Compact Vehicle	4500D Department of Public Works	Gasoline	5,368.8	
PV Hybrid Gasoline Cargo Van/Truck/SUV	4500D Department of Public Works	Hybrid Gasoline	1,429.6	
PV Hybrid Gasoline Compact Vehicle	4500D Department of Public Works	Hybrid Gasoline	7,810.3	
PV Hybrid Gasoline Mid-Size Vehicle	4500D Department of Public Works	Hybrid Gasoline	295.2	
PV Large Truck	4500D Department of Public Works	Gasoline	895.8	
PV Mid-Size Vehicle	4500D Department of Public Works	Ethanol: E-85	1,070.8	
PV Mid-Size Vehicle	4500D Department of Public Works	Gasoline	6,441.1	
PV Passenger Van	4500D Department of Public Works	Gasoline	4,310.2	
ROLLERS	4500D Department of Public Works	Diesel	15.0	
ROLLERS	4500D Department of Public Works	Gasoline	45.0	
RV 1 TON PICK UP OR LESS - MILES	4500D Department of Public Works	Hybrid Gasoline	117.5	
RV 1 TON PICK UP OR LESS - MILES	4500D Department of Public Works	Propane	35.0	
RV 1 TON PICK UP OR LESS - MILES	4500D Department of Public Works	Gasoline	11,599.0	
RV 1TON PICK UP TRUCKS OR LESS	4500D Department of Public Works	Diesel	14,343.1	
RV 1TON PICK UP TRUCKS OR LESS	4500D Department of Public Works	Propane	30.6	
RV 1TON PICK UP TRUCKS OR LESS	4500D Department of Public Works	Gasoline	5,761.9	
RV Compact Vehicle	4500D Department of Public Works	Gasoline	224.5	
RV Hybrid Gasoline Compact Vehicle	4500D Department of Public Works	Hybrid Gasoline	484.2	
RV LG TRKS (10 WHLR,TRNSPRT,FUEL)	4500D Department of Public Works	Diesel	15,219.4	
RV LG TRKS (10 WHLR,TRNSPRT,FUEL)	4500D Department of Public Works	Propane	5.6	
RV LG TRKS (10 WHLR,TRNSPRT,FUEL)	4500D Department of Public Works	Gasoline	169.0	
RV SEWER FLUSHER / RODDER TRUCKS	4500D Department of Public Works	Diesel	1,687.9	
RV SIX YARD DUMP TRUCKS	4500D Department of Public Works	Diesel	6,389.2	
RV SIX YARD DUMP TRUCKS	4500D Department of Public Works	Propane	6.0	
RV SIX YARD DUMP TRUCKS	4500D Department of Public Works	Gasoline	95.3	
RV SWEEPERS / VAC-CONS	4500D Department of Public Works	Diesel	8,495.9	
SMALL EQUIP (SAWS,TRIMMERS,UTV,ETC)	4500D Department of Public Works	Diesel	18.1	
SMALL EQUIP (SAWS,TRIMMERS,UTV,ETC)	4500D Department of Public Works	Gasoline	193.1	
Auction Vehicle	3000D Sheriff's Office	Gasoline	1,247.3	
Auction Vehicle	4500D Department of Public Works	Gasoline	1,554.5	
Inactive/Hold	3000D Sheriff's Office	Gasoline	10,968.7	
Inactive/Hold	3580D Fire Protection Services	Diesel	414.8	
Inactive/Hold	3580D Fire Protection Services	Gasoline	353.4	

Inactive/Hold	4500D Department of Public Works	Diesel	1,634.5	
Inactive/Hold	4500D Department of Public Works	Ethanol: E-85	1,176.7	
Inactive/Hold	4500D Department of Public Works	Hybrid Gasoline	203.0	
Inactive/Hold	4500D Department of Public Works	Gasoline	30,159.2	
Fuel Card	3000D Sheriff's Office	Gasoline	2,490.1	
Fuel Card	3580D Fire Protection Services	Diesel	6,083.6	
Fuel Card	3580D Fire Protection Services	Propane	58.6	
Fuel Card	3580D Fire Protection Services	Gasoline	887.3	
Fuel Card	3900D Parks Department	Diesel	2,994.1	
Fuel Card	3900D Parks Department	Gasoline	818.1	
Fuel Card	4500D Department of Public Works	Propane	7.6	
Fuel Card	4500D Department of Public Works	Gasoline	282.5	
Fuel Card	7000D Human Services Agency	Diesel	749.4	
Fuel Card	Office of Education	Diesel	131.1	
Fuel Card	Office of Education	Gasoline	13,160.5	
Fuel Card	Peninsula Library System	Gasoline	1,355.0	

Note: Assumed that all vehicles labeled in original data as "Diesel/unleaded" consumed diesel fuel.

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Peninsula Clean Energy – 2018 Community Pilot Grant Proposal

August 3, 2018

Submitted To:

Peninsula Clean Energy
2075 Woodside Rd.
Redwood City, CA 94061

1. Proposal Narrative

TRC Energy Services (TRC) proposes the following grant application to address a significant contributor to greenhouse gas (GHG) emissions from multifamily buildings: gas wall furnaces.

1.1 Description of Project

Gas wall furnaces are a common heating system type in multifamily buildings and are installed in 30 percent of buildings participating in Pacific Gas and Electric Company's (PG&E) multifamily energy efficiency programs[1]. These heating systems are inefficient (typical existing equipment have annual fuel utilization efficiency (AFUE) ratings of 64 percent) and contribute indoor air pollutants (e.g. carbon monoxide [CO]) into residents' living spaces.

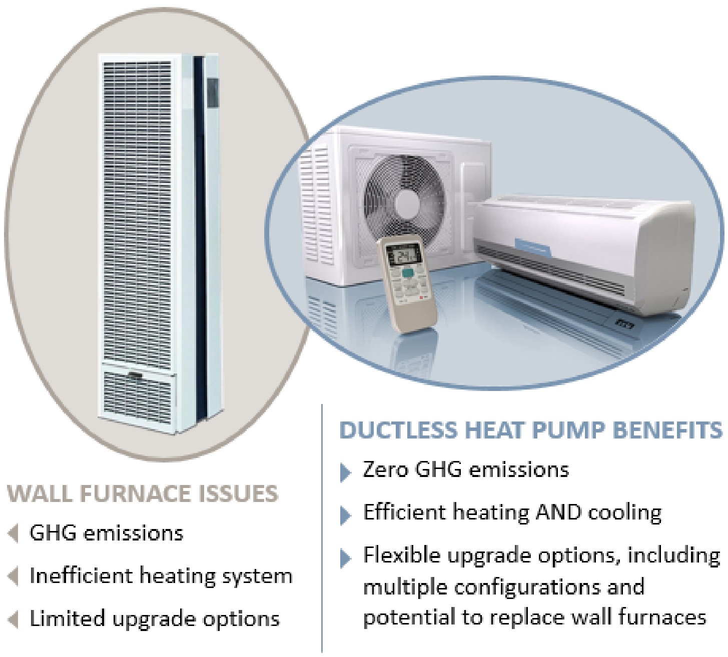

Figure 1. Wall furnace issues and ductless heat pump benefits comparison

Grant funding is needed to explore energy efficient and clean space heating alternatives to wall furnaces. Like-for-like (in-kind) replacement options for wall furnaces are limited, with the efficiency of new wall furnaces averaging just 70% AFUE. Replacement of wall furnaces with efficient heat pump solutions will deliver energy savings, GHG reduction and improvement in indoor air quality. However there are many challenges and cost uncertainties related to the heat pump replacement options. The Peninsula Clean Energy (PCE) funding will support a detailed case study on retrofitting the wall furnaces of a multifamily building with ductless heat pumps. The following are examples of construction and infrastructure challenges regarding the replacement of wall furnaces with ductless heat pumps and how our team anticipates PCE

[1] Data sourced from TRC's project database of PG&E Multifamily Upgrade Program (MUP) participants from 2014 through 2018 (to date)

funding will play a critical role in overcoming these challenges and making clear full replacement costs:

- **Cost of electrical infrastructure upgrade:** most heat pumps require at least a 15 amp current to operate. Typical multifamily buildings have limited electrical capacity and their circuit breaker panels cannot accommodate this extra load without electric system upgrades. CPAU and TRC will leverage the PCE grant funds to help the selected project hire an electrician to upgrade the circuit panel and potentially make additional wiring and circuit upgrades.
- **Cost and complexity of removing gas lines:** the grant will help fund removal of gas pipes that supply natural gas from the multifamily building meter to the wall furnace. TRC will document best practices learned from decommissioning these gas lines.
- **Tenant engagement and education:** the grant will help the project team ensure minimal disruption to resident spaces during the retrofit, and we will leverage grant funds to educate residents about the costs (electric vs. natural gas) and recommend a schedule of operation for ductless heat pumps.

As the implementer of the Multifamily Upgrade Program (MUP)—PG&E's whole building custom energy efficiency retrofit program, TRC witnessed firsthand the challenges with multifamily wall furnaces. Since program launch in 2014, the program has:

- Replaced 229 wall furnaces
- Conducted over 7,000 combustion appliance safety (CAS) tests
- Addressed numerous CAS failures associated with wall furnaces

Through implementation of the program, TRC has documented these concerns as well as the potential GHG emissions impacts. In-kind wall furnace replacements offer limited efficiency improvements (70 percent AFUE). New condensing gas wall furnaces, while slightly more efficient (90 percent AFUE), require a condensate drain line and must be installed on an exterior wall, which adds to construction cost and installation complexity. Even with efficient wall furnaces GHG emissions remain. Therefore, the only option to eliminate GHG emissions is to replace the gas appliance with an electric alternative and to use GHG-free electricity provided by PCE. Ductless heat pumps are a viable alternative as they are both energy efficient and offer flexible installation options. Ductless heat pumps provide a significant energy efficiency improvement (heating seasonal performance factor [HSPF] of up to 14 in some cases, the equivalent of 400% efficiency) and remove a potential source of carbon monoxide from the living space.

With the following grant application, we propose replacing gas wall furnaces with ductless heat pumps—thereby removing or reducing GHG emissions contributed by inefficient heating systems in PCE service territory. Because this replacement is considered fuel switching, it cannot be typically funded through investor-owned utility programs such as PG&E MUP. TRC is currently piloting the limited-time Furnace Replacement Initiative within PG&E MUP to replace gas wall furnaces with ductless heat pumps. If funding remains, TRC can leverage the incentives from that initiative to reduce total costs of replacement. If the Initiative's funds are exhausted, the property could still receive potential incentives through MUP for any savings resulting from reduced cooling energy use if the new heat pumps also replace an existing cooling system.

The following sections document the strategic approach to completing the project.

1.1.1 Identify properties

PCE will identify properties that are a good fit for this grant funding opportunity. To make the best use of funding, we will target properties that would not proceed or otherwise be cost-effective without assistance from a grant. For example, many multifamily buildings lack sufficient electrical capacity and will require panel upgrades to satisfy the added load of the electric heat pumps. These buildings are a priority because without additional funding through the grant, uncertainties around the electrical infrastructure upgrades needed to support new ductless heat pumps prohibit project progress. To maximize the number of units that can be upgraded with the grant funding, we propose that funding should be limited to 50% of total project costs. While the property may leverage other funding sources such as MUP, this approach ensures the property is invested in the outcome of the project.

1.1.2 Gather utility data and benchmark each building

With electricity data and gas data from PCE and PG&E, TRC will benchmark the property selected using ENERGY STAR® Portfolio Manager. Benchmarking will allow the team to document existing energy usage at each building prior to the furnace replacement. We will also use this data to inform energy modeling accuracy by using the resulting utility consumption data to calibrate the energy model. Energy modeling is necessary, as this is the savings claim methodology used for PG&E's Multifamily Upgrade Program. By providing a clear picture of energy use before and after the furnace upgrade, benchmarking will allow the team to evaluate both predicted and actual energy savings and greenhouse gas emission reduction impacts.

1.1.3 Conduct energy assessment and site interviews

TRC will conduct a detailed energy assessment of the selected property and build energy simulation models to estimate energy savings. TRC will conduct in-unit diagnostic testing to identify gas leaks and evaluate combustion safety. As part of the energy assessment, TRC will collect data on the existing heating system and cooling system. Many multifamily properties in San Mateo county may not have cooling systems installed; however, information about the prevalence of portable and room air conditioners is unknown. The project will document the prevalence of existing air conditioning systems to accurately calculate the energy savings resulting the new systems.

Additionally, gas wall furnaces have poor heat distribution, and residents may use supplemental electric heaters to heat their apartments. While conducting the on-site energy assessment, TRC will interview residents and maintenance staff to learn more about the use of supplemental equipment such as room air conditioners and space heaters. Using information from benchmarking, the site assessment, and interviews, TRC will build calibrated energy models to estimate energy savings. We will also estimate GHG emission reductions (due to fuel source substitution) as a result of the furnace replacement. TRC will review the GHG emission reduction methodology with PCE prior to finalizing the energy savings and GHG emissions reduction estimates (see section 1.6).

1.1.4 Solicit bids and hire installation contractor

TRC will compile retrofit specifications that are specific for the building. PCE will compile these specifications into a bid package. The goal of these clearly defined bid specifications is for multiple private installation contractors to deliver consistent and comparable bids of efficient, right-sized equipment. PCE, working with the building owner, will issue a competitive RFP for the installation work and collect at least three bids for each building—our experience informs us that this is a best practice for multifamily affordable housing projects in particular.

1.1.5 Complete installation

Market adoption of electric heat pumps in California is in the "early adopter" stage, and these technologies need grant funding to document proper installation, measure performance, and, ultimately, promote market transformation. PCE will hold a community meeting to inform residents of the upgrade plans and answer questions. TRC will attend to answer technical questions about the project. Working closely with the contractor, TRC will document any construction challenges.

1.1.6 Verify measure installation

TRC will verify correct heat pump installation in accordance with manufacturer's specifications and best practices. To ensure that the new electric heating system remains in use through its measure life, TRC will specify that gas lines be decommissioned or made inaccessible at the location of the wall furnace. TRC will review the gas consumption data for 12 months after the retrofit project to document the meter-based overall natural gas (therms) reduction attributable to the project. TRC will document the project results (challenges and successes) and identify recommended best practices for future similar retrofits.

1.1.7 Post installation surveys of residents and property managers

Information gathering is a key goal of this project, and the team will conduct surveys to understand the benefits and challenges of the furnace replacements. During verification, TRC will interview property maintenance staff and residents to document the impact of the grant funding. We will ask questions about indoor air quality, comfort, maintenance, and ease of use. TRC will draft the following deliverables in support of this project:

Deliverables

- List of potential buildings identified for the grant
- Benchmarking report: one report for each building
- Energy assessment report with energy savings estimates
- Installation verification report
- Summary of resident and property staff feedback

1.2 Outcomes

TRC will work with PCE to ensure that the grant funds accelerate GHG reduction technology adoption, eliminate GHG emissions in residents' heating systems, support PCE load serving needs and improve overall energy efficiency.

1.2.1 Accelerates GHG reductions and renewables

The grant funds will help PCE unlock the GHG reduction potential of the primary heating source in multifamily buildings. The grant funds will leverage other market efforts to maximize GHG reduction policies and program opportunities. Our proposal helps achieve this goal and will also provide a framework for future decarbonization efforts in San Mateo and beyond. Based on our analysis, detailed in section 1.6, each dwelling unit retrofitted will achieve GHG reductions of 0.80 metric tons of carbon dioxide ($MTCO_2$), assuming the project uses 100% clean energy from PCE. A key aspect of this work is to document the challenges and benefits of this upgrade in multifamily buildings. Our findings will inform market solutions for future market transformation work, which is needed to support these types of projects.

1.2.2 Delivers community benefits

PCE will identify properties in disadvantaged communities and reaching out to non-profit and other affordable housing providers in San Mateo county that could be good candidates for this pilot. TRC can provide contacts of multifamily customers in the area based on its work on the Multifamily Upgrade Program. This pilot will serve residential customers and with the budget provided, we expect to serve up to 21 dwelling units, or between 30 and 50 residents. TRC will document all aspects of installation and costs, which will lead to a better understanding of how to replicate electrification of wall furnaces at scale. We will thoroughly document existing combustion safety issues, associated retrofit costs, challenges, and best practices to make these furnace replacements work. We will present our findings in a report to PCE, and we will disseminate findings to local communities and utilities.

In addition to the PCE objectives, TRC plans to leverage other regional and statewide initiatives to complete this work.

TRC will specify very high efficiency equipment to minimize cost differences and possibly reduce utility costs for residents when switching from natural gas to electric heating. Other noticeable improvements for residents include improved indoor air quality and comfort. Property management staff and building owners will see reduced maintenance costs and higher property values.

PCE will solicit bids for the project from at least three contractors and will reach out to qualified local firms to encourage them to bid on the project. TRC will develop specification criteria for the bids. In developing award criteria, we will give preference to firms that employ union labor, take part in state apprenticeship programs, and have fair compensation practices.

1.2.3 Supports PCE's load serving needs

TRC will explore the compatibility of selected heat pumps with demand response ready thermostats currently available. For eligible customers, TRC can coordinate with the PG&E Auto Demand Response program to explore potential options to shed load during peak periods.

1.2.4 Additional benefits

TRC's proposal takes gas wall furnaces out of service and removes a source of nitrogen oxides, carbon monoxide, formaldehyde, and ultrafine particles from the multifamily residence. Reduced emissions provide benefits inside the multifamily residential unit as well as to the environment. The aging wall furnaces we find in multifamily buildings have average efficiencies of only 64 percent AFUE. That means that 36 percent of the heat content goes up the flue as wasted heat and extra GHG emissions. Additionally, many wall furnaces use standing pilot burners, which increase nitrogen dioxide concentrations inside units and are a respiratory irritant. To document and eliminate potential methane emissions from gas leaks, we propose testing equipment for gas leaks and removing gas lines to the appliance.

1.3 PCE Implementation Requirements

TRC will replace gas wall furnaces with ductless mini split heat pumps in multifamily buildings within the San Mateo county. This grant will support replacements in one to three buildings.

- **PCE** will identify target properties with support from TRC as needed. By recruiting participants, PCE can leverage its existing contacts made through the Easy Charge Apartments program and it gains visibility among local property owners and managers. TRC will lend support by contacting previous MUP participants in San Mateo county.

- **PCE** will gather utility data for the selected project to support benchmarking of the property both pre- and post-retrofit.
- **TRC** will conduct benchmarking analysis of the property, conduct field assessments, collect data, and develop energy models to estimate savings.
- **PCE** will facilitate a community meeting to inform residents about the heat pump installation and to answer any questions. TRC will be present at the meeting to answer any technical questions about the project.
- **TRC** will draft equipment specifications and requirements for use the bid process. TRC will support bid review and assist in developing award criteria
- **PCE, in coordination with the building owner/manager,** will advertise and solicit bids, coordinate one walk-through for bidders, review bids received, and award the project based on the award criteria. A TRC engineer will be available to attend the bid walk-through.
- **The building owner/property manager** will hire contractors and manage construction on the project.
- **TRC Energy Services** will be the technical lead on the project and will provide technical support throughout the project and conduct measurement and verification (M&V) at the conclusion of the project. TRC will provide a summary report of findings.

1.4 Qualifications

San Mateo county is an innovation center and TRC Energy Services has a history of delivering innovative energy efficiency programs. This project will determine the best practices and solutions to replace an inefficient, but pervasive heating system with heat pump technology that will provide efficient heating and cooling for residents.

In a similar project to that proposed here, TRC, in partnership with the City of Palo Alto Utilities, recently won a grant proposal to pilot furnace replacements at up to 36 units in the city. TRC has a proven track record of managing multifamily retrofit programs for many utilities and state agencies and is the current implementer of PG&E's Multifamily Upgrade Program. Within Multifamily Upgrade, TRC is also piloting the Furnace Replacement Initiative to replace aging gas wall furnaces with ductless heat pumps. Taken together, these similar but distinct efforts will provide a solid platform to evaluate and accelerate market transformation of ductless heat pumps installations in multifamily retrofit scenarios.

TRC designed and manages the SMUD Smart Homes Program to align, complement, and leverage the statewide utility California Advanced Homes Program, allowing for the capture of municipal electric savings. The program creates an on-ramp for future Demand Response (DR) interventions, and encourages cutting edge technologies such as electric vehicle (EV) pre-wiring, peak energy reduction, heat pump water heaters, and LED lighting. TRC provides design assistance to the market to encourage deeper energy savings toward Zero Net Energy (ZNE) and plugs into existing renewable incentives. TRC supports SMUD in developing an all-electric home pathway, exploring ways to reduce peak demand to align with SMUD plans to launch time-of-use pricing for all residential customers in 2018. Measures under consideration include: battery storage, high performance attics and walls, west and southwest facing solar, and optimized home orientation. This work complements this proposal and speaks to TRC's capacity to implement innovative programs.

1.5 Evaluation

The team will measure the success of this effort based on three separate information sources: data collection (building and project costs), energy simulation modeling, and utility bill disaggregation. Data collection will follow best practices established by TRC in the Multifamily Upgrade Program handbook[1]. We will use this data to:

- Document the cost of electrical infrastructure upgrades
- Document the cost of removing gas pipe infrastructure (and any cost incurred for gas meter removal)
- Document best practices of wall furnace replacement with ductless heat pumps
- Identify any gas valve methane leaks (in the existing building)
- Identify and estimate any CO emissions into the living space

We will use the data collected at the project site, in combination with system research, to build an energy simulation model in EnergyPro. This process will result in an analysis to show the estimated energy use of each building before the retrofit. Using the base case energy model, TRC will also estimate the expected energy savings from the retrofit scope selected by the multifamily building owner. The building owner-specified budget, PCE grant funding, and the opportunity for upgrades will determine the retrofit scope. Based on the energy simulation model, TRC will estimate the overall energy savings (in equivalent BTU), while factoring in added electrical load. This analysis will factor in the energy savings from heating energy removed and the potential added energy consumption from the air conditioning system installed with the heat pump systems.

Ultimate success of this effort hinges on successful and accurate documentation of GHG emissions reduction and construction best practices for the wall furnace retrofits. To accomplish this, TRC will review building (or property) utility bill data for 12 months prior to the retrofit project. The natural gas use at the property will establish the baseline value for gas consumed on-site. TRC proposes to review the gas consumption data for 12 months after the retrofit project to determine the project's overall natural gas (therms) reduction. If the project uses natural gas for other end uses (e.g. domestic hot water or appliances), TRC will conduct utility bill disaggregation to estimate the gas energy used for heating in gas wall furnaces.

TRC understands that further work is necessary to transform the market towards GHG reducing heating systems. Beyond the scope of this grant solicitation, we foresee a need to investigate residents' potential cost increase as a result of having access to cooling systems where previously there were no cooling systems installed. In addition, studies are needed to understand the real cost impacts of using time of use (TOU) electric rates instead of natural gas rates for the primary heating load for the building. The resident cost impact is outside the scope of this grant application.

1.6 Metrics and Assumptions

To estimate GHG emissions reductions from this project, TRC ran multiple energy model test cases. We based the test cases on two projects that participated in the PG&E Multifamily

[1] MUP Handbook available online at: https://multifamilyupgrade.com/home-2/how-to-participate/

Upgrade Program and have building characteristics that are typical of units found in San Mateo county. TRC adjusted the analysis to be specific to San Mateo's climate (California climate zone 3), and we included a pre-retrofit scenario of no cooling installed. The following table (Figure 2) outlines the gas wall furnace (base case) and ductless heat pump (test case) assumptions used to develop the energy savings estimates.

Analysis Assumptions	Equipment type	Heating efficiency	Cooling efficiency
Base Case	Gas wall furnace	64% AFUE	No cooling
Test Case	Ductless heat pump	9.6 HSPF	21 SEER, 12.5 EER

Figure 2. Analysis base case and test case building system characteristics

Using the equipment type outlined in the table above, and average building characteristics, TRC performed preliminary analysis using EnergyPro version 7 under the Non-Residential Performance Module (the tool recommended for use with existing multifamily building retrofits through California Public Utility Commission impact evaluations). Based on the available budget, and assuming that the grant covers 50% of the construction cost, TRC estimates supporting the retrofits at up to 21 dwelling units. The following table presents results of the analysis—note that the electricity savings will be negative, in other words, electricity use will increase.

Equipment Scenario	Electricity savings per project (kWh)	Gas savings per project (therms)	Net Energy savings per project (kBtu/yr)	GHG reductions per project ($MTCO_2e$)
Ductless heat pump (21)	(26,526)	3,159	225,363	16.8

Figure 3. Energy savings analysis for replacing wall furnaces with ductless heat pumps

The energy savings analysis shows significant annual net energy savings, even when factoring in the increased electricity consumption (shown in Figure 3 as negative electricity savings). From this preliminary average analysis, TRC is confident that the furnace replacements resulting from this grant application will reduce GHG emissions by approximately 16.8 $MTCO_2e$ annually provided the customer is using 100% clean energy provided by PCE. As outlined in section 1.1.3, TRC will update the analysis based on actual project details and the findings from our site assessment, benchmarking, and equipment surveys.

In addition to the GHG emissions reduction resulting from energy reduction at the property, we will document any evidence of GHG emissions reductions from leaking gas valves and incomplete combustion in the wall furnace. During the site assessment, TRC will perform diagnostic testing to measure the ambient CO concentration found in resident living spaces. A test of combustion efficiency of the existing wall furnace will also provide evidence of GHG emissions resulting from inefficient system operation. Finally, TRC will identify any methane leaks (from valves, flanges, or pipe fittings) in the natural gas pipe between the meter and the wall furnace gas valve (at the inlet to the combustion chamber). We will document any leaks resulting from this work.

2. Budget

We broke down the budget for this effort into labor time and materials required to meet project deliverables and construction costs for the actual retrofit installation. Figure 4 outlines the hour estimates, labor rates ($/hour), and budget total for the deliverables outlined in Section 1.1 Description of Project. The columns denoted with an asterisk (*) are estimated in-kind labor contributions to the project from Peninsula Clean Energy.

Project deliverables	Hours PCE Program Manager*	Hours PCE Senior Program Manager*	Hours TRC Project Associate ($90)	Hours TRC Project Manager ($155)	Budget Labor
Identify properties (1.1.1)	12	0	4	1	$ 515
Gather utility data and benchmark (1.1.2)	8	0	6	1	$ 695
Field Assessment and data collection (1.1.3)	8	0	16	3	$ 1,905
Modeling (1.1.3)	0	0	20	2	$ 2,110
Project scope (1.1.4)	0	0	16	4	$ 2,060
Bid solicitation (1.1.4)	16	3	12	2	$ 1,390
Construction management support (1.1.4 & 1.1.5)	0	0	6	2	$ 850
Measure Verification (1.6)	8	2	32	2	$ 3,190
Savings verification (1.6)	16	5	16	2	$ 1,750
Report (1.5 & 1.6)	2	2	24	4	$ 2,780
Project tasks budget subtotal	**70**	**12**	**152**	**23**	**$ 17,245**
	* Estimated labor contribution from PCE				

Figure 4. Project deliverables budget

The bulk of the grant award amount ($74,995) is reserved for the construction costs of the project. We developed the cost estimate based on past project experience:

- **Purchase ductless heat pumps:** TRC will review any additional incentive or manufacturer in-kind contributions available for this project. The budget shown below assumes full retail price of heat pumps
- **Remove wall furnaces, dispose of waste appropriately, install heat pumps, decommission gas lines, drywall, and finish work:** PCE will solicit bids from at least three contractors qualified to complete this work and will prioritize contractors with experience installing similar types of scope and those that align with PCE's sustainable workforce goals.
- **Electrical infrastructure upgrade:** PCE will solicit bids from electricians (either separately or as part of the heat pump installation bid) to review the existing infrastructure and redesign the components to accommodate the added current requirements of the heat pumps. PCE will prioritize electricians with prior experience with heat pump replacements and that align with PCE's sustainable workforce goals.

Construction Scope	Cost Estimate per residence	Budget Construction (21 residences)
Purchase and install ductless heat pumps (21) Remove wall furnaces and gas line decommissioning (21) Drywall and finish work (21)	$6,500	$136,500
Electrical infrastructure upgrade (21)	$1,000	$21,000
Total	**$7,500**	**$157,500**

Figure 5. Estimated construction costs and scope for wall furnace replacement

We will leverage approximately $99,750 in external funds in addition to the proposed grant funding budget (approximately 57 percent of the total budget). Figure 6 shows the estimated leveraged funds for this grant.

Leveraged Funds	Budget
PG&E MUP Incentives	$21,000
Building Owner	$78,750
Leveraged Funds	$99,750

Figure 6. Grant budget leveraged funds

Based on the deliverables' labor and the estimated construction costs, TRC requests $74,995 for this grant solicitation. Figure 7 below outlines the total grant amount request.

Grant Breakdown	Budget
Labor	$17,245
Construction	$157,500
Leveraged funds	($99,750)
Grant amount requested	**$74,995**

Figure 7. Grant amount request breakdown

Here is a budget accounting for this grant:

- **Salary:** TRC staff supporting this project are: Jessica Nunez, Nolan Stephens and Neil Perry ($90/hour) and Matt Jones, Siobhan McCabe and Mike Maroney ($155/hour)
- **Fringe/benefits:** The rates identified in the tables above are fully loaded rates including fringe, overtime, overhead and all costs.
- **Consultants/sub-contractors**: The consultants hired will be paid in milestone payments for delivering construction services to the project.
- **Meetings:** There are two resident engagement meetings proposed for this project: one before construction begins, and the other after construction is complete.
- **Materials design & production (including web)**: There are no materials design costs specified in the budget.
- **Indirect expenses/overhead:** The rates identified in the tables above are fully loaded rates including fringe, overtime, overhead and all costs.
- **Other expenses:** Additional expenses may include travel costs.

TRC Energy Services
TRC - Community Pilot Proposal
8/3/18
Community Pilots

		YEAR 1	TOTAL		STATUS*
REVENUE SOURCE	SOURCE				
Income #1	PG&E Multifamily Upgrade Incentives	$21,000	$21,000	21%	Estimated
Income #2	Contributions to project by building owner	$78,750	$78,750	79%	Estimated
Income #3			$0	0%	
Income #4			$0	0%	
Income #5			$0	0%	
Income #6			$0	0%	
Income #7			$0	0%	
Income #8			$0	0%	
Income #9			$0	0%	
Income #10			$0	0%	
	Total	$99,750	$99,750		

REVENUE SUMMARY		
Total Requested	$0	0%
Total Pledged	$0	0%
Total Received	$0	0%
Total Estimated	$99,750	100%
TOTAL PROPOSAL REVENUE	$99,750	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	TRC Project Associate ($90/hour) at XX hours		$13,680	18%	
Expense #2	TRC Project Manager ($155/hour) at XX hours		$3,565	5%	
Expense #3	Grant funds used for capital upgrades (lifetime 15 years)		$57,750	77%	15
Expense #4			$0	0%	
Expense #5			$0	0%	
Expense #6			$0	0%	
Expense #7			$0	0%	
Expense #8			$0	0%	
Expense #9			$0	0%	
Expense #10			$0	0%	
TOTAL PROPOSAL EXPENSES		$0	$74,995	100%	

Net Income - Expenses	99,750	24,755

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

2018 Community Pilot Program:
Water Heater Electrification

August 3, 2018

Submitted to

Peninsula Clean Energy

Submitted by

Center for Sustainable Energy

Point of Contact:

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Description of Project

The Center for Sustainable Energy (CSE) is pleased to present a water heater electrification pilot for consideration by Peninsula Clean Energy (PCE). The pilot is designed to test the ability of heat pump water heaters (HPWH) to offer both greenhouse gas reductions and load shaping benefits. CSE proposes a streamlined pilot focused on replacing natural gas water heaters with heat pump water heaters in PCE territory. The initial pilot would target a small number of customers and identify key metrics to evaluate the overall performance and load shaping capability of these devices. The pilot is designed to work with a single contractor to ensure quality installation of devices and to potentially capture water heater replacements in addition to retrofits.

CSE has partnered with GRID Alternatives to reduce barriers of low-income homeowners to participation in water heater electrification and other related electrification programs. While these two programs can be independent, they have been budgeted and presented as a comprehensive offering, as program design for the HPWH program can be leveraged to decrease administration cost for the low-income offering. This program also offers a unique opportunity to assist income-qualified populations in accessing solar PV or additional electrification programs.

These programs have been designed as pilots and are intended to scale. CSE has identified Phase I and Phase II activities, along with metrics to inform subsequent program design and implementation.

<u>Building Electrification: $75,000</u>

Electric HPWHs offer an energy efficient option for water heating, displacing natural gas as a fuel source and taking advantage of a cleaner grid. Smart HPWHs equipped with grid-connected controls can provide benefits to the electrical grid as well. When appropriately sized, they can serve as a flexible load—heating and storing enough water during off-peak hours to satisfy hot water demands during peak hours. This helps utilities flatten load profiles in crucial evening peak times and better integrate intermittent renewable energy sources.

Despite these benefits, HPWHs currently suffer from very low market penetration and a lack of meaningful utility incentives. Additionally, their usefulness to the grid as a flexible load remains largely theoretical, with few real-world demonstrations to provide proof of concept. Barriers to widescale adoption include the higher up-front purchase and installation cost of HPWHs compared to natural gas, propane, and electric resistance heaters, and a lack of trained installers who are knowledgeable about the benefits of HPWHs and installation best practices.

This pilot program will seek to overcome those barriers by focusing on the following objectives:

- Encourage single family homeowners in San Mateo County to switch from natural gas or electric resistance water heaters to smart electric HPWHs.
- Assess the ability of smart HPWHs to decarbonize water heating while helping to integrate renewable energy by shifting water heating load to off-peak periods.
- Increase homeowner comfort with grid-interactive flexible load devices, paving the way for electrified homes with a diverse portfolio of flexible resources, from solar plus storage, to EV charging, water and space heating/cooling.

To achieve these objectives, the project will:

1. Provide rebates for the installation of 20 HPWHs equipped with smart controls.
2. Select a preferred HPWH installer; train them on program requirements and how to effectively communicate benefits to homeowners.
3. Monitor the performance of installed HPWHs, evaluating their ability to meet homeowner hot water needs while a) operating in heat-pump only mode, and b) pre-heating during off-peak periods to avoid operation during the 4pm – 9pm peak period.
4. Provide additional support to income-qualified customers to upgrade their service panel or offset equipment expenses.
5. Evaluate the potential for scaling to the broader Peninsula Clean Energy (PCE) service territory and provide recommendations for an at-scale program.

Low Income Electrical System Upgrade Incentive: $75,000[1]

While many programs assist in helping income-qualified populations access clean energy programs, often customers need to make important electrical system upgrades in order to take advantage of these programs. Specifically, service panel system upgrades are often required for fuel switching, or replacing carbon-based fuels such as natural gas or gasoline, with electricity. These service panel upgrades, which can cost as much as $3,000, are rarely an eligible program expense. CSE proposes to administer a rebate program to offset the cost of service panel upgrades for low-income homeowners. CSE would administer this program in partnership with GRID Alternatives, a leading provider of income-qualified solar and related programs programs nationwide. GRID Alternatives has a strong presence in PCE's service area, combining the Single-Family Affordable Solar Homes (SASH) program resources with recently awarded work to promote access to electric vehicle rebates and chargers in the region. GRID can assist CSE and PCE in designing a rebate program that overcomes these barriers and assists in the electrification of income-qualified properties. This rebate would not only be available for customers who would like to participate in the heat pump water heater program but would also remove barriers to participation in electric vehicle rebate programs and solar rooftop programs. The tasks and budget presented in the water heater electrification proposal would include the development and implementation of the low-income incentive offering, and the low-income incentive offering budget reflects an incremental increase in funding required to administer this rebate program.

Roles of Partners

Subcontractor: GRID Alternatives

GRID Alternatives (GRID) is the nation's largest nonprofit solar installer with the mission of making renewable energy technology and job training accessible to underserved communities, providing energy cost savings, valuable job skills, and a source of clean energy that benefits all. Since 2004, GRID has trained 35,000 volunteers and job trainees in solar installation while bringing no-cost solar power to nearly 10,000 low-income families, saving them an expected $321 million over the systems' lifespans. GRID will assist with design of the low-income incentive for electrical panel

[1] The budget and metrics proposed herein for this pilot assume this is taken together with the heat pump program. If PCE desires to fund solely the low-income incentive pilot, the budget would need to be slightly reconfigured to allow more time for establishing the rebate administration.

upgrades and can identify customers who would benefit from receipt of this incentive to expand the participation in programs available to low-income customers.

Partner: Open EE

Open EE offers a platform to enhance the usability of energy consumption data. CSE would work with Open EE on tracking and processing energy consumption data associated with program participants to inform evaluation of technologies installed and potential load shaping opportunities in a scaled program.

Activities

Task 1: Program Administration (Ongoing)

CSE will conduct a program kick-off meeting within ten business days from the contract execution date. The purpose of this meeting will be to finalize strategies for accomplishing program objectives, establish key program timelines and milestones, and establish a project charter, communications plan, and risk mitigation plan. This task also includes the production of a final report for the program summarizing outcomes and identifying recommendations for Phase II.

Deliverables:

- Final program design, schedule, metrics, project charter, communications plan, and risk mitigation plan.
- Monthly invoices and progress reports.
- Final report.

Task 2. Program Design (3 months)

Following program kickoff, CSE will consult with equipment manufacturers, distributors and installers, as well as other entities that have implemented similar programs to inform and finalize program design. CSE will also support PCE in procurement of a qualified installer for the program by providing technical content to inform a solicitation process.

Deliverables:

- Technical eligibility requirements and a list of approved heat pump water heater models.
- Program Application forms, homeowner eligibility requirements.
- Technical content to support a procurement process for identifying a qualified installer.

Task 3. Implementation (15 months)

Once program design is finalized and a preferred installer has been selected, CSE and PCE will launch the program. Once launched, CSE will serve as the primary point of contact for program inquiries and will handle all aspects of the rebate application process.

Deliverables:

- Approved incentive claim packages, including proof of compliance with program requirements.
- Updates on program status including agreed upon KPIs in monthly reports.

Task 4. Marketing and Outreach (6 months, following program launch)

Marketing and Outreach activities will consist of the creation of web content with program information, as well as a direct email campaign that will strategically target PCE customers more likely to adopt HPWH technology – for example customers with solar PV, EV charging, or newer vintage homes that are less likely to require expensive upgrades to electrical infrastructure.

CSE will create messaging and content and will rely upon PCE staff to format website and direct email content to ensure materials conform to PCE's branding and style guide. To avoid confusion among PCE customers and support PCE's brand building efforts, all program materials and communications will carry only PCE branding.

CSE will work with PCE to establish appropriate customer communication channels, which may include a designated mailbox and phone line to CSE program staff, to ensure that interested parties are able to obtain information about the program, while reducing administrative burden for PCE staff.

Deliverables:

- Content for direct emails to PCE customers.
- Content for a program page to be hosted on PCE's website.

<u>Task 5. Evaluation</u>

CSE has budgeted for a customer survey to evaluate the comfort impacts of participation in the heat pump water heater program.

Deliverables:

- Brief phone interviews with rebate recipients to gather customer feedback on incentive design, comfort, and HPWH performance.

More detail on evaluating program success can be found in the Evaluation section.

Scalability

This pilot will be most effective for PCE's resource portfolio if it can build towards a Phase II, focused on broader participation and designed with specific price signals for load shaping. CSE recommends that Phase II offer a declining incentive as participation reaches certain quotas, helping to improve the cost effectiveness of the program and the market viability of the technology over time. While data analysis to support a broader implementation is beyond the scope and budget of this pilot, through working with a partner such as Open EE, CSE can assist PCE in identifying metrics to track to measure the impact of the program on load shapes in the homes selected. Working with a partner such as Open EE in the pilot implementation phase, CSE could help PCE to analyze energy use data from installed HPWHs to determine how frequently the heaters are required to operate in electric resistance mode, as well as how frequently they operate during the peak 4pm – 9pm period, expanding the utility of the pilot in informing future load shaping programs. If the pilot were taken to scale, CSE envisions the need to recruit a demand response (DR) provider that could aggregate electric water heater load to provide valuable grid services.

PCE Implementation Requirements

CSE will undertake the majority of project activities, requiring only minimal support from PCE staff. PCE will primarily play a support role in this project but will maintain decision-making authority with regards to major components of program design including, but not limited to, eligible technology, preferred installer(s), rebate amounts and delivery method, and program messaging.

PCE staff will be expected to:

- Provide feedback/input on program design to ensure alignment with other PCE programs and general approach.
- Assist in the recruitment of program participants through direct mailings targeting homeowners with specific characteristics (e.g. newer home vintage, installed solar PV, etc.) CSE will assist in developing content for marketing collateral.
- Manage procurement process to recruit a preferred installer for the program. CSE will provide content support for this process and will work closely with the selected installer to train them on program requirements.
- Work with CSE to access customer information and/or energy use data for the purposes of eligibility verification and program evaluation.

PCE plans to significantly expand their energy program offerings over the next five years.[2] This project will build critical institutional capacity in the following areas:

- **Program design for innovative fuel-substitution and electrification programs** – CCAs offer a unique ability to expand electrification of homes and transportation, reducing greenhouse gas emissions and integrating with an increasingly renewable grid. Early learning can help PCE develop strategy and build capacity for a key emerging resource.
- **Customer relationship development** – the pilot program will provide an important touch point for PCE with customers; it will help develop customer loyalty, and set the stage for participation in other programs, as PCE expands its portfolio of offerings.

Program Outcomes, Metrics and Assumptions

Table 1. Metrics for Water Heating Electrification Program

Desired Outcome	Metric	Data Source
Greenhouse gas reductions	Number of gas water heaters replaced with high efficiency electric equipment	Count of installed water heaters
Customer satisfaction	No comfort issues	Customer surveys
Knowledge of grid benefits	No impact to peak electric use	Load shapes from Open EE

Table 2. Low Income Rebate Program

Desired Outcome	Metric	Data Source

[2] Peninsula Clean Energy 5-Year Projections. https://www.peninsulacleanenergy.com/wp-content/uploads/2018/07/PCE-5-Year-Financial-Projections_Board-approved-062818.pdf

Greenhouse gas reductions	Greenhouse gas reductions associated with electrification activities.	Program application
Increased participation of income qualified populations in programs	Impact of rebate on customer participation in programs	Customer surveys

Estimated Program Benefits

This program aims to explore the feasibility of helping PCE customers switch from a carbon-based combustion appliance to a high-efficiency electric appliance, resulting in significant reduction in emissions associated with water heating. Program benefits are summarized briefly in Table 3.

Table 3. Summary of Estimated Program Benefits[1]

Benefits	Pilot Phase[2]	Phase II[2]
Greenhouse gas emissions (cumulative, lifetime)	111 MT CO_2e	3,583 MT CO_2e
Customer cost savings (cumulative, lifetime)	$16,460	$176,942
Cost of GHG savings	$594 / MT CO_2e	$218 / MT CO_2e

[1]Calculations and assumptions are included in the attached appendix.
[2]Phase I assumes 20 participants, Phase II assumes 645 participants.

As PCE works to achieve the carbon free portfolio adopted by its board, and as fuel rates increase, the avoided GHG and cost benefits are expected to increase. Fuel switching programs do present additional load for PCE. By serving as flexible load, HPWHs will allow PCE to procure more lower cost renewable energy during off-peak periods, and rely less on the purchase of expensive, carbon-intensive on-peak period electricity, either through shaped contracts, or through CAISO spot markets. The table above does not reflect these potential benefits.

Evaluation

CSE will use quantitative and qualitative methods to evaluate program success. CSE has budgeted to perform customer surveys as described in Task 5, but presents a more detailed evaluation plan in conjunction with Open EE's platform. Quantitatively, CSE will work with Open EE to understand the whole building impacts for participating customers. OpenEE will manage on their platform the process of acquiring, cleaning, and normalizing AMI data, and joining that data with building, customer, control, and measure data. OpenEE will provide analytics to enable the program implementer and PCE to visualize and analyze time and locational load impacts, and filter by relevant metadata through a series of custom designed analytics interfaces.

Augmenting the whole building analysis with operational data from HPWHs; OpenEE will gain insights into total energy use, times of operation, and operating mode during those times and compared with hourly load impacts pre and post installation. Analysis will be conducted once during implementation (defined by a period post installation when at least 50% of customers have at least 6 months of usage on the new equipment. And once at the point where at least 80% of customers have at least 6 month of post installation data. Usage and metadata will be delivered in the same format both times.

OpenEE will analyze the resource curve impact to load shape using normalized metered energy consumption pre and post the intervention. When evaluating electrification, OpenEE will request that devices are cycled from smart to traditional modes at defined intervals to evaluate the effect of smart controls specifically.

If systems do not have the capability to be remotely set, then “smart” controls should be set to off for the first 3 months, and then turned on. A few should be turned on from day one to establish any changes in usage patterns due simple to the equipment being new (this may be hard to do on a sample of 20). Other considerations for evaluation design will be dealt with as the project rolls out and in collaboration with PCE staff.

The customer’s retail cost of electricity, based on PCE tariff and time of use period, if applicable, will be used to quantify operational costs and bill impacts. The emission factor for PCE electricity and natural gas, as specified in Table 5 of Attachment 12, will be used to calculate GHG emissions.

Qualitatively, CSE will conduct brief phone interviews with rebate recipients, approximately six months after installation of their HPWHs. These interviews will explore the customer experience with the incentive design and application process, as well as their satisfaction with their HPWH’s performance. Results will be used to inform future program design, as well as evaluate the ability of HPWHs to shape load without negatively impacting customer comfort.

Qualifications

CSE is a 501(c)(3) nonprofit, mission-driven organization that has designed and successfully implemented dozens of innovative sustainable energy market development programs in support of our goal to transform the market for clean and sustainable energy. This work includes over 15 years of experience administering programs for the CPUC as a third-party administrator. Through the distribution of over three quarters of a billion dollars in consumer incentive programs, CSE has developed extensive experience in the technical and administrative requirements for successfully executing clean energy projects involving consumer adoption of new technologies. CSE specializes in energy efficiency and resilience, clean transportation, and distributed generation (solar, wind, energy storage, fuel cells and combined heat and power). CSE has earned the trust of consumers, industry, local governments, state and federal agencies and utilities through effective engagement, efficient administration and a deep understanding of the markets

Since 2000, our programs have provided incentives and technical assistance that facilitated

- Over $765M in incentives to consumers
- Over 346 MW of distributed generation of capacity
- Over 10.5 million therms saved
- More than 2.46 million metric tons of lifetime avoided greenhouse gas emissions
- Over 1,800 community, regional and state workshops hosted

we support. We are expert implementation partners for energy policymakers, regulators, public agencies and businesses tasked with achieving ambitious energy goals.

CSE has over 20 years' experience administering and implementing energy efficiency and other clean energy programs for utilities and public sector clients, including many local governments and agencies throughout California. CSE is the only other non-utility, third-party administrator of ratepayer funds in California aside from the current Regional Energy Networks. CSE currently implements more than 35 clean energy and energy efficiency programs in California and across the nation, including several large-scale programs. These efforts are continuously recognized by key stakeholders such as the California Public Utilities Commission (CPUC) and the California Air Resources Board (ARB) for their innovation and exceptional results. To date, CSE has directly supported more than 70,000 energy projects representing more than $765M in sustainable and energy-efficient technologies. This work has allowed CSE to cultivate a network of well-established relationships with key statewide stakeholders and develop a reputation as a trusted results-orientated partner for local governments.

CSE serves as program administrator and implementer for the California Electric Vehicle Infrastructure Project (CALeVIP). This statewide program, funded by the California Energy Commission, works with local partners to develop and implement EV charger incentive projects that meet regional needs for Level 2 and DC fast chargers and aims to provide a streamlined process for getting chargers installed to fill the significant gaps in charging availability.

CSE is working with Sonoma Clean Power (SCP) to provide electric vehicle charging station Technical Assistance programs, a targeted effort to provide workplace and MUD customers in SCP service territory with customized analysis and engineering support in evaluating the potential costs and benefits of hosting electric vehicle charging at their properties. CSE also administered and evaluated SCP's Drive EverGreen electric vehicle incentive program, aimed at achieving GHG emission reduction through increasing electric vehicle adoption in SCP territory.

Our experience working with SCP and the Energy Commission demonstrates our leadership and experience in driving a transition to electrification.

CSE has assembled a team of well-established, experienced energy efficiency experts, clean energy planners, project managers, engineers, research and policy analysts and program implementers. Our team of industry experts bring a wide breadth of clean energy expertise and experience as well as critical relationships with stakeholders in the California ratepayer and energy efficiency program space.

Key Program Staff

Brian Jones, Project Manager, Incentives & Operations, Distributed Energy Resources Programs, has eight years of non-profit project management experience in the sustainability field. Brian manages the California Solar Initiative Thermal Program in San Diego Gas & Electric's service territory, as well as a similar Solar Water Heating rebate program for City of Palo Alto Utilities. He has also advised Sonoma Clean Power Authority on development of zero net energy and electrification pilot programs. Brian brings a strong understanding of the barriers to adopting renewable heating and cooling technologies, and best practices in design of market transformation programs, as well as experience engaging with contractors and homeowners.

Lindsey Hawes, Assistant Director, Advisory Services, Distributed Energy Resources Programs, is a certified Project Management Professional (PMP) and administrator of numerous energy efficiency, building performance and codes and standards contracts for a range of clients including investor-owned utilities, local governments, and the California Energy Commission. Lindsey's experience spans residential and commercial energy efficiency projects in the existing building sector. For contracts that target contractors and similar service providers, Lindsey acts as a liaison between efficiency program administrators and industry partners. Her primary focus has been on increasing demand for energy efficient buildings and technologies through design and implementation of outreach and market incentive programs and increasing the supply of qualified workers through workforce education and training in building energy efficiency.

Beckie Menten, Director, Distributed Energy Resources, oversees implementation of a broad range of programs representing distributed generation, storage, energy advisement, and emerging technologies. Before coming to CSE, Beckie most recently worked for five years designing and implementing DER programs at Marin Clean Energy, a CCA in northern California. Beckie has an awareness of the opportunities and constraints that are unique to CCA program administration. Beckie will provide program design and implementation oversight.

Budget

Budgets as presented below represent a combined program that leverages economic efficiencies in rebate administration. If PCE would like to fund the low-income incentive offering as a stand-alone program, the labor costs are expected to increase.

Table 4. Budget for Water Heater Electrification Program

Category	Total
Labor	$34,746
Rebates (20)	$40,000
Survey Incentive (gift cards)	$200
Total Budget	**$74,946**

Table 5. Budget for Low Income Electrical Panel Upgrade Incentive

Category	Total
Labor	$14,738
Rebates (20)	$55,000
Survey Incentive (gift cards)	$200
Subcontractors (GRID Alternatives)	$5,000
Total Budget	**$74,938**

Please see attached budget template for further detail on proposed program budgets.

This bid/proposal is subject to mutually agreeable contract terms being reached.

Center for Sustainable Energy
Water Heater Electrification Program
3-Aug-18
Community Pilots (proposed 18 month project)

		YEAR 1	TOTAL		STATUS*
REVENUE SOURI	**SOURCE**				
Income #1	**Requested from PCE**		**$74,946**	100%	Requested
Income #2			**$0**	0%	
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$74,946**		

REVENUE SUMMARY		
Total Requested	**$74,946**	100%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$74,946**	100%

EXPENSE	**DESCRIPTION****	**YEAR 1**	**TOTAL**		**If the expense request is classified as capital***, what is its anticipated length of service**
Expense #1	Manager 1, $130, 145 hours		**$18,850**	25%	
Expense #2	Director, $216, 8 hours		**$1,728**	2%	
Expense #3	Assistant Director, $189, 24 hours		**$4,536**	6%	
Expense #4	Program Associate II, $70, 86 hours		**$6,020**	8%	
Expense #5	Marketing Associate II, $81, 2 hours		**$162**	0%	
Expense #6	Senior PR Specialist, $119, 2 hours		**$238**	0%	
Expense #7	Research Analyst, $146, 22 hours		**$3,212**	4%	
Expense #8	Gift cards to encourage timely participation in customer survey		**$200**	0%	
Expense #9	Rebates		**$40,000**	53%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$0**	**$74,946**	**100%**	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Center for Sustainable Energy
Low-Income Electrical Panel Upgrade Incentive
3-Aug-18
Community Pilots (proposed 18 month project)

REVENUE SOURCE	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**		**$74,938**	100%	Requested
Income #2			**$0**	0%	
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$74,938**		

REVENUE SUMMARY		
Total Requested	**$74,938**	100%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$74,938**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Manager 1, $130, 47 hours		**$6,110**	8%	
Expense #2	Director, $216, 2 hours		**$432**	1%	
Expense #3	Assistant Director, $189, 4 hours		**$756**	1%	
Expense #4	Program Associate II, $70, 57 hours		**$3,990**	5%	
Expense #5	Senior PR Specialist, $119, 2 hours		**$238**	0%	
Expense #6	Research Analyst, $146, 22 hours		**$3,212**	4%	
Expense #7	Gift cards to encourage timely participation in customer survey (20 @ $10 each)		**$200**	0%	
Expense #8	Rebates (20)		**$55,000**	73%	
Expense #9	Subcontractor		**$5,000**	7%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$0**	**$74,938**	**100%**	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

2018 Baseline		Annual Energy Use	Emissions Factor (lbs CO2e/unit energy)	Annual Emissions (lbs. CO2e)	Energy Cost ($/unit energy)	Annual cost to operate ($/yr/unit)
Replacement:	80 gal. Rheem HPWH	517	0.14226	73.55	$ 0.2220	$ 114.79
Baseline:	50 gal. Gas Storage	109	11.7	1,275.30	$ 1.2480	$ 136.03
	Annual savings per unit			1,201.75		$ 21.24

# of units installed by year

2019	215
2020	215
2021	215

GHG Emissions

Annual emissions reductions (MT CO2e)

Year installed	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
2019	117.90	118.22	118.53	118.82	119.10	119.36	119.61	119.85	120.08	120.29			
2020		118.22	118.53	118.82	119.10	119.36	119.61	119.85	120.08	120.29	120.49		
2021			118.53	118.82	119.10	119.36	119.61	119.85	120.08	120.29	120.49	120.69	
													3,582.93

This table reflects the decreasing GHG intensity of PCE's electricity mix across the 10-year expected life of a HPWH.

Operating Cost Savin

Annual utility bill savings ($, undiscounted)

Year installed	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
2019	$ 4,882.98	$ 5,049.00	$ 5,220.67	$ 5,398.17	$ 5,581.71	$ 5,771.49	$ 5,967.72	$ 6,170.62	$ 6,380.42	$ 6,597.35			
2020		$ 5,049.00	$ 5,220.67	$ 5,398.17	$ 5,581.71	$ 5,771.49	$ 5,967.72	$ 6,170.62	$ 6,380.42	$ 6,597.35	$ 6,821.66		
2021			$ 5,220.67	$ 5,398.17	$ 5,581.71	$ 5,771.49	$ 5,967.72	$ 6,170.62	$ 6,380.42	$ 6,597.35	$ 6,821.66	$ 7,053.60	
													$ 176,942.34

This table reflects increasing operating cost savings, assuming both electricity and gas rates increase at 3.4% annually, across the 10 year expected life of a HPWH.

Costs, Revenue, and Additional Load

Total Rebate Payments	$ 967,500.00	
Program implementation costs	$ 107,500.00	*Assumes implementation costs are 10% of total budget*
Additional electric load (kWh, lifetime)	3,334,650	
Additional PCE revenue (undiscounted lifetime)	$ 295,765.70	*Revenue from incremental electricity sales, based on PCE's electricity generation charge with annual escalator, and 10 year EUL for HPWH*
Net cost to PCE	$ 779,234.30	*Total program cost minus additional revenue*
Cost of GHG savings ($/MT CO2e)	$ 217.49	
Undiscounted lifetime utility bill savings to PCE customers	$ 176,942.34	

2018 Baseline		Annual Energy Use	Emissions Factor (lbs CO2e/unit energy)	Annual Emissions (lbs. CO2e)	Energy Cost ($/unit energy)	Annual cost to operate ($/yr/unit)
Replacement:	80 gal. Rheem HPWH	517	0.14226	73.55	$ 0.2220	$ 114.79
Baseline:	50 gal. Gas Storage	109	11.7	1,275.30	$ 1.2480	$ 136.03
	Annual savings per unit			1,201.75		$ 21.24

# of units installed by year

2019	20
2020	0
2021	0

GHG Emissions

Annual emissions reductions (MT CO2e)

Year installed	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
2019	10.97	11.00	11.03	11.05	11.08	11.10	11.13	11.15	11.17	11.19			
2020		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
2021			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
													110.86

This table reflects the decreasing GHG intensity of PCE's electricity mix across the 10-year expected life of a HPWH.

Operating Cost Savin

Annual utility bill savings ($, undiscounted)

Year installed	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
2019	$ 454.23	$ 469.67	$ 485.64	$ 502.16	$ 519.23	$ 536.88	$ 555.14	$ 574.01	$ 593.53	$ 613.71			
2020		$ 469.67	$ 485.64	$ 502.16	$ 519.23	$ 536.88	$ 555.14	$ 574.01	$ 593.53	$ 613.71	$ 634.57		
2021			$ 485.64	$ 502.16	$ 519.23	$ 536.88	$ 555.14	$ 574.01	$ 593.53	$ 613.71	$ 634.57	$ 656.15	
													$ 16,459.75

This table reflects increasing operating cost savings, assuming both electricity and gas rates increase at 3.4% annually, across the 10 year expected life of a HPWH.

Costs, Revenue, and Additional Load

Total Rebate Payments	$ 40,000.00	
Program implementation costs	$ 35,000.00	*Assumes implementation costs are 10% of total budget*
Additional electric load (kWh, lifetime)	103,400	
Additional PCE revenue (undiscounted lifetime)	$ 9,171.03	*Revenue from incremental electricity sales, based on PCE's electricity generation charge with annual escalator, and 10 year EUL for HPWH*
Net cost to PCE	$ 65,828.97	*Total program cost minus additional revenue*
Cost of GHG savings ($/MT CO2e)	$ 593.80	
Undiscounted lifetime utility bill savings to PCE customers	$ 16,459.75	

Input	
Output	
Assumption	

		Reference
# of PCE residential accounts	258,677	PCE 2018 Integrated Resource Plan
% residential water heaters replaced (at scale)	0.25%	
# of units replaced (at scale)	647	
# of units replaced (pilot)	20	
Rebate amount Y1	$2,000	
Rebate amount Y2	$1,500	
Rebate amount Y3	$1,000	

Replacement model	80 gal. Rheem HPWH	
Electricity rate	ECOPlus	
Gas rate	PG&E Standard	
2017 PCE electricity emissions factor (lbs/kWh)	0.14226	PCE guidance document
Natural gas emissions factor (lbs/therm)	11.7	PCE guidance document
HPWH Expected Useful Life (yrs)	10	DEER 2014 EUL Table
Annual GHG reduction of PCE electricity emissions factor (%)	5%	PCE 2018 Integrated Resource Plan
Annual utility cost escalator	3.40%	CPUC (2017) California Electric and Gas Utility Cost Report. Available at: http://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/About_Us/Organization/Divisions/Office_of_Governmental_Affairs/Legislation/2017/AB67_Leg_Report_PDF_Final_5-5-17.pdf

Other Assumptions

Baseline water heater is 50 gal. natural gas with UEF = 0.6

PCE customer is on ECOPlus tariff

PCE customer is on PG&E Standard gas rate

Electric rate	Total rate ($)	Electric Generation Rate	Emissions Rate (lbs CO2e)
ECOPlus	$ 0.222	$ 0.068	0.14226

Gas rate	Total rate ($)	Emissions Rate (lbs CO2e)
PG&E Standard	$ 1.248	11.7

Annual energy use		
50 gal. Gas Storage	109	*CSE calculations based on UEF of 0.6*
80 gal. Rheem HPWH	517	*CSE calculations based on UEF of 3.7*
80 gal. AO Smith HPWH	700	*CSE calculations based on UEF of 2.7*

	PCE Electricity Emissions Rate (lbs CO2e / kWh)	**ECOPlus generation rate**	**ECOPlus total rate**	**PG&E Standard Rate**
2018	0.135147	$ 0.0707	$ 0.2296	$ 1.2904
2019	0.12838965	$ 0.0731	$ 0.2374	$ 1.3343
2020	0.121970168	$ 0.0756	$ 0.2455	$ 1.3797
2021	0.115871659	$ 0.0782	$ 0.2538	$ 1.4266
2022	0.110078076	$ 0.0808	$ 0.2624	$ 1.4751
2023	0.104574172	$ 0.0836	$ 0.2714	$ 1.5252
2024	0.099345464	$ 0.0864	$ 0.2806	$ 1.5771
2025	0.094378191	$ 0.0894	$ 0.2901	$ 1.6307
2026	0.089659281	$ 0.0924	$ 0.3000	$ 1.6862
2027	0.085176317	$ 0.0956	$ 0.3102	$ 1.7435
2028	0.080917501	$ 0.0988	$ 0.3207	$ 1.8028
2029	0.076871626	$ 0.1022	$ 0.3316	$ 1.8641
2030	0.073028045	$ 0.1056	$ 0.3429	$ 1.9274
2031	0.069376643	$ 0.1092	$ 0.3546	$ 1.9930

Accelerate Residential Beneficial Electrification

Submitted by Home Energy Analytics

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Accelerate Residential Beneficial Electrification

Description of Project

Home Energy Analytics proposes enhancing two of our existing products – Smart Audit and AskDrPower.com – to support residential beneficial electrification (BE). Both are currently being used by PG&E customers and are part of other energy reduction programs. Enhancements would include:

- Using Smart Audit to qualify homes and assess potential energy savings by switching from burning natural gas to electric heat pump technology.
- Including timely information on beneficial electrification including a forum for discussion and ability to submit questions on the informational portal, AskDrPower.com.

Smart Audit combined with AskDrPower.com will encourage customers to explore the possibility of beneficial electrification, and for some customers it will be compelling to proceed and actually install heat pump technology. Enabling a switch from natural gas to electrical appliances supports three of PCE's goals for a community pilot.

1. Reducing GHG emissions
   The move from natural gas appliance such as furnaces, hot water heaters and clothes dryers to those based on efficient electric heat pumps not only eliminates the use GHG producing natural gas consumption but also saves energy overall due to the improved efficiency of heat pump technology. The efficiency will continue to increase as heat pumps are more widely deployed which will also drive down the price of units.
2. Delivering local community benefits
   Installing heat pump devices requires local labor. While this proposal is for a pilot, it is designed to be scalable at a low cost and leverage existing energy efficiency work supported by PG&E and the CEC. The goal is to increase installations of heat pump technologies, which can only be performed by local contractors and technicians.
3. Advancing innovation
   There are no tools available to help residents determine the energy savings they can expect to see when switching to heat pump technology from their existing unique energy profile. By adding this technology into our existing easy-to-use Smart Audit tool we will be able to accurately estimate the energy savings for each individual residence.

Enhancements in this proposal will take advantage of both an existing customer base and new promotion since both products are already in use. As the enhancements are deployed, current customers will immediately have access to them. We will also work with PCE on special promotions as part of the roll out. HEA is actively recruiting new customers for our HomeIntel energy reduction program for PG&E, a program we expect to continue for several years, so PCE customers will also benefit from ongoing promotions of that free service.

Background

Smart Audit is the foundation of HEA's HomeIntel energy reduction program. HomeIntel is available to all PG&E residential customers at no cost. By enrolling in HomeIntel customers receive a Smart Audit account and access to a personal energy coach. HEA is paid by PG&E for measured energy savings, both electricity and natural gas. HomeIntel is a breakthrough program because it is the first in California to use savings as measured by meter interval data as the basis of payment, i.e. HEA is paid only for actual savings. As of 8/1/18 more than 900 PG&E customers have enrolled in HomeIntel, and a significant portion of those customers are in San Mateo County since we have been conducting active outreach with both the County of San

Mateo and local communities. Measured savings (from CalTRACK.org) already exceed 2,000 MMBtus as of 8/1/18.

Existing HomeIntel participants will have access to the proposed BE enhancements as soon as they are incorporated into Smart Audit. We expect HomeIntel will continue as a PG&E program for several years so PCE customers will benefit from HomeIntel outreach and participation, magnifying the impact of the BE enhancements with no additional cost to PCE.

Dr. Power is a mobile and web app available for iOS, Android and standard browsers funded through an EPIC grant from the CEC, part of GFO-15-310 *Developing a Portfolio of Advanced Efficiency Solutions (Phase II): Plug Load Technologies.* Dr. Power enables users to explore their "Home Idle Load": the electric power, measured in watts, being used when everything in the home is turned off. Most people are not aware how much this contributes to their overall energy consumption. HEA co-authored a paper with the NRDC and Stanford: *Home Idle Load: Devices Wasting Huge Amount of Electricity When Not in Active Use.* This study concluded the idle load consumes 22.5% of electricity used in the home using data from 70,000 PG&E users (and well over 30% when refrigerators are included).

As part of the EPIC grant, HEA has started development work on AskDrPower.com as an informational resource. It contains articles and is set up to be an interactive forum. As part of this PCE grant it will be expanded to focus on BE with particular focus on answering questions, qualifying homes for heat pumps, and idea exchange. AskDrPower.com will become a source for information on BE targeted to the homeowner interested or considering it. AskDrPower.com will be expanded to include a section on the concept of BE, practical considerations, resources for making the transition, guest articles and a moderated discussion forum.

Combined, AskDrPower.com and Smart Audit will give PCE customers the knowledge they need to determine if BE is the right path for them. Through this grant, PCE will have a scalable way to both educate and encourage their customers that will also be beneficial to other Californians as well.

Outcomes

Accelerates GHG reductions and renewables

Switching homes to be mostly or all electric will have a direct impact on reducing GHGs as PEC energy becomes GHG-free. The difficulty is learning how to realistically incentivize BE. There are two components to consider:

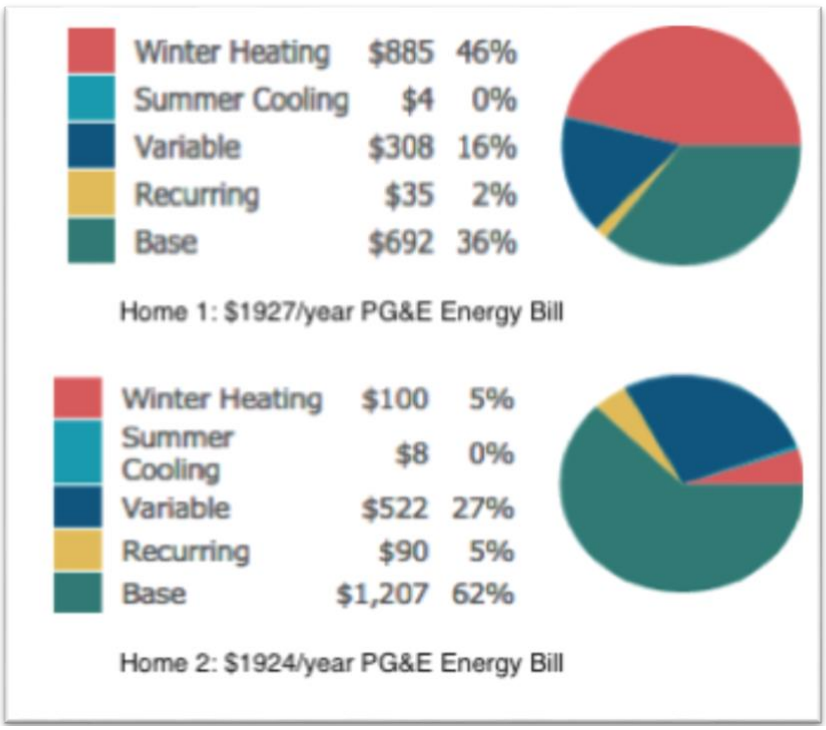
1. Understanding the process of electrifying homes.
2. Understanding how to analyze homes to identify those best qualified and with the highest potential energy savings from converting.

HEA recommends PCE consider the Ardenna Energy proposal to address the first component. Their program would go through the process of electrifying homes to create an understanding of project difficulties and costs. Our proposal addresses the second issue, and is necessary to scale BE. Smart Audit offers a simple interactive method to qualify homes for BE and quantifies the amount of natural gas used for space and water heating, information necessary to determine the potential energy and GHG savings from electrification.

Our analytics capability was developed in 2009 and has been continually refined since then. It is the cornerstone of our home energy analysis, and with enhancements can provide accurate savings estimates for electrification specific to each home.

This grant would fund the enhancements to add qualifying parameters (where is the existing water heater? Is a 220V outlet nearby? etc) and perform the analysis to calculate the cost/benefits of electrifying space heating, water heating or both. In addition, Smart Audit would be enhanced to allow the parameters and calculations to be easily modified to accommodate what we expect to be many fluctuations as we all gain more experience in residential BE.

Smart Audit shows the customer how much money they are spending on different energy use categories. Each home is unique and the differences are sometimes surprising as seen in Figure 1. This is data from actual homes in the Bay Area. Home 1 is spending 46% of their yearly energy bill on winter heating. Home 2 is spending 62% of their yearly energy bill on base loads. Even though the homes have similar yearly energy bills the approach to reduce their overall energy use is different: Home 1 needs a HERS audit and a plan to fix either the home envelope, insulation or heating equipment. Home 2 would not benefit from a HERS audit because the home HVAC system is using only 5% of the overall energy use. Instead, Home 2 needs to do a careful analysis of their plug loads and look for appliances with high standby energy use or appliances that are always on such as hot water recirculation pumps or perhaps a fountain or fan running continuously or a combination of these things.

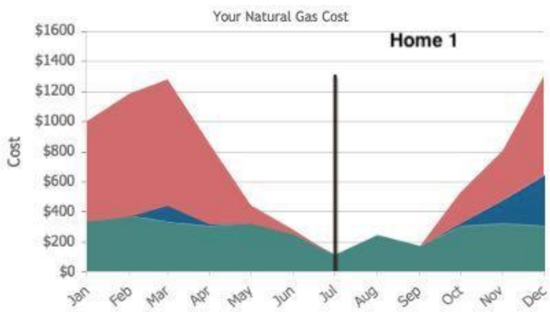


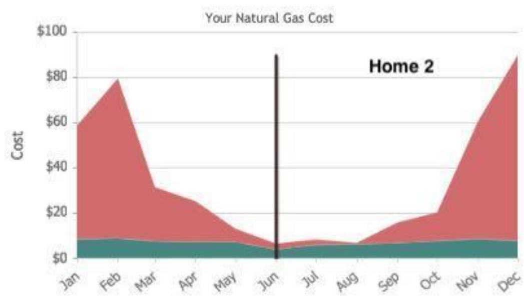
The previous charts are combining both electric and natural gas because we encourage customers to initially think about energy use in categories so they can more easily equate energy use to their actions. The following table shows how Smart Audit categories energy use for both natural gas and electricity.

Energy Category	Nat. Gas	Electricity	Consists of…
Winter Heating	✓	✓	Energy use that correlates with lower temperatures, including gas furnaces, electric space heaters, heated floors, electric blankets, etc.

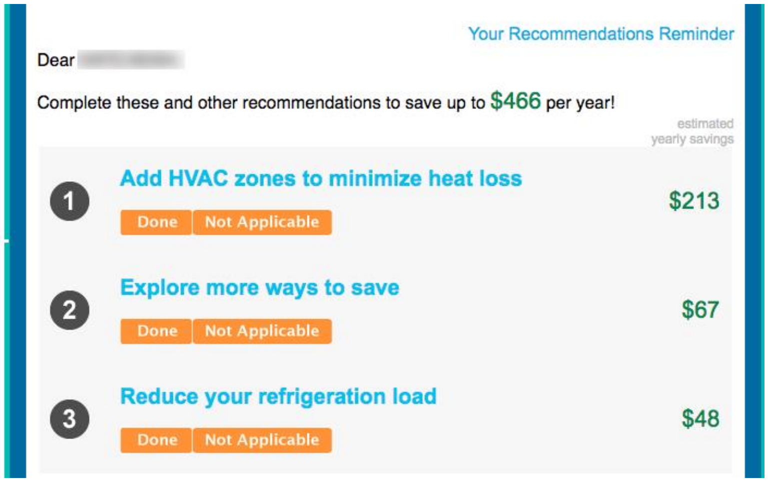
Energy Category	Nat. Gas	Electricity	Consists of…
Summer Cooling		✓	Energy use that correlates with higher temperatures, including fans, air conditioning, etc.
Variable	✓	✓	Behavioral energy use that is unpredictable: lights, washing machines, dishwashers, microwaves, stoves, cook tops, entertainment systems when they are on, computers when they are turned during a portion of the day, etc.
Recurring		✓	Energy used consistently at the same time every day: pool or spa pumps, outdoor lighting, coffee pots on timers, etc. These loads can be controlled by timers but can also include consistent behavioral patterns (i.e. easily recognized by residents).
Base	✓	✓	Continuous energy use (meaning consistent across specified time intervals) caused by devices that draw power in a predictable manner: refrigerators, natural gas water heating, desktop computers in sleep mode, game consoles in sleep mode, DVRs, whole house audio systems in standby, surround sound systems, wifi routers, powered phones, clocks, etc.

The two categories of interest for BE are natural gas Winter Heating and natural gas Base Load. Smart Audit accurately measures the natural gas used for winter heating and hot water heating. Knowing the existing amount and cost is the first step in making an accurate estimate of the cost and GHG savings for BE. The following example illustrates a similar situation to the two homes above. Notice that the y-axis has a different scale on the two examples. Home 1 is spending up to $1,200 per month on natural gas in the winter, while home 2 is only spending around $80 per month. Home 2 is a poor candidate for BE because their natural gas use is relatively low. The GHG reductions from Home 1 would be considerable so is a much better candidate.





New survey questions, parameters and calculations will be added to the Smart Audit to address BE qualification and cost analysis. All of these values will be changing rapidly over the next few years so they need to be incorporated in a way that they can be easily changed and calculations based on them can change as well. Being able to refine BE estimates will be important so the additions to Smart Audit will require careful planning and testing. It is also important to present the information in a way so that customers find it useful and can act on it. Smart Audit already presents recommendations on energy savings so we have experience in presenting actionable information. Customers also receive an email each month with their top 3 money saving suggestions as showing in the example below. We’ve learned that it is important to make suggestions based on realistic savings potential calculated using their home’s specific energy profile.



Methods used for BE may look different than the example but will be equally accurate and useful. In the case of BE, instead of listing the potential dollar savings, users may see an estimate of natural gas savings, GHG reduction and a high level estimate of the cost of installing the new systems. The detailed user experience (UX) will be designed as part of this grant.

We’ve presented the proposed analysis and recommendation improvements to Smart Audit, but the enhancements to AskDrPower.com are an equally, if not a more important component of this proposal. The website was developed in support of the Dr Power app developed for the CEC. As part of this grant we will add a focus on BE, including: general articles about BE technology, equipment developments and installation considerations; articles by experts such as Bruce Mast, Tom Kabat, Sean Armstrong, Pierre Delforge, etc; and a forum for users. The site will not take a position for recommending specific equipment or contractors, but users can comment on contractors or equipment they have used. Developing a forum will take patience and persistence, but should become both an introduction to people considering BE and a source for detailed information for those engaging in an upgrade.
BE is such a new concept and the California CCEs are leading the way in promoting adoption. If you search for BE (or beneficial electrification since searching on BE doesn’t yield anything on the topic) you will find only articles describing the concept at a high level. This is useful information but it doesn’t help a motivated homeowner get started. AskDrPower.com will become that resource. We foresee it being modeled on other interactive, informational websites similar to nerdwallet.com or the forum on Trulia.com. Updates and moderating for AskDrPower.com will continue for the 18 months of the grant.

Below are the high-level development schedules for Smart Audit and AskDrPower.com. The first step in both is to add details concerning deliverables and define a more exact schedule. This information would be presented to PCE approximately 4 weeks after executing the contract. AskDrPower.com is already available but during the 18 months of this contract the content supporting BE would continue to increase. In addition, we would experiment with social media and other outreach channels to increase traffic. Smart Audit enhancements would be completed in the first 6 months of the contract including beta testing. The remaining 12 months will be devoted to having customers use the BE analysis. It isn't necessary to wait until completion of the enhancements to recruit users. Recruiting for HomeIntel customers will be ongoing and all HomeIntel customers will be contacted as soon as the BE enhancements are available and encouraged to explore them. Because of the current HomeIntel program PCE will have the advantage of having a pool of interested customers as soon as the enhancements are available.

Schedules

Smart Audit Development Plan		
Task	**Duration**	**Milestone**
Define enhancements	4 weeks	Presentation to PCE.
Implement enhancements	20 weeks	Demonstration to PCE. Successfully used by 2 PCE customers.
Promote BE	1 year	500 customers in PCE territory use Smart Audit. 25 users embark on BE projects
AskDrPower.com Development Plan		
Task	**Duration**	**Milestone**
Define enhancements and timeline	4 weeks	Presentation to PCE.
Continuously enhance AskDrPower.com	17 months	Monthly summary to PCE management 1,500 customers in PCE territory visit AskDrPower.com

GHG Reductions: See attached HEA_Calcs.xlsx

The expected GHG reductions for the duration of the grant, 248 MT CO2e, are not large, but it is important to understand that the value of enhancing both Smart Audit and AskDrPower.com is to build the tools to both increase familiarity with BE and the analytical capability to build impactful future BE programs at scale. There is little to no data on what energy profiles are the best candidates for BE. What winter heating usage patterns are the sweet spot for a heat pump heater? Or hot water usage for a heat pump water heater? Answering these questions by analyzing a large population of homes will help PCE tune the outreach to homes that would see the greatest GHG savings. What's the payback period? Answering this question will help establish compelling rebates. But the answer to these questions will also change over time because all the parameters are changing. It's also possible that a value for GHG reductions will be established so that being able to accurately predict GHG reductions will be important. HEA will build the capability into Smart Audit to answer these questions, and endeavor to make the service available to all homes in California at no cost.

We appreciate that PCE emphasizes that the results of these grants should benefit other CCEs. Since Smart Audit works for all PG&E customers, all CCEs in PG&E territory will benefit. Smart Audit will soon be integrated with SCE and SoCalGas as well, so CCEs in those areas will be able to take advantage of the new capability.

Delivers community benefits

This proposal supports energy analysis and education for residential customers, primarily owner-occupied single family homes. The educational aspects of AskDrPower.com may also be valuable for small business owners considering installing heat pump technology. The analysis of Smart Audit is applicable to all residences, single and multi-family residences occupied by either owner or renters, but the expectation is appliance upgrades are interesting to owners of single-family homes. It is possible that owners of townhomes or condominiums might be interested in upgrading but it will be dependent on the configuration of their residences. As this pilot is structured, renters are unlikely participants because they would need to convince the owners of residences to invest in upgrades. But the data gathered through this pilot could help structure a program for landlords based on targeting residences that would benefit most from BE for a specific cost.

HEA's proposal delivers two substantial benefits to the community:

- Tools to create cost effective BE programs
- Employment for local contractors

As explained above, with the analysis to more accurately target homes PCE will be able to support more BE projects by being able to promote more efficient use of PCE funds. PCE can use the analysis capability to search for energy profiles that are the "sweet spot" for BE, or use the analysis to determine what if any rebates would deliver the most GHG reductions. Smart Audit will provide the type of analysis to make these and other decisions on program design.

BE upgrades will be performed almost exclusively by local contractors. The results of this pilot will be a web service and data that will guide PCE in determining which and how many homes are good targets for BE based on the economic parameters defined by PCE. The results of another pilot such as that by Ardenna Energy would quantify the labor requirements for replacing natural gas appliances. To some extent, PCE will be able to determine the benefit to local contractors who can perform the replacement work.

This is the type of analysis that will lead to being able to support BE for disadvantaged communities. Before creating such a program it is necessary to know the true costs and benefits. Smart Audit will be able to estimate the costs, the benefits and then also track energy use after installations to determine the realized benefit. PCE can use this information to determine if subsidiaries are necessary and to what level are needed to support disadvantaged communities.

Supports PCE's load serving needs

The primary purpose of the grant is to set up a process for reducing GHGs. Because heat pump technology can have load-shifting capability through controlled demand response, there could potentially be load shifting capability over the longer term. The bigger barrier to load shifting with heat pump technology is having the embedded capability to automatically control the load and control systems. The analysis capability of Smart Audit could enable upfront evaluation of this technology, but there are at least two significant technology components needed to make the actual load shifting viable.

Additional Benefits

Smart Audit and AskDrPower.com will put PCE in the forefront of community supported BE. PCE will be funding a practical guide through AskDrPower.com on how to implement BE. As mentioned above, this doesn't currently exist. We expect many more people will initially research BE using AskDrPower.com than will actually take action. But the idea and information flow needs to start and it needs to come from a creditable source that isn't funded by a specific contractor or equipment supplier.

Smart Audit will be the tool to use for both customers and PCE staff. Customers will use it to determine whether their home is good fit, and how much GHG savings they can expect to see. PCE staff will have access to summary data via a dashboard to determine how much GHGs are actual saved across the community, which will help tune the program to achieve maximum savings, or other goals such as more strongly supporting disadvantaged communities. Knowing how much savings have been achieved and estimating how much savings could be achieved gives PCE the power to realistically tune BE programs in the future.

PCE Implementation Requirements

We expect the requirements on PCE to support this proposal will be modest. They break into roughly two categories:

- **Project Review**
  Would start with review of enhancements and schedules 4 weeks from contract execution. Following the initial meeting we would suggest monthly reports with a meeting if necessary. At the release of Smart Audit another meeting to see a demonstration of the upgraded system would be valuable. After that, we would continue monthly summary reports and be available for meetings as necessary. At the end of the project there should be a wrap up meeting.
- **Outreach support**
  Any participant in HomeIntel has the potential to engage in BE so we suggest PCE support HomeIntel outreach as soon as the project begins. All HomeIntel users will be informed when the BE capability is available and can begin using it. After BE capability is available in Smart Audit, PCE can recruit directly for households interested in BE. We have found through our outreach efforts with HomeIntel that outreach supported directly by either the local government or other trusted information source, such as PCE, achieves the greatest response rate. Outreach support includes: letters sent on PCE letterhead, mentions in enews and newsletters, and social media postings. HEA has a catalog of messages and articles available for each medium.

Following the completion of the contract the support of AskDrPower would continue at some level but PCE may choose to take a more proactive role in adding articles, blog postings and expert guidance. This is an option that should be discussed during the 18 months.

Smart Audit will continue to be available to PCE customers as long as HomeIntel continues. PG&E has the option to extend the program up to 5 years.

Qualifications

PG&E Pay-for-performance (P4P)

HEA was chosen as the first vendor to provide residential P4P in California. P4P has been mandated by the legislature and PUC to increase energy savings in support of the State's aggressive GHG reduction goals. The California utilities needed to dig deeper and be more innovative in achieving energy savings because the easy energy saving programs have already been implemented. P4P gives program managers the flexibility to look for the most cost effective energy saving measures in each home because they are paid on measured energy savings, not prescriptive measures that may or may not be the most appropriate for a specific home. Payments are made each month. The program manager submits a list of customers and the beginning date of their enrollment. PG&E then verifies the savings using an independent 3rd party software tool: a CalTRACK implementation provided by Open EE. Once the savings are calculated, PG&E pays HEA per MMBtu recorded. This simple transactional approach streamlines the energy reduction program while also making it accountable to public scrutiny for cost effectiveness.

HEA launched HomeIntel (the name of our P4P program) within 8 weeks of executing the contract with PG&E in July, 2017. HomeIntel is in charge of outreach and managing a group of partners providing energy coaching services to their clients. To date (7/13/18) we have billed (and have been paid by) PG&E for 2,019 MMBtu of savings. Savings accrue monthly so the current cohort of customers continues to deliver measurable savings and we are increasing the customers daily as outreach expands.

We will be launching the same program in southern California in Q3, 2018, under existing contracts with both SCE and SoCalGas.

High Energy Homes (HEH): HEH commenced in 2010 and was funded by five affluent Peninsula towns: Atherton, Los Altos Hills, Monte Sereno, Portola Valley and Woodside. These towns used their ARRA funds to purchase Smart Audit accounts for residents. These communities are among the highest per household energy consumption in PG&E territory and we saw correspondingly high savings. Most participants chose their own energy saving actions based on the online recommendations. HEA also provided email and phone support to participants requesting help. We learned that homes with high energy use are excellent candidates for achieving large energy reductions based non-asset based strategies (see detailed results in table below).

HEA Program Group	Annual Electric Savings			Annual Natural Gas Savings		
	Initial kWh	kWh Savings	% Savings	Initial therms	therm Savings	% Savings
HEH 2012 (181 users)	15,958	1,133	7.1%	1,216	45	3.7%
HEH Top Quartile (45 users)	23,683	4,405	18.6%	1,474	84	5.7%
EUMV 2013 (1,239 users)	5,453	301	5.5%	378	62	16.4%
EUMV Top Quartile (310 users)	7,264	1,573	21.6%	512	172	33.7%
Alameda 2014 (462 users)	5,807	352	5.6%	419	59	12.9%
Alameda Top Quartile (116 users)	7,265	1,074	15.1%	537	142	28.0%
SVEW (77 users)	2,846	289	10.2%	34	4	12.2%

Energy Upgrade Mountain View (EUMV): The City of Mountain View used a portion of their ARRA funds to provide Smart Audit accounts to all residents. HEA managed outreach and support in conjunction with a local non-profit, Acterra. We learned how to achieve sustained program enrollment rates for a modest cost by working closely with the community. We worked with the city to promote the program through city materials and provide educational seminars at a city venue. Monthly seminars were over-subscribed at 50+ attendees each.

Alameda: StopWaste, a public agency responsible for reducing waste in Alameda County, selected HEA to provide Smart Audit accounts for all Alameda County residents as part of their Home Energy Analyzer program. StopWaste managed outreach and support in this PG&E funded program. Outreach benefited from being associated with a popular public agency. Stopwaste also employed high-touch outreach through a professional door-to-door canvassing group, GreenPro Network. This program reinforced the lessons we learned from EUMV: high-touch outreach with local community branding is the most effective.

Evaluation

We propose a small set of metrics/evaluation criteria.

1. Number of visits to AskDrPower.com from the PCE territory. Target – 1,500
2. Number of Smart Audit users - 500
3. Number of PCE customers who implement or start to implement BE by the end of the program – 25
4. Measure GHG reductions due to BE using AMI data -- 248 MT CO_2e
   (It will take 12 months post installation to determine this metric because Smart Audit will need a year of data to determine savings attributable to switching space heating. GHG reduction attributable to water heating may be available in less than a year.)

Metrics and Assumptions

Metrics 1 and 2 (listed above) are based on the size of the PCE customer base and HEA's experience with outreach for HomeIntel and other programs.

Metric 3 is based on our best guess since there is no other data for this type of program. We do believe that with close collaboration with Ardenna Energy this is a realistic number. The HEA proposal and Ardenna Energy proposals are complimentary and supportive.

Metric 4 is based on our experience in using AMI data to track energy savings.

Increasing metrics 1,2 and 3 is easily scalable with little support from PCE. The value of metric 4 will help determine how to scale installations based on 2 metrics controlled by PCE:

1. How valuable is GHG reduction.
2. How much money is available to achieve reductions.

The HEA proposal will build awareness and knowledge about BE and is set up to be scalable at a low cost. The transition from interest to actual installation will require a monetary investment and PCE will be capable of deciding how much of that investment, if any, they want to subsidize.

All players in the BE market believe the equipment costs will continue to fall as equipment efficiency improves making BE more and more attractive. Having the knowledge of actual GHG savings is important to move more households into taking advantage of these trends. BE will be a project that continues for many years. Smart Audit and AskDrPower.com are the tools PCE needs to increase BE as it becomes more and more viable.

Home Energy Analytics
Encouraging Residential Beneficial Electrification
8/3/18
Community Pilots

REVENUE SOURCE	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**	$75,000	**$75,000**	19%	Requested
Income #2	EPIC grant EPC-15-025 ("Plug Load Reduction App: RYPL"; app & resources for res. EE)	$42,000	**$42,000**	10%	Pledged
Income #3	EPIC grant EPC-15-025 ("Plug Load Reduction App: RYPL"; app & resources for res. EE)	$38,000	**$38,000**	9%	Received
Income #4	PG&E Pay for Performance EE contract (began 7/17; for residential PG&E users)	$62,500	**$250,000**	62%	Estimated
			$0	0%	
	Total	**$217,500**	**$405,000**		

REVENUE SUMMARY			
Total Requested	Requested grant from PCE	**$75,000**	19%
Total Pledged	Remaining budget for AskDrPower.com from CEC EPIC award EPC-15-025	**$42,000**	10%
Total Received	Funds already received from CEC for AskDrPower.com via EPC-15-025	**$38,000**	9%
Total Estimated	Expected payments from PG&E for savings from HomeIntel users in PCE territory	**$250,000**	62%
TOTAL PROPOSAL REVENUE		**$405,000**	100%

From the PCE instructions:
"If costs are to be shared, please be clear about breakdown of costs to each entity."
Please note color coding between Income categories and Expense categories in far left column.

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Development updates to HomeIntel service for BE analysis [Dev; $100; 150 hrs]	$15,000	**$15,000**	4%	n/a
Expense #2	BE content & education updates to HomeIntel [EA; $200; 50 hrs]	$10,000	**$10,000**	2%	n/a
Expense #3	BE content & education updates to AskDrPower.com [EA; $200; 50 hrs]	$10,000	**$10,000**	2%	n/a
Expense #4	Development updates to AskDrPower.com for BE qualification [Dev; $100; 200 hrs]	$20,000	**$20,000**	5%	n/a
Expense #5	Create & grow online community for BE at AskDrPower.com [SEO; $200; 100 hrs]	$20,000	**$20,000**	5%	n/a
Expense #6	Residential EE content & education updates to AskDrPower.com [EA; $200; 190 hrs]	$38,000	**$38,000**	9%	n/a
Expense #7	Build & grow AskDrPower.com as primary site for res. EE & BE [SEO; $200; 210 hrs]	$42,000	**$42,000**	10%	n/a
Expense #8	Custom EE & BE analysis & advice for ~500 PCE customers (the HomeIntel service)	$62,500	**$250,000**	62%	n/a
	Codes used for staff labor: Dev=Software Developer; EA=Energy Expert; SEO=Growth hacker.		**$0**	0%	
			$0	0%	
TOTAL PROPOSAL EXPENSES		**$217,500**	**$405,000**	**100%**	

Net Income - Expenses		-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

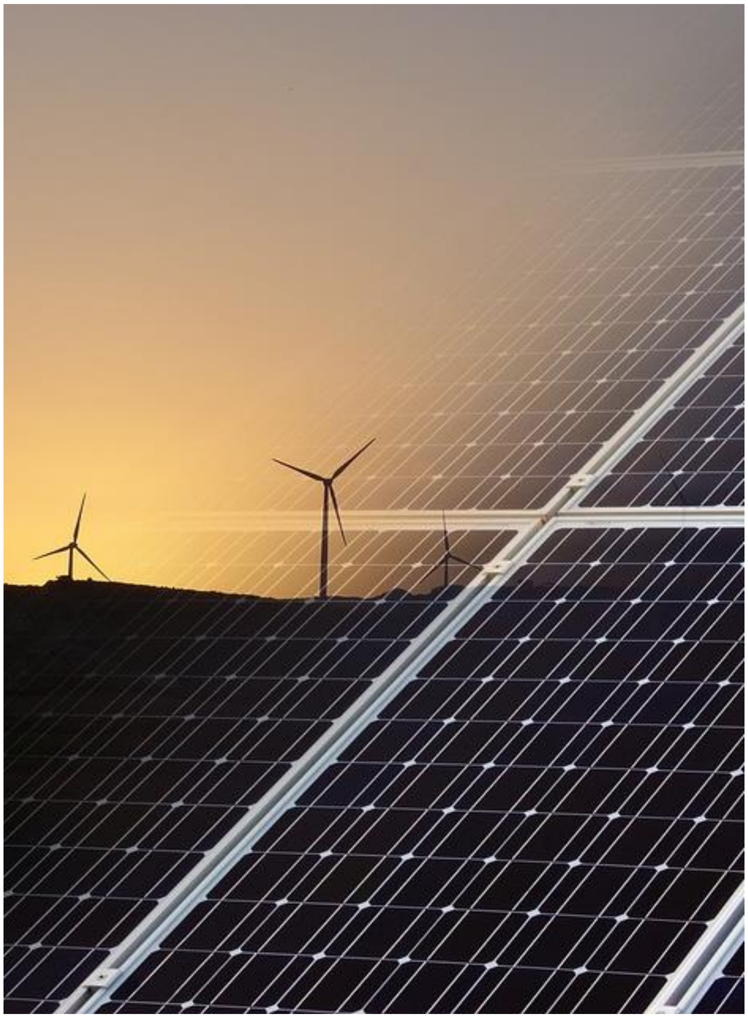
** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

HEA Calculations for PCE Community Grant Proposal

Description	Value	Units	Source
Electric CO2e Emissions Factor:	0.14	lbs/kWh	Table 5 of References document provided
latural Gas CO2e Emissions Factor:	11.7	lbs/therm	Table 5 of References document provided
Heat Rate used for site electricity:	6,515	BTU/kWh	HEA contract with PG&E for HomeIntel savings calculation
ical Electric Use for Target homes:	10,000	kWh/yr	HEA experience
cal Nat Gas Use for Target homes:	600	therm/yr	HEA experience
lectric savings rate for HomeIntel:	(10%)	kWh/yr	PG&E confirmed figures from July 2018.
Natural Gas savings for HomeIntel:	(12%)	therm/yr	PG&E confirmed figures from July 2018.
Estimated electric change for BE:	15%	kWh/yr	HEA experience
timated natural gas change for BE:	(40%)	therm/yr	HEA experience
Lbs per Metric Ton:	2,204.62	lbs/MT	Google

		Change (kWh)	Change (therms)	Change (MMB)	Change (lbs CO2e)	Change (MT CO2e)
Total Smart Audit Users:	**475**					
Electricity change:	(10%)	-475,000		-3,095	-67,574	-31
Natural Gas change:	(12%)		-34,200	-3,420	-400,140	-182
		-475,000	-34,200	-6,515	-467,714	-212
nart Audit plus BE Users:	**25**					
Electricity change:	5%	12,500		81	1,778	1
Natural Gas change:	(46%)		-6,900	-690	-80,730	-37
		12,500	-6,900	-609	-78,952	-36
All users:	**500**	-462,500	-41,100	-7,123	-546,665	**-248**



WIND AND PV AT PESCADERO

OFFICE OF SUSTAINABILITY

COUNTY OF SAN MATEO

COUNTY OF SAN MATEO
Point of Contact:

Jim Eggemeyer
Director, Office of Sustainability

Lillian Clark
Special Districts, Resource Conservation Program Manager
lclark@smcgov.org
650-599-1447

1 PROJECT DESCRIPTION:

1.0 INTRODUCTION

A key goal for the County of San Mateo (County) is to support and foster an environmentally conscious community, as seen in the Shared Vision 2025 document. One important aspect of this goal is to reduce carbon emissions. The County has set a goal of reducing emissions for unincorporated areas and for the County's operations. In 2012, the County published the Government Operations Climate Action Plan (GOCAP), which sets a target emissions reduction of 80% below 2005 levels by 2050. To achieve this goal, the County has implemented a number of measures including opting up to PCE's ECO100, implementing building retrofits, and incentivizing alternative commute transportation. In addition to measures outlined in the GOCAP and the Community Climate Action Plan, the County is interested in further offsetting its emissions by building a local renewable energy source on vacant land in Pescadero.

The County solicited input from the community in a few public meetings on ideas to generate revenue to help offset the costs to continue providing garbage and recycling services to the community at the Pescadero Transfer Station. As a result of this input from the public, residents suggested ideas. The two ideas that moved to the forefront in these meetings were: explore the potential for solar/wind at the Pescadero landfill site, and explore a small scale in-vessel composting operation to produce organic soil from the local farmers' organic waste.

The County released a RFP to conduct two feasibility studies based upon the community input, and SCS was selected to conduct the studies. The two studies produced at the end of this project were "Final Report Renewable Energy Technology Evaluation, Pescadero Transfer Station and Landfill Sites", and "San Mateo County Organics Processing Study."

SCS Engineers (SCS) evaluated options of developing solar and wind renewable energy technologies. As part of this task, SCS identified the potential technologies, technical feasibility, rough costs and revenues associated with development and operations, and various development scenarios. SCS has estimated a maximum of approximately 4MW of solar and wind could be installed at this Pescadero Landfill site. The amount of electricity that would be generated is equivalent to all the electricity required by all County operations. Since the County receives 100% renewable electricity from PCE, the renewable energy generated by this plant can go directly back into the grid, helping PCE reach its goals of local renewable electricity by 2025. If awarded, <u>funding from the PCE grant would be used to conduct a more extensive wind and solar study to determine actuals, siting the locations and preparing the remaining specifications that would be incorporated into a Report and eventual RFP</u> (Future phase, not a part of this grant application.). The future RFP would solicit bids for construction at the Pescadero landfill and areas adjacent to the landfill that are owned by the County.

1.1 DESCRIPTION OF TECHNOLOGIES AND FEASIBILITY

1.1.1 Solar Photovoltaic (PV)

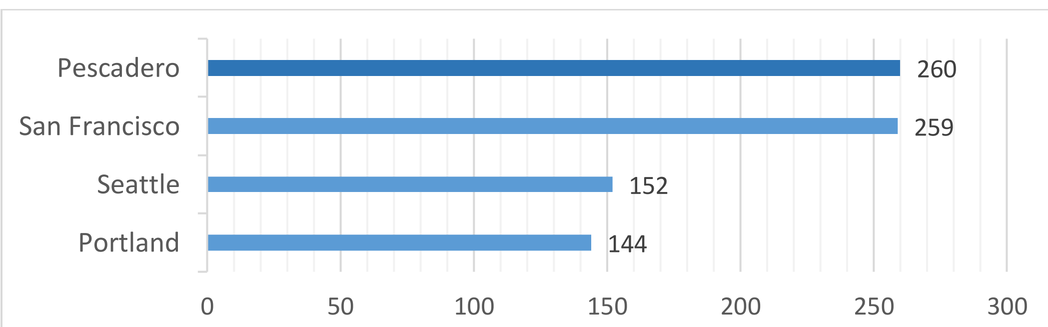
Two solar developers that evaluated the site estimated a 3MW and 1.4-1.8MW output respectively.

SCS researched the feasibility of siting a PV system at the Pescadero site, and specifically the closed landfill, which included a review of landfill characteristics, such as age, slope, and type of cover. The rate of settlement at the Pescadero landfill is expected to be minimal due to its age and should not have an effect on the installation of solar modules. A maximum slope of 15% is set by most developers to avoid possible challenges, such as wind loading, erosion, and foundation requirements.

Regulatory considerations were also researched while assessing the potential of placing the PV system on any closed landfill. A minimum of two acres is recommended for development of the PV system. The Pescadero landfill is approximately 5 acres in size and has sufficient buffer space that makes it a suitable location. The installation of the system does not require foundations to penetrate the capped landfill because the technology can use a ballasted mounting system that will allow all construction-related activities for the PV system to take place above ground.

On average, Pescadero has roughly 260 sunny days per year, which will allow the modules (e.g. panels) to produce their maximum output of 300-400 Watts per hour. During cloudy conditions, modules produce electricity at 10-25% of their normal power output. Many solar panel systems have been installed in regions where there are fewer sunny days per year than Pescadero, such as San Francisco, Portland, and Seattle. **Table 1.** below illustrate the annual days of sunshine in these cities in comparison to Pescadero. Solar developers no longer rule out a location based on solar radiation since efficiency has increased, and the cost per solar panel has decreased by 60% since 2008.

Table 1. Days of Sunshine Per Year



Electricity generated by the solar installation can be used to offset power to the transfer station, while excess electricity can be sold to the local utility to help offset the costs of operating the Transfer Station and maintenance costs for the landfill. This project is not only beneficial in greenhouse gas reductions and renewable energy generation, but also in generating revenue to provide recycling which, in turn, reduces greenhouse gases and disposal into a landfill.

1.1.2 Wind Turbines

Wind turbines are not widely installed on top of landfills due to weight loading and foundation requirements. Concrete foundations that anchor the base of the turbine may be up to 50 feet wide, and piles may need to be driven down if the soil properties are not suitable for a normal foundation. The buffer zones of a landfill may be more suitable locations to install wind turbines than the capped portion of the landfill.

Coastal areas, such as this site, are ideal locations for turbines due to the constant wind that moves across the water towards landmasses. Turbines have been designed to withstand coastal climates and the salt spray that is constantly in the air. They can be equipped with dehumidifiers to reduce corrosion inside the tower and motor. Although wind turbines are not widely placed on landfills, two have been installed at the Frey Farm Landfill in Pennsylvania and Hull Wind II in Massachusetts.

All wind projects require a wind assessment to determine the economic feasibility of the project. An assessment involves collecting wind speed data and conducting a model analysis and terrain study. Additionally, a geological engineering assessment is necessary to assess if the ground around or underneath the landfill will support a wind turbine.

A vendor, the Yancy Group, Incorporated (Yancy Energy), connected with the consultant SCS through San Mateo County, and suggested a demonstration site at the landfill outer portions that would include the installation of 50 hybrid Windstrument applications. These turbines are not the type you see in Altamont, they are small scale turbines where multiple turbines can be mounted on a single pole. One application the Yancy group is proposing is the Windorchard, which incorporates both solar and wind technologies to produce a total of 1MW per hour. The Windorchard combines both wind and solar energy technology, requiring an area of 400 square feet of steel reinforced concrete for the footers, with a solar panel at the base on a tracking system with 180-degree swivel and 40-degree maximum tilt. This is new innovative wind turbine technology.

The energy output is dependent on the speed of the wind and the amount of time the turbine is working. <u>This funding would further this project to determine actuals in the location.</u> Two similar wind projects, (summaries for which are provided in the next section), Frey Hills Landfill wind turbine and Hull Wind II project generated 3.7 million kilowatt hours in 2016 and 16 million kilowatt hours in 2010, Yancy Energy estimates 1 MW or 1,000 Watts per hour could be generated by the 50 wind/solar installations.

1.2 PROJECT DEVELOPMENT PROCESS

There are several steps that are necessary for development of the PV solar system and Wind Turbine. This grant will provide funding for:

- Conducting a preliminary feasibility assessment to determine the technical capacity to host the solar project.
- Wind resource assessment to determine the viability of a system (An average wind speed of nine miles per hour (mph) is typically required). The installation of a wind monitoring station may be required to collect the data.
- Geological engineering assessment to assess if the ground around or underneath the landfill will support a wind turbine system.
- Interconnection study to evaluate the current utility system with local utility providers to understand their systems' compatibility to the PV solar system and wind technology.
- Evaluating the permitting process in the area for both types of systems.

2 AFTER A SPECIFIC SITE HAS BEEN PROPOSED, THE APPROPRIATE SYSTEM TOWER OUTCOMES

2.1 ACCELERATES GHG REDUCTIONS AND RENEWABLES

The County of San Mateo unincorporated area produces around 459,249 MTCO2e (2015) each year with the County operations accounting for 8.7% of that total. By contributing around 4.47 million kWh of renewable energy to the grid each year, the County can offset 5,607 MTCO2 each year. This is equivalent to 1,200 cars driven each year, 6 million pounds of coal burned, and 840 homes' electricity for one year. In terms of sequestration, this amount is equal to around 6,600 acres of U.S. forests in one year and 145,000 tree seedlings grown for 10 years.

2.2 DELIVERS COMMUNITY BENEFITS

A local energy source will provide more jobs to this area. For the solar PV installation (future phase), this will account for approximately 24-30 new jobs[2]. The County will comply with PCE's workforce policy during the future construction phase of this project. This project falls within Pescadero, which scores a 44.54 on the Community Vulnerability Index, which measures health insurance coverage, educational attainment, supplemental security income, gross rent as a percentage of income, poverty, unemployment, and disability status. The revenue that is generated from this project can also help to ensure the community continues to have access to recycling and garbage disposal services.

2.3 SUPPORTS PCE'S LOAD SERVING NEEDS

If constructed, adding an additional 4MW to the local grid will help PCE achieve its 20MW goal of renewable generation by 2025. This project has the potential to later include battery storage which will be able to help change the supple curve and shave peak energy demand during times of top solar production. This will become increasingly more important due to that solar energy installation is adding more energy to the grid each year in San Mateo County. An additional benefit of the Pescadero installation is that the wind component will be producing electricity at alternate times than the solar peak generation, making its price per kWh more economically valuable.

2.4 ADDITIONAL BENEFITS

The project could act as a pilot to demonstrate the role and importance of in-county renewable generation for Peninsula Clean Energy. The project has the potential to serve as a demonstration project for the entire Bay Area and is extremely replicable. Also, this project can serve as an example for other closed landfill renewable energy projects for the County. Seeing as there are 16 closed landfills[3] in San Mateo County, similar renewable energy sites can be scaled to other closed landfills. This will benefit all jurisdictions as the cost to maintain these sites is annual.

Site Benefits for Solar PV

- The Pescadero site can provide a large, shade free area where panels can be installed,
- Concept to operation in approximately 2 years,
- Solar developer pays all project development costs (option),
- Landowner (County) can receive royalties (% or flat rate),
- Will not compromise the final cover system of the landfill,
- No maintenance or liability for SMC (Routine operations and maintenance ranges from $10-15/kW per year or $20,000-30,000/year for a 2MW installation.)

Site Benefits for Wind Turbines

Developing a wind turbine at a closed landfill has been completed successfully at two sites in the United States. Turbines have become highly efficient and provide many advantages, including:

- Once approved, installation can be completed in a short period of time,
- Landowner (County) can receive royalties (% or flat rate),
- Will not compromise the final cover system of the landfill.

3 PCE IMPLEMENTATION REQUIREMENTS

To ensure the project will be successful, the County of San Mateo will allocate staff time to ensure the consultant chosen is on track with deliverables that are mutually agreed upon by PCE and the County. The County will provide progress reports on a regular interval that is convenient for PCE staff. Additionally, County staff will partner with PCE throughout the process of developing specifications for this project and to carry it through completion.

4 QUALIFICATIONS

County staff lead Lillian Clark has 21 years of experience at the County of San Mateo and has been involved in many construction projects as a project designer/manager prior to coming to the County. Support staff Carolyn Raider has two advanced degrees in energy, has years of energy data analysis experience, and has implemented combined wind/solar projects with the Indiana National Guard. The County will put out a request for proposals for this project and will work with the most qualified consultant to ensure this project is successful.

5 EVALUATION

The first phase of this project's success will be the completion of a report detailing specifics for this project including:

1) Solar and wind generation annual output,
2) Site analysis,
3) Wind project feasibility assessment,
4) Permitting Requirements

6 METRICS AND ASSUMPTIONS

Solar assumptions were based on a site study performed by SCS which determined between a 1.4-3MW solar PV installation would be ideal for the site. In this proposal, the 3MW estimation was used. To determine the kWh/year from the site and to account for the weather variability, the NREL PV Watts Calculator was used with the following specifications:

- DC System Size (kW): 3000
- Module Type: Standard
- Array Type: Fixed (open rack)
- System Losses (%): 14.08
- Tilt (deg): 20
- Azimuth (deg): 180
- Inverter Efficiency 96%
- DC to AC Size Ratio 1.2
- Capacity Factor: 17%
- Location: Pescadero

Wind assumptions were also based on the site study performed by SCS which determined a 1MW installation would be used for the site. In the calculations, staff used a modest capacity factor of 0.35 to get the annual kWh produced.

All emissions for the County operations are based on the 2016 GOCAP inventory which was calculated by County staff and consultant DNVGL.

References:

1. https://www.epa.gov/sites/production/files/2015-03/documents/best_practices_siting_solar_photovoltaic_final.pdf
2. https://pv.energytrend.com/knowledge/Energy_Solar_USA.html
3. http://www.calrecycle.ca.gov/SWFacilities/Directory/SearchList/List?COUNTY=San+Mateo
4. http://windstrument.com/#essentials

Office of Sustainability
Wind and PV at Pescadero
8/3/18
Community Pilots

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**		**$75,000**	88%	Requested
Income #2	Office of Sustainability - In-Kind		**$10,000**	12%	Received
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$85,000**		

REVENUE SUMMARY		
Total Requested	**$75,000**	88%
Total Pledged	**$0**	0%
Total Received	**$10,000**	12%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$85,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Consulting Time		**$70,000**	82%	Solar and Wind Feasibility Study, interconnection analysis, siting and system cost analysis, explore specialty racking systems, and permitting requiremnts
Expense #2	Admin Time: Reporting		**$5,000**	6%	
Expense #3	In Kind: Contractor Selection and Project Management		**$10,000**	12%	
Expense #4			**$0**	0%	
Expense #5			**$0**	0%	
Expense #6			**$0**	0%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$0**	**$85,000**	**100%**	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

	Value	Units	Notes
San Mateo County Emissions by Sector (2016)			
San Mateo County Government Operations total			
Natural Gas Emissions	13,096	MT CO2e	
Electricity	5,956	MT CO2e	
Vehicle Fleet	4,626	MT CO2e	
Wastewater Treatment	164	MT CO2e	
Airports	64	MT CO2e	
Water and Wastewater Transport	28	MT CO2e	
Solid Waste Facilities	99	MT CO2e	
Employee Commute	15648.44634	MT CO2e	
Government-Generated Solid Waste	261.2911747	MT CO2e	
Total Emissions (2016)	**39,942**	**MT CO2e**	
Pescadero Project Generation			
Annual Estimated Wind Output	3066000	kWh	
Annual Estimated Solar Output	4,467,941	kWh	Calculated through NREL's Pvwatts site: https://pvwatts.nrel.gov/pvwatts.php
Total Annual Generation	**7,533,941**	**kWh**	
Equivalent MTCO2 Offset/year	**5,607.0**	**MT CO2e**	Calculated through https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

2018 Community Pilot

Proposal to Peninsula Clean Energy

August 3, 2018

Project Title:	**Solar Pump Up Pilot**
Organization:	**Sustainable Silicon Valley**
Purpose:	**Laying groundwork for market transformation through a pilot implementation of Heat Pump Water Heaters (HPWH)**
Population Base:	**Single Family Homes with GRID Alternatives Solar Arrays Located in East Palo Alto, CA**
Associated Organizations	**Air District (BAAQMD), GRID Alternatives, SunWork,** **Plumbing and Electrical Contractors** **City of East Palo Alto, Ecumenical Hunger Program, St. Francis Church**
Key Contact:	**Jennifer Thompson, Executive Director** **Bruce Naegel, Director, Metrics and Research** **650 996 5793, bnaegel@sustainablesv.org**

Project Description

Objectives

The Solar Pump Up Pilot will implement the new technology of Heat Pump Water Heaters (HPWHs) in select homes that have solar in East Palo Alto, then develop a guide establishing best practices. HPWHs are the most efficient way to turn electricity into heat. If powered by low carbon electricity (e.g., ECOplus today at 85% carbon-free), they represent a very low carbon solution. When electricity is 100% carbon-free in 2021 (1), they will provide carbon-free heat. The goal of the Solar Pump Up Pilot is to develop a guide to accelerate the adoption of HPWHs.

The guide will be developed based on the lessons learned during the installations over the course of the Solar Pump Up Pilot. SSV has already received a $20K grant from the Bay Area Air Quality Management District (BAAQMD) (2) to gather data in preparation for the installation of HPWHs in homes with solar. HPWHs and solar pair well together for several reasons. Solar improves the ROI of moving to HPWHs by lowering the cost of electricity. HPWHs also enable load shifting as they can be used for thermal storage.

This grant request is for seven free installations of HPWHs in East Palo Alto homes with solar that SSV already has an established relationship. We view working with a small number of residents who know and trust SSV from our prior work in East Palo Alto as a huge advantage. Installing a small number of HPWHs will result in learning about the installation process and will provide an opportunity for continued monitoring. These measurements can be used to validate projected savings.

The Solar Pump Up Pilot will:

- Lay the groundwork for market transformation of the fuel we use to provide heat
- Demonstrate a way for households to reduce greenhouse gas (GHG) emissions to comply with AB 32 and SB 350
- Provide residents in low-income households a way to save money on operational energy expenses
- Further align energy generation and load (via thermal load shifting—meaning being able to store energy produced in the middle of the day, when it is cheapest, in the form of heat so that it can be used later in the day)
- Bring attention to the low-income community of East Palo Alto as an innovation leader by being a testbed for the new technology of HPWHs

Details on these objectives can be found in the Outcomes section of this document.

Heat pumps are a proven technology, but HPWHs are at an early stage of market development. The Solar Pump Up Pilot can accelerate acceptance if we develop an implementation guide on what works and what doesn't in converting households from gas water heaters. Beyond reducing household GHG emissions in East Palo Alto, the broader purpose of this pilot is to start building this guide.

East Palo Alto is a community with three census tracts that have high CVI (Community Vulnerability Index) scores that cover most, if not all, of the city. One of the three CVI tracts is a state-designated Disadvantaged Community (DAC). Serving East Palo Alto ensures that this community will reap the benefits from adopting technology upgrades.

Data from energy.gov (3) indicates that the average gas consumption for a tank-based hot water heater is around 240 therms/year. When burned, each therm produces 11.7 lbs. of CO2e of GHG (CO2 equivalent of greenhouse gas). This translates to 2,808 lbs. of CO2e per year per heat pump or home. Over a 10-year period, each HPWH would save on average 14 short tons or 12.8 metric tons of CO2e.

SSV Qualifications

With support from BAAQMD, SSV has conducted almost 40 energy audits—we call them 'checkups' in East Palo Alto. As a result of the checkups, SSV identified a handful of candidates for GRID Alternatives solar PV system installations. SSV worked with these residents to help facilitate and navigate the qualification process for GRID's free or low cost solar. SSV has kept in touch with these residents to monitor their energy, GHG, and financial savings. In preparation for the Solar Pump Up Pilot, SSV reached out to several of these residents to see if they would be interested in having a HPWH installed in their homes. To date, we have received an overwhelmingly positive response.

Additionally, SSV has been in touch with GRID about the Solar Pump Up Pilot. GRID has installed over 30 solar arrays in East Palo Alto. They said they would be willing to introduce SSV to East Palo Alto residents whose homes where they installed solar. SSV is confident that we will be able to connect with enough East Palo Alto residents who have solar to successfully execute the Solar Pump Up Pilot.

In addition to the energy audit program and referrals from GRID, SSV has worked extensively with a non-profit that is the heart of the East Palo Alto community— the Ecumenical Hunger Program (EHP). On EHP's five building campus, SSV facilitated the installation of solar on the warehouse building and a "cool roof" on the office building. Through its good work at EHP, SSV has gained the trust of both the community and the City of East Palo Alto.

Role of organizations working with Sustainable Silicon Valley

SSV will conduct energy checkups which will help determine what is required to convert households from gas water heaters to HPWHs. We will continue our working relationship with GRID Alternatives (4) for cross referencing single-family homes for those with GRID Alternatives solar arrays. GRID Alternatives provides PV solar arrays for income-qualified households at no cost or a very low cost to the homeowner. They have and continue to install solar PV systems on homes in East Palo Alto. Note that there are around 30 homes in East Palo Alto with solar from GRID Alternatives. This makes it likely we will get sufficient takers for the pilot.

Having solar is key to increasing the ROI of conversion. We will also continue our relationship with SunWork (5) to cover non-profit structures as available. SunWork completed the solar installation SSV oversaw at the Ecumenical Hunger Program (6), a nonprofit providing food, clothing, and other assistance to residents of East Palo Alto and surrounding communities.

BAAQMD has played a key role, having funded SSV outreach into the East Palo Alto community. SSV also worked with the Ecumenical Hunger Program, St. Francis of Assisi Church (7), and the City of East Palo Alto (8). These associated organizations have provided venues for outreach into the community for SSV programs.

Heat Pump Water Heaters are disruptive from a service delivery standpoint. Gas water heaters have been the domain of plumbers, and sales are predominantly based upon emergency replacements. HPHWs require some planning and project management between plumbers and electricians. We are in the process of finding these contractors. Two candidates have been identified.

Population Served

Through two energy checkup programs, SSV performed 37 energy checkups on households in East Palo Alto. Households that appeared to be income-eligible were referred to GRID Alternatives, which supplies PV solar to single-family, owner-occupied homes at minimal cost. Homes that met GRID Alternatives' income and roof qualifications now have PV solar arrays, reducing their energy bills with 100% renewable energy.

The area served by the Solar Pump Up Pilot, East Palo Alto, has three census tracts with high CVI (Community Vulnerability Index) scores. One is also a DAC (Disadvantaged Community). These designations mean that the Solar Pump Up Pilot will help the communities in the most need.

These homes are now candidates for receiving a HPWH through the Solar Pump Up Pilot. The pilot provides two outcomes for these households:

- Each home will receive an energy checkup showing what is required to put in an HPWH and the expected savings.
- Some homes will receive an HPWH. This will provide data to validate estimates
- The plumbing cost of a Heat Pump Water Heater can range from $3,000 to $8,000. The least expensive installation would be to replace a hot water heater that is in the garage near an outside wall.

Extending the pilot beyond this grant request

Extensions of the pilot will allow SSV to include additional homes in the program. We will begin with the homes with a lower cost of HPWH installation, and work on more difficult homes requiring more plumbing, electrical, carpentry work in later program stages. We will determine ways to systematize the more difficult installations.

Extensions of the program could also include working with replacements for gas space heaters. Old gas heaters that should be replaced are those that fit in wall cavities (not a central heating location), and those in homes that lack an easy vent to the outside. Replacing gas heaters cuts down on carbon monoxide, so this would be an additional benefit.

This plan here work with existing structures. We need a plan for new structures, especially new multifamily housing. Having Heat Pump Water Heaters installed to begin with in the construction of new buildings addresses many concerns. The capital cost is part of new construction. Builder costs for HPWHs will be offset by the elimination of gas lines for the building. Title 24 2019 will start to address all electric buildings.

Outcomes

Overall Outcome

The overall outcome is a guide of best practices for upgrading/replacing gas water heaters with heat pump water heaters. Costs and measurements will be verified or corrected.

GHG Outcomes

HPWHs are the most energy-efficient hot water heaters. When HPWHs are supplied with 100% carbon-free electricity, they produce 100% carbon-free heat.

Each HPWH installation replaces one gas water heater and approximately240 therms per year of gas or 2,425 lbs. reduction in CO_2e per year. This is using PCE ECOplus 85% carbon-free electricity. When ECOplus moves to 100% carbon-free energy, savings of 240 therms per year or about 2,808 lbs. of CO_2e per year are the result. This is per home per year. Cost Savings are

HPWHs are most cost-effective when tied to a home with solar electricity. SSV has worked with GRID Alternatives to provide East Palo Alto single-family, owner-occupied homes with solar PV systems. We may also find we have opportunities in commercial and office buildings.

The GHG reductions scale with the number of buildings that use Heat Pump Water Heaters.

Disadvantaged Communities

East Palo Alto is listed as having three census tracts with high CVI (Community Vulnerability Index) scores. One is also a DAC (Disadvantaged Community). These designations mean working in these areas will help communities in need.

This pilot focuses on households with GRID Alternatives solar arrays. A household must be income-qualified to receive a GRID Alternatives system. We are going back to those customers for placing HPWHs in homes with GRID Alternatives solar arrays. We will also look at providing them in homes with solar not supplied by GRID Alternatives.

Load Serving Needs

The load profile for a typical home has peaks at breakfast and at dinner. The middle of the day has low demand. The challenge comes in the transition from the high output of renewable solar in the middle of the day, when demand is low, to the high demand at dinner, when solar output is low. This is the famous “duck curve.”

One way to optimize the use of HPWHs is to use them as heat storage devices. One powers them during the day to make hot water. This help relieves the energy oversupply from PV solar during the middle of the day. The water will still be hot at night, so it can be used. This limits the draw on the grid at night, when demand is highest.

Other Benefits

HPWHs are early in their product life cycle. This will be a “cutting edge” deployment, in line with the innovation in San Mateo County.

In addition, there are several studies that suggest natural gas leakage is higher than previously thought. The latest studies have been published in *Science* magazine, one of the tier 1 science journals. Natural gas (methane) is a potent GHG with up to 90 times the potency of CO2 over 20 years (9). Estimated leakage rates of 2.3% says leaking natural gas creates as much GHG effect as burning it. We need to stop burning natural gas to stop the leaks, so getting rid of gas-powered appliances is doubly important.

PCE (Peninsula Clean Energy) is currently supplying power that is 85% carbon-free in their standard product.

<u>Sequence of Activities</u>

- Note: We have received a grant for a part of this project from BAAQMD as mentioned previously. We will start on those pieces that we can now and move forward.
- Initiate contact with potential HPWH recipients
    - Past SSV checkup recipients get another checkup
    - Most will have GRID Alternatives PV solar
- Identify plumbing contractors
    - Two have expressed interest: EJ Plumbing and Water Heaters Only
        - Both work in East Palo Alto
        - Both have installed HPWHs
    - Is two sufficient? Add any others?
- Solicit range of costs based on amount of rework required.
- Perform energy checkups and assessments for HPWH upgrades
    - Determine first-order upgrade plan and costs for upgrades, looking first for those upgrades not requiring extensive carpentry or electrical work. To do this, we will:
        - Examine energy bill, how well solar is doing for them
        - Determine location of current water heater: garage, basement, or outside
        - Determine whether water heater is near an outside wall.
        - Determine if there’s sufficient 220V electrical service close to water heater
        - Determine if there’s a place to put the condensate drain
- Install HPWHs based on available funding in homes that meet the criteria
- Monitor expenses over time with the installation
- Gather information from other HPWH installations
- Assemble the documentation in various forms (document, website, etc.)
- Determine how the pilot can be expanded.

- **<u>PCE Implementation Requirements</u>**

- Overview
    - Load should be minimal to PCE
    - SSV systems to keep load from PCE
- Contractors and PCE policy
    - PCE has listed policy recommendations on the hiring of outside contractors.
    - This proposal has plumbers and electricians as contractors for installation.
    - Note there are few tradespeople who know how or want to install HPWHs.

- These criteria will be factored into the contractor selection process.
- Load on PCE and how it is addressed
  - How are requests handled (vectored to SSV)?
  - Warranty issues (who handles, contract to the supplier)
  - Data reporting and its final location
- SSV concierge service
  - Customer contact to address concerns as an install moves forward.
  - SSV program management for this program.
  - Manage to project completion
  - Focus attention on conversions that are simple to start.

- **<u>Solar Pump Up Pilot Deliverables Details</u>**

- Document the process of how to convert to HPWH from gas water heaters.
  - Do initial energy checkup to see what will be needed in electrical and plumbing upgrades
  - Document anticipated energy savings and cost savings over time
  - Challenges and especially solutions are not widely understood
  - Centralized distributed knowledge on challenges and solutions
- Benefits to PCE:
  - Better understanding of what is required to do the conversion
  - Reduced GHG for the homes that are converted
  - Load shifting possibilities using electricity in the middle of the day and storing it as heat.
- Benefits to homeowners
  - Lower cost on hot water, based on lower cost of electricity from a GRID Alternatives array
  - Free extended life (portion of the water heater that is used up based on an anticipated life of 10-12 years)
  - Protection against a price rise in gas.
- East Palo Alto has three census tracts that are in the CVI (Community Vulnerability Index) for San Mateo County. Serving East Palo Alto provides support to a community in need.

- **<u>Evaluation Criteria</u>**

- Ultimate: Quantify acceleration of HPWH adoption
- Number of case studies that are reported
  - Energy checkup information
  - PCE-sponsored HPWH installations
  - Total number of GRID Alternatives installations vs our listing
- Data in the case studies
- Data from doing the installation
- Energy consumption data
  - 1 year + of previous data
  - 1 year of forward data.
- Creating a guide
  - As a document
  - As an online tool

- Customer interaction
    - Satisfaction of the participants with their new water heater
    - Installation and minimal disruption of the customer
    - Level of financial savings
    - Improvements (Determine installation process and then streamline it)
    - Energy checkup logistics (Promotional item still required)
    - Energy use before and after (Validate the overall energy bill goes down)

- **Metrics**

- Data in the case studies
- Total cost of energy before and after the conversion (electrical and gas)
- Cost of upgrade to HPWH (construction cost)
- Estimated cost savings for x quantity of homes converted
- CO2e changes for 10 years listed
    - 2019-2021 at 85% carbon-free electricity
    - 2022-2028 with 100% carbon-free electricity savings
- Us metrics data to build a guide
    - As document
    - As web-available data engine.
    - The guide will cover the most effective way to upgrade households from gas water heaters to more efficient HPWHs.

Potential GHG Savings for 10 Years per home

A	2019-2021 Electricity is 85% GHG-Free	85.0%
B	Assume home uses 40 therms /mo.	40
C	Assume 1/2 is used for Hot Water	20
D	PCE ECOplus has 0.142 lbs. of C02/kWh	0.142
E	Average CoP (Coefficient of Performance)	3.5
F	More conservative CoP	3
G	Divide 0.142 / CoP 3.5 =	0.04
H	Divide 0.142 / CoP 3.0 =	0.05
I	1 Therm = 29.3 kWh	29.30
J	1 Therm x G (CO2e lbs.)	1.19
K	1 Therm x H (CO2e lbs.)	1.39
L	1 Therm = 11.7 lbs. of C02e when burned	11.7
M	GHG Savings COP 3.5 (L-J)	10.51
N	GHG Savings CoP 3.0 (L-K)	10.31
O	GHG Savings with 100% Carbon Free	11.70
P	20 Therms /mo. x 12 mo. = Therms /Year	240
Q	GHG / Yr., CoP =3.0, 85% GHG Free (P x N)	2475
R	GHG / Yr., CoP =3.0, 100% GHG Free (P x L)	2808
S	Lb. Co2e Savings 10 Yrs. / home (Q x 3) + (R x 7)	27081

Notes

- These savings are based on the equipment being free. This is valid for the pilot.
- Both the cost and GHG analyses were performed on 20 therms a month of gas burned.
- These are per home measurements. One could extend the results by multiplying the number of homes x the 10-year estimate.
- PCE ECOplus has 0.142 lbs. of CO2e per kWh (provided in entry form)
- Assume HPWH efficiency factor of 3.5 (market average of 3 leading brands)
    - Rheem = 3.5 AO Smith = 3.61 Stiebel Eltron = 3.39 (10)
    - 1 Therm = 29.3 kWh and when burned = 11.7 lbs. of CO2e (11)

- OI and Cost Savings (send in questions)
    - Cost of natural gas
    - Cost of electricity (outside and its NEM value in the middle of the day)
    - Assume a ratio of 3.5 to 5 on comparative energy efficiency between an HPWH and a standard tank gas water heater.

Operational Energy Cost Savings.

A	Cost of Energy at .15 per kWh	0.15
B	Assume customer uses 400 kWh	400
	Energy bill would be (A x B)	$60
C	If Solar supported 50% of load then bill is	$30
D	Assume gas bill = 40 therms/mo.	
E	Assume 20 therms /month for Hot Water	20
F	Price per therm = $.95 so gas price =	$19
G	1 Therm = 29.3 kWh	29.3
H	20 Therms x 29.3 kWh /therm (E x G)	586
I	Assume CoP of gas heater is 0.6	0.6
J	Assume COP of HPWH is 3.0	3
K	Ratio of HPWH to Gas is (J/I) = 3.0/0.6	5.0
L	kWh of HPWH = (H / K) 586/5.0	117.2
A	Cost per kWh of electricity =0.15	$0.15
M	Cost of Electricity (A x K)	$17.58
N	% Savings (F-N) / F (19-17.58)/19	7.5%
O	Assume Electricity cost = $0.09	$0.09
P	Cost of electricity is now 0.09 (solar) (O x L)	$10.55
Q	Savings % (F- O)/ F (19-10.55)/19	44.5%
R	10 yr. savings / CoP 3.0 No Solar (F-N) x 120	$170.40
S	10 yr. savings / CoP 3.0 Solar (F-P) x 120	$1,014.24

Notes:

- These savings are based on the equipment being free. This assumption works well for this program since it will provide the equipment for free. Expense models that include the cost of capital will be done during the execution of the program.
- The execution phase will need to be run with a number of
- Cost per kWh ($.15) and per therm ($0.95) were given in the instructions
- 1 Therm = 29.3 kWh and 1 therm = 11.7 lbs. of C002e defined here (11)
  Define Coefficient of Performance figures
- http://industrialheatpumps.nl/en/how_it_works/cop_heat_pump/
- These savings are independent of the carbon content of the electricity.

Budget Notes:

- The BAAQMD budget is based on a grant that SSV received from BAAQMD. This is for the analysis process for homes. It does not cover the actual installation of Heat Pump Water Heaters (HPWHs).
- The objective of this pilot is to determine see what is required to install and operate HPWHs.
- This data feeds into the process of installing HPWHs in 7 homes
  - Note these are estimates based on the information we have.
  - The purpose is to confirm or correct our estimates
- The Contractor estimate includes a range of values since conditions vary
  - Electrical estimates vary in the distance from the 220 V Source to the heat pump
  - Plumbing estimates depend on the distance from existing water heater to the new location. There are prerequisites for the new listing
- Heat Pump Water Heaters range in price based on manufacturer, capacity, and features.
- SSV is looking at water heater pricing from around $1500 to $2500. Two examples are Rheem and Siebel Eltron. Prices from Home Depot are here: (10)

Guide Contents

The purpose of this pilot is to gather knowledge to understand the process for doing Heat Pump Water Heater upgrade to homes with gas water heaters. Here are some of the questions:

- Segmenting the installation process
  - Easy installs (less expensive) and harder ones
  - Inspection process to have the homeowner help in determining the process
  - Questionnaire to help the process
- How do we make the process easier and less expensive?
- The process of getting plumbers and electricians on the job site at the same time
- Understanding the permit / inspection process
- When should one use a specific brand of Heat Pump Water Heater?
- Case Studies with successes and challenges faced.

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(11) https://en.wikipedia.org/wiki/Therm

Insert YOUR ORGANIZATION'S NAME: Sustainable Silicon Valley
Insert PROPOSAL TITLE: Solar Pump Up
Insert Date: August 3, 2018
Community Pilots

REVENUE SOURCE	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**		$75,000	79%	Requested
Income #2	BAAQMD		$20,000	21%	Pledged
Income #3			$0	0%	
Income #4			$0	0%	
Income #5			$0	0%	
Income #6			$0	0%	
Income #7			$0	0%	
Income #8			$0	0%	
Income #9			$0	0%	
Income #10			$0	0%	
	Total	**$0**	**$95,000**		

REVENUE SUMMARY		
Total Requested	$75,000	79%
Total Pledged	$20,000	21%
Total Received	$0	0%
Total Estimated	$0	0%
TOTAL PROPOSAL REVENUE	**$95,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	BAAQMD Expenses	$20,000	$20,000	21%	
Expense #2	Project Manager (600 hours @ $30/hr)	$18,000	$18,000	19%	
Expense #3	Heat pump water heater ($1k-$2.2K)	$15,400	$15,400	16%	
Expense #4	Plumbing Work (Remove old water heater, replace with HPWH) $1K-$2.8K	$19,600	$19,600	21%	
Expense #5	Electrical Work (instal 220 V for HPWH)	$10,500	$10,500	11%	
Expense #6	Permits (in East Palo Alto)	$1,400	$1,400	1%	
Expense #7	Misc Expendables	$500	$500	1%	
Expense #8	Incentives	$600	$600	1%	
Expense #9	SSV Overhead	$9,000	$9,000	9%	
Expense #10			$0	0%	
TOTAL PROPOSAL EXPENSES		**$95,000**	**$95,000**	**100%**	

Net Income - Expenses	**(95,000)**	**-**

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

PENINSULA
CLEAN ENERGY

2018 Community Pilots:

Not Recommended Proposals

Peninsula Clean Energy is San Mateo County's locally-controlled electricity provider. We are reducing greenhouse gas emissions and offering customer choice at competitive rates.

TABLE OF CONTENTS

Electrify!
Paving the Way for Heat Pump Water Heaters in San Mateo County

Acterra Proposal to Peninsula Clean Energy's
2018 Community Pilot Program
August 3, 2018

Contact

Julie Noblitt, Energy & Climate Program Director | Acterra | julie.noblitt@acterra.org | 650.962.9876 ext. 302

ACTION FOR A HEALTHY PLANET

Key Partner

Mike Balma, Development Director | SunWork | mike@sunwork.org | 650.678.2213

SunWork Renewable Energy Projects

Table of Contents

Project Description

The Problem

Gas-fired home hot water heaters produce too much CO2e. Nationwide, hot water production is the second-largest component of home energy consumption, accounting for 13% of total home energy use (U.S. Energy Information Administration, 2015). According to a June 2018 CEC report, we would need more than 50% of new sales of residential water heaters and HVAC systems to be of high efficiency electric heat pumps by 2030 in order to meet our climate goals for the state (California Energy Commission, 2018).

Today, despite consumer rebates on heat pump water heaters (HPWHs) offered by municipalities and public agencies, sales and installation of this technology remain stubbornly low. This is in part because the technology is unfamiliar to most homeowners and in part because too many electricians and plumbers are also unfamiliar with it. To make matters worse, both an electrician and a plumber traditionally need to work in tandem to accomplish the installation, making it costly and difficult for the consumer to contract and schedule both tradespeople. As replacement of a water heater is typically an emergency after the failure of an existing heater, few consumers are willing to wait several days – or even weeks – to get their water heater replaced. As a result, **most people continue to simply replace their gas water heater with another gas water heater, and will continue to do so unless we work proactively to shift the market.**

Proposal

Acterra – in partnership with SunWork – seeks a $75,000 grant to launch the "Electrify!" Pilot Program in San Mateo County. Acterra is expanding its existing Green@Home program, which is focused on home energy waste mitigation, to encompass the next phase of education and awareness around the importance of shifting away from gas-fired home appliances such as cooktops, water heaters, dryers, and heating systems. This pilot project will seed the first phase of this expansion with a focus on advocacy for residential heat pump water heaters.

The pilot program will consist of two main components:

- **Workforce development:** Hands-on training for plumbers and contractors who serve San Mateo County to do the electrical work associated with installing heat pump water heaters in residences.
- **Demand development:** Education and awareness for San Mateo County community members about the benefits of moving away from gas-fired water heaters, including the cultivation of a team of "Electric Ambassadors."

Workforce development plan - SunWork

Plumbers (California C-36 plumbing contractor license holders) easily install gas water heaters and are also authorized to install active electric pumped solar water heaters. But many are not yet trained to install the simple 220V circuit and conduit associated with electric heat pump water heaters (HPWHs). This makes it very difficult for customers to replace a failed gas water heater with an electric HPWH in a cost effective or timely manner with a single contract. Using the Bay Area Consumer Checkbook, Angie's List, and referrals from trusted partners such as **Rebuilding Together** and **Build It Green**, we will recruit up to **20 plumbers and general contractors serving PCE territory** to be trained in the electrical portion of HPWH installation. In this way, consumers will have a number of professionals to choose from who are a "one-stop-shop" for one-day installation of a HPWH. Only licensed plumbers and contractors, or those with five or more years of experience in their field will be eligible to participate in the trainings.

The training will have three components:

- **A one-time, three-hour workshop** on HPWH installation basics: 220 V circuit design, electrical panel assessment (including load calculations and permitting considerations) and troubleshooting, parts and tools discussion, and safety procedures. Participants will receive handouts they can take away with them, including the "HPWH Installation Blueprint" (see below). Skills taught will include:
  - Circuit design and wire sizing
  - Conduit route design
  - Conduit bending, assembly and strapping for workmanlike installation
  - Wire pulling
  - Circuit breaker box assessment and circuit breaker selection
  - Circuit breaker installation and wire termination

- **Three hands-on conduit and circuit installations** with SunWork's experienced team leads performing actual installations of conduit, 220V circuits, wires and circuit breaker ties into main electrical panels. The training circuits will be identical to the type needed for HPWH installations, the same ones used to connect solar inverters to electrical main panels and circuits to connect solar arrays to inverters. The training will emphasize the safe installation of high quality, code-compliant electric circuits done in a workmanlike manner.
- The **"HPWH Installation Blueprint"** including the standard details associated with a code-compliant HPWH installation. This allows inspectors and installers to anticipate what a code compliant installation looks like. As part of this grant, the Blueprint will be made **freely available to all online**. It will also be included in the class materials.

The Installation Blueprint will be developed by Tom Kabat, an energy consultant for the Department of Energy with 35 years of utility energy planning experience, along with selected experts and advisors.

The workshop curriculum will be developed by experts in installing HPWH and electrical work with input and review by **SunWork Founder and Operations Manager, Reuben Veek** as well as by Tom Kabat in consultation with Acterra's partners at **Build It Green** in Oakland, CA. Both the curriculum and the Blueprint will be **reviewed by the Community Energy Services Corporation (CESC)**. We will also refer to PG&E's curriculum for their class, *Electric Heat Pumps for Domestic Space and Water Heating: Applications and Considerations.*

Trainers will track the progress of each trainee and confirm that all parts of the curriculum have been successfully completed. (See the "Training Log" tab of the attached Excel spreadsheet for a sample.)

Course Incentives

- **A $599 stipend** for successful training completion, to offset the opportunity cost for attending the training.
- **Inclusion in a list of recommended installers** for HPWHs that will be maintained online on SunWork's web site and on Acterra's "Electrify!" resource page.
- **Invitation to participate in community workshops and meet potential customers.**

Demand development plan - Acterra

The "Electrify!" program at Acterra will provide San Mateo County residents with resources they need to understand their options when it comes to home electrification, as well as the reasons they should consider weaning themselves off of gas, especially for water heating. Leveraging our extensive experience with home energy efficiency outreach in the Bay Area, Acterra's campaign will include the following elements.

Educational workshops

Acterra will offer three educational workshops for community members during the program year in three different locations in San Mateo County. These workshops will include:

- A 20-minute presentation about home electrification and how residents will benefit from moving away from gas water heaters. Information about planning ahead for water heater failure will be included, to minimize emergency replacement scenarios that lead to re-installment of gas water heaters
- A hands-on opportunity to look at a model water heater, with an installer on hand to answer questions about how it works.

- A computer set up to show participants the financial and environmental benefits of home electrification using YellowTin software (when available) to model what combination of electric resources are right for them.
- Participants will be entered in a drawing for a free heat pump water heater, to be awarded at the end of the program year.
- Participants will also receive other giveaways as an incentive to attend workshops, such as shower timers or water leak alarms.

"Electrify!" Ambassador Program

Acterra's experience with the GoEV Ambassador program has shown that people highly value the ability to talk to a peer who has experience with a new technology, instead of learning about that technology from a salesperson. We have found that early adopters of new EV technology have been very eager to share what they know with others and even to let people take their cars for spin (now, *that's* dedication!). We currently have more than 60 people registered as EV advocates on "warm standby" to participate in events and bring their cars to our expos and "ride-and-drive" events. We will apply this same "ambassador" model to heat pump water heaters, cultivating a team of 20 "Electrify!" Ambassadors who have HPWHs set up in their own homes and who are willing to talk about the ins and outs of their experiences. We will arrange tours for San Mateo County residents who are considering installing one so that they can see how it works. We will recruit ambassadors from our many connections with people who have one, and will provide a way for people to sign up to be an ambassador on the Acterra web site.

Publicity

- **Direct email campaigns -** Through the environmental education programs we have offered during our nearly 50-year history, Acterra has touched the lives of thousands of Peninsula residents. We maintain contact with most of them via Constant Contact mailing lists containing nearly 4,000 residents across all twenty cities in San Mateo County. We also send a bi-weekly newsletter called "EcoHappenings" that reaches approximately 3,200 subscribers. We will also partner with the County of San Mateo's Sustainability Academy and the nonprofit Sustainable San Mateo County to get the word out through their networks.
- **Social media campaigns -** We maintain active Facebook and Twitter feeds with a combined following of nearly 2,000 followers that we will use to educate our followers in San Mateo County about the program, including compelling images and alerts about upcoming events.
- **Flyers -** Acterra will develop sharable flyers (both electronic and paper) to disseminate information about the program. Flyers will be distributed via email campaigns with share requests to neighborhood organizations, community leaders, and churches in cities where workshops will be held. SunWork will also share these flyers with their new PV customers via a link on new quotes for solar installation.
- **"Electrify!" web page -** Acterra will host a dedicated web page with information about the program, with links to helpful resources, information about workshops and tours, and a form to sign up to become an "Electrify!" Ambassador.

Note: Because of the stage of market development we are in now for HPWHs, we believe it is wise to target customers who have – or who are considering – solar panels for their homes. This is because:

- They have already demonstrated willingness and ability to take action to reduce their home's carbon footprint.

- They are likely to be open to messaging on this topic.
- The benefits of running a HPWH are enhanced for homes that run on solar power.

Objectives

Our overarching **goals** are:

- To make it faster, easier, and more affordable for homeowners in San Mateo County to replace gas-fired hot water heaters with electric heat pump water heaters.
- To help transform the market for replacement water heaters on the Peninsula by giving plumbers/contractors the electrical skills required to do **one-day replacements** of gas water heaters with HPWH technology for **residential** customers.
- To help meet California's goals of reduced carbon emissions to 40% below 1990 levels by 2030.

Project Execution

Start date: January 2019
End date: December 2019

- **January:** Curriculum development. Hiring of part-time project coordinator. Identification of Ambassadors. Set schedule of workshops for community. Outreach to plumbers and contractors.
- **February:** Training of Ambassadors; publicity campaigns; production of class curriculum with Installation Blueprint; finalization of community workshop curriculum.
- **March – June:**
    - **Workforce:** Four three-hour classes for plumbers/contractors (one per month); 8 hands-on training sessions for plumbers/contractors (2/month)
    - **Community:** 1 community workshop; 1 house party
- **July – Sept:**
    - **Workforce:** Three 3-hour classes (one per month); 6 hands-on training sessions (2/month)
    - **Community:** 1 community workshop; 1 house party
- **Oct – Dec:**
    - **Workforce:** Three 3-hour classes (one per month); 6 hands-on training sessions (2/month)
    - **Demand:** 1 community workshop; 1 house party.
    - **Project finalization:** Project evaluation and report. Posting of class materials with finalized Installation Blueprint. Announement of winners of drawings for free HPWHs.

Outcomes

Acceleration of GHG Reductions

Exhaust emissions prevented

Each HPWH saves 10.91 metric tons (tonnes) of CO2 exhaust emissions during its 13-year life, assuming PCE 2012 references. Assuming we train 20 plumber/contractors that they each install an average of only five HPWHs per year, they will collectively install 1,000 HPWHs over ten years. Under this very conservative scenario, the combustion CO2 savings under this program would be 10,910 tonnes of CO2e.

Methane leakage prevented

Each HPWH saves an additional 10.67 metric tons of CO2e from reduced methane leakage during its 13-year lifetime, assuming 3% well-to-residential burner leakage, according to the CEC. This leakage estimate is quickly evolving as the science improves and is within the current research range of 2% to 11% observed. Including reasonable leakage reduction credit (3%), it essentially doubles the CO2e savings of our program.

Tonnes of CO2e saved

Combined GHG savings are 21.6 tonnes CO2e per HPWH over its lifetime. Assuming 20 plumbers/contractors are trained in our program, and assuming they collectively install 100 HPWHs per year, and assuming no demand growth over 10 years, the cumulative program savings are 10,910 tonnes of CO2 exhaust. This is a conservative estimate.

In sum: Assuming 100 HPWHs per year installed by our trainees, the 10-year effective lifetime net savings of our project is **21,600 tonnes of CO2e**. Please see our attached spreadsheet for these calculations.

Community Benefits

Types of PCE customers served

Any San Mateo County homeowner served by a one of our trained plumbers or contractors will benefit when they need to replace their water heater. They will save money on labor and be able to make more informed choices. They will also have more places to go for information. At this stage of market development, it is likely that residents who are already motivated to save energy and who have the means to retrofit their existing water heater will be the first ones to benefit. These early adopters will then drive the shift to a “new normal” for home electrification.

If incentives for HPWHs become available for low-income residents such as those now available in Contra Costa and Alameda Counties, this program will also help accelerate their deployment. Rebuilding Together replaces many hot water heaters for low-income residents in San Mateo County and they have agreed to evaluate the opportunity for HPWHs for their customers as incentives become available.

Health and environmental benefits

Improved health and safety of the home are another benefit since HPWHs reduce the risks associated with gas including poor air quality, carbon monoxide, and risk of fire during earthquakes or gas pressure events.

Economic benefits

HPWHs **expand the use of renewables** by adding beneficial electric load and **help PCE keep rates lower for all customers**. The program will **help small plumbing shops and sole proprietors future-proof their businesses** by giving them another way to serve residential retrofit customers. It will also help develop the market for HPWHs, **bringing down the cost of the technology** over time.

Support of PCE's Load Serving Needs

Much of the demand for hot water already falls during daylight hours when renewable energy is abundant (Hendron & Burch, 2007). If more San Mateo residents used HPWHs, PCE would have the option through demand response programs to shift consumption away from evening hours, where possible, and to encourage reduction of storage temperatures during overnight hours.

Additional Benefits

Supports community resilience

Records show typical disaster-related electric outages can be returned to service in a matter of 1-3 days, whereas disaster-related gas disruptions can last for weeks. Conversion to electrification supports resilience especially with HPWHs that have 50-80 gallons of stored hot water that can **help people through brief energy shortages and get them through longer water outages associated with disasters such as earthquakes**.

Is innovative

To our knowledge, nobody has yet proposed to train plumbers in the electrical portion of HPWH installation. In addition, we have not yet seen targeted program to enhance community education and outreach with a team of peer ambassadors for HPWH technology.

Is scalable and replicable

The purpose of this project is to create a **blueprint for installers that can be used by anyone**, **anywhere**. We will make our blueprint and curriculum freely available to anyone via our website. In addition, our community ambassador program, which has already proven successful in the realm of EVs, can be adopted by any community.

PCE Implementation Requirements

Under our proposal there are no PCE implementation requirements. However, PCE is invited to take as active a role as it desires in assisting with outreach to PCE customers about the program and/or outreach to plumber/contractors to participate in the training.

Our Qualifications

Partners

Acterra is a nonprofit environmental education and action organization whose mission is to make it faster, easier, and cheaper to take action on climate. Since 1970, we have served cities in Santa Clara and San Mateo counties that want to strengthen the resiliency of their communities and accelerate the transition to clean and renewable energy. We are current PCE grant recipients, providing education and outreach to low-income communities about the many benefits of PCE programs.

SunWork Renewable Energy Projects (SunWork) is a nonprofit solar installation company whose mission is to help make solar more affordable and wide spread with the help of trained volunteers. SunWork provides services to nonprofits and to homeowners with low electric bills averaging less than $100 per month or $140 per month if the homeowner has a HPWH. All installations are done by paid experienced staff with the assistance of trained volunteers, saving 1/3 in installation cost over traditional options. Since 2009, SunWork has installed more than

2,800 kilowatts of solar energy and was the winner of Sustainable San Mateo County's 2017 Sustainability Award. SunWork has worked with San Mateo County's Sustainability Academy for the past two years providing information and training sessions on solar energy.

Experience Executing Similar Work

Acterra has many years of experience conducting outreach on home energy efficiency. For example, our Green@Home program in Mountain View served 1,800 households, resulting in an average 16.4% reduction in natural gas usage, a 5.5% reduction in electricity use, and eliminated a total of 1,366 metric tons of CO_2e. A similar program is now also underway in Sunnyvale. Today, Acterra is working with the City of Sunnyvale and IDEO to support community outreach for the city's upcoming Climate Action Plan 2.0. In addition, our Climate Resilient Communities Program provides education and outreach to assist eligible low-income homeowners in **East Palo Alto** and **Belle Haven (Menlo Park)** receive free energy upgrades such as solar panels, weatherization, and water-saving devices. We also provide education about the benefits of electric vehicles through our GoEV program which deploys more than 60 "EV Ambassadors" who provide peer-to-peer education about what it is like to own and drive an electric vehicle. Finally, see **our online webinar on heat pump water heaters** at https://youtu.be/MFFFTytAeok

Since 2009, SunWork has **trained over 1,000 volunteers in conduit installation skills** as part of its normal solar installation process on **more than 600 solar installations** in the Bay Area. That includes training in the 220 Volt circuit and conduit work of wiring solar arrays, inverters, shutoff equipment, and circuit breakers for main panel connection. These skills are directly transferable to installing the simple 220V AC circuit for a HPWH.

Readiness of Technology

HPWHs are readily available technology and can be easily purchased by anyone. In addition, PG&E offers a $300 rebate for HPWHs (excluding tankless) with an efficiency rating of 2.0 or more (PG&E, 2018). Although this rebate is currently only for customers moving from electric resistance water heaters to HPWHs, it shows confidence in current HPWH products. As mentioned above, both Acterra and SunWork will be leveraging skills and technology in which they are already expert to deploy the proposed program. In addition, YellowTin's consumer-facing dashboard for individualized assessment of the benefits of home electrification will be available in the coming months. SunWork already uses a business-facing version of this technology very successfully in their current operations.

Risks

Targeted outreach, combined with a financial incentive and customer identification and prequalification will be persuasive for a core group of plumbers and contractors to upgrade their skills. However, there is a risk that we are too early to market and will have difficulty filling all available training slots.

Evaluation

Success will be measured by the number of:

- Plumbers and general contractors trained (target = 20)
- HPWH installations completed by trainees during the year following the program (target = 100 HPWH installations per year)
- HPWH Ambassadors engaged (target = 12)

- Homeowners/building managers attending our workshops (target = 120)
- Homeowners receiving our messaging (target = 20,000)

All numbers will be collected by Acterra as part of the program.

Metrics and Assumptions

The project is to *increase and streamline workforce supply for HPWH installation* by training 20 plumbers or other potential installers of HPWHs and to *stimulate customer demand for HPWHs* with education, advocacy, and peer encouragement.

Our impact calculations in the "Outcomes" section above are conservative, and do not account for additional trainings and installations beyond those estimated for our pilot. Please see the **attached spreadsheet** for our calculations and assumptions.

To extrapolate further impact going forward:

Our numbers presented concentrate just on the first-year installations and could be enhanced by the plumbers ramping up installations in following years. We anticipate additional parties may want to replicate our efforts using the tools we freely provide. GHG savings will be improved by several factors, 1) including 3% methane leakage reduction assumption that doubles the CO2e savings per HPWH, 2) considering the 13-year average life of HPWHs and that the replacement is easy once the conduit and circuit already exist again doubling the CO2 savings estimate, 3) considering the many HPWHs each of our trained installers may provide in their remaining careers and 4) the transference of knowledge to their shops. 5) possible synergistic impacts as more utilities take on the market transition effort with our tools and others.

For example, if our 20 trainees were to increase their installations to just two per month for only the 3 years following the training, the installed fleet would grow to 1,540 HPWHs (a small percentage of all water heaters) saving **more than 33,000 tonnes of CO2e** across their first lives only and coming in at a cost of saved CO2 at just about **$2.22 per tonne**.

This would generate net revenue to PCE of approximately $430,000. Our calculations in the spreadsheet show each HPWH generates net revenues of about $28/year to PCE (based on PCE retail rate of about 8 cents/kWh minus its assumed wholesale cost of 5 cents per kWh) Over the 13-year life of the HPWHs, that amounts to about **$430,000 in net revenue to PCE** on the fleet of 1,540 water heaters.

Budget

As described in the budget spreadsheet attachment, PCE's grant of $75,000 will cover 80% of program costs, with the balance of expenses coming from pledged in-kind donations (2%), estimated in-kind donations (3%), and estimated supplemental grants (15%) that Acterra is seeking from other public agencies such as BAAQMD, BayREN, the County of San Mateo, and other CCEs.

Most of the expense is ongoing staffing expense (71%) plus contract expense (10%). There is some budget for materials including participation incentives for trainees and community workshop participation (6%). Assuming we fill all training slots, up to 13% is earmarked for a $599 stipend per plumber/contractor trainee to help offset their job opportunity costs of attending the training. We feel this is vital at this stage in market development.

Total budget = $93,380
PCE portion = $75,000

References

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Acterra
"Electrify!" Pilot Program: Paving the Way for Heat Pump Water Heaters in San Mateo County
3-Aug-18
Community Pilots

REVENUE SOUR	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**		**$75,000**	80%	Requested
Income #2	Supplemental grants to be sought from County of San Mateo, the Bay Area Air Quality Management District, BayREN, and other CCEs		**$14,000**	15%	Estimated
Income #3	In-kind donations of 3 HPWHs from manufacturers as incentives to trainees		**$3,000**	3%	Estimated
Income #4	In kind pledge from SunWork.org for onsite training sessions (2/month x 10 months @ $45)		**$900**	1%	Pledged
Income #5	In-kind pledge from SunWork for training tools for onsite training sessions		**$480**	1%	Pledged
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total		**$93,380**		

REVENUE SUMMARY		
Total Requested	**$75,000**	80%
Total Pledged	**$1,380**	1%
Total Received	**$0**	0%
Total Estimated	**$17,000**	18%
TOTAL PROPOSAL REVENUE	**$93,380**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Acterra Staff Labor - Program Coordinator - 20 hrs/wk @ $45/hr (loaded) for 12 months		**$46,800**	50%	
Expense #2	Acterra Contract Labor - Graphic designer - 20 hours @ $60/hr		**$1,200**	1%	
Expense #3	Acterra Program Oversight - Energy & Climate Program Director - 10hrs/month @65 (loaded) for 12 months		**$7,800**	8%	
Expense #4	Community workshop materials (photocopying, food, publicity, mileage, venues)		**$500**	1%	
Expense #5	Acterra overhead (offices, financial admin, meeting space, phone, etc.)		**$11,177**	12%	
Expense #6	Incentive stipends to trainees - 20 @ $599		**$12,043**	13%	
Expense #7	Contract labor - Class Instructor (electrician)- $400/class x 10 classes		**$4,000**	4%	
Expense #8	Contract Labor - Class Curriculum and Blueprint content development (flat fee)		**$2,880**	3%	
Expense #9	Contract Labor - Review of class curriclum and Blueprint by CESC		**$1,000**	1%	
Expense #10	Heat Pump Water Heater (1, for community workshop attendee incentive prize drawing)		**$1,000**	1%	
Expense #11	Shower timers (community workshop attendee incentive giveaways - 120 x $5)		**$600**	1%	
Expense #12	SunWork Onsite training sessions (2/month x 10 months @$45)		**$900**	1%	
Expense #13	Tools for onsite training sessions (wires, etc.)		**$480**	1%	
Expense #14	HeatPump Water Heaters (3, for plumber/contractor trainee incentive drawing)		**$3,000**	3%	
TOTAL PROPOSAL EXPENSES			**$93,380**	**100%**	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Number of Attendees we can train

Attendees per field session		1	
Field Sessions per attendee		3	
First Friday		# of attendees	
Classroom session for 2 Attendees	3 hours	2	
Second Friday			
Field Session Lead A	7 hours	1	each attendee participates one on one with a SunWork team leader(s) for 3 Fridays
Field Session Lead B	7 hours	1	
Third Friday			
Field Session Lead A	7 hours	1	
Field Session Lead B	7 hours	1	
Fourth Friday			
Field Session Lead A	7 hours	1	
Field Session Lead B	7 hours	1	
Total Plumbers trained in 4 weeks		2	every four weeks
Number of times this month-long series is offered		10	times in the year
Number of times this month-long series is filled		10	times in the year
Total number of Plumbers trained if spots are filled		20	cumulative for the year

PCE Heat Pump Water Heater Training Transformation

Use of Grant funds

Tax Free Stipend paid to plumber attendees		# of attendees	Product	Responsible party	
$ 599	each	20	$ 11,980	Acterra	
Payment to plumber's distributor for HPWH		# of winners			Pass through to plumbers
$ 1,000		1	$ 1,000	Acterra	$ 1,599 per plumber
Training Class curriculum and blueprint development					
$ 5,000			$ 5,000	Acterra	
Classroom trainer (1/month)		Sessions			
$ 500		10	$ 5,000	Acterra	
Onsite Training sessions (3/month)		Sessions			
$ -		60	$ -	SunWork	Pass through to plumbers
					$ 12,980 16%
Extra materials, tools etc.		Sessions			
$ -		60	$ -	SunWork	SunWork Sub total
					$ - 0%
Acterra Administration			$ 60,000	Acterra	Acterra Subtotal
					$ 82,980 100%
			Total		Total
			$ 82,980		$ 82,980 100%

		Calculations using PCE statewide References from 2012			Calculations using data from 2018		
	Gallons of hot water per day	50			50		
	Hot Water Temp	120	degree F		120	degree F	
	Cold Water Temp	55	degree F		55	degree F	
	degrees rise	65	F degrees		65	F degrees	
	Btu/gal-degree	8.34	heat capacity of water		8.34	heat capacity of water	
	days per year	365			365		
	BTU delivered per year	9,893,325	BTUs of water heat delivered from water heater		9,893,325	BTUs of water heat delivered from water heater	
	EF of gas WH	0.6	Somewhat below instant efficiency		0.6	Somewhat below instant efficiency	
	Site combustion	165	Therms		165	Therms	
	Retail Gas Rate	$ 0.96	per Therm	From PCE 2012 reference	$ 1.15	per Therm	From July 2018 PG&E bill tier 1
	Wholesale Gas Rate	$ 0.30	per Therm	From 2012 NYMEX wholesale prices	$ 0.35	per Therm	From NYMEX forwards on traded commodity
	Distribution rate	$ 0.66	/Therm		$ 0.80	/Therm	
	Stranding	$ 109	per year		$ 132	per year	
	The stranding of distribution costs works its way into future retail **gas rate increases**						
	EF of HPWH	3.10	Slightly below COP		3.10	Slightly below COP	
	Site usage	935	kWh		935	kWh	
	Full Retail rate	$ 0.15	/kWh	From PCE 2012 reference	$ 0.20	/kWh	From July 2018 PG&E bill
	PG&E distribution Rate	$ 0.08	/kWh	TK's estimate that about 1/2 is distribution	$ 0.12	/kWh	From July 2018 PG&E bill
	PG&E increased distribution revenue	$ 75	per year		$ 112	per year	
	The additional PG&E distribution revenue works its way into future retail **electric rate reductions for PCE customers**						
	PCE retail price component	$ 0.07	/kWh	TK's estimate that 47% is energy component	$ 0.08	/kWh	PCE retail price component
	PCE wholesale cost from CAISO at DLAP	$ 0.04	/kWh		$ 0.05	/kWh	PCE wholesale cost from CAISO at DLAP
	PCE net margin	$ 0.03	/kWh		$ 0.03	/kWh	PCE net margin
	Contribution to PCE margin/ HPWH-year	$ 28	/ HPWH-Year		$ 28	/ HPWH-Year	Contribution to PCE margin/ HPWH-year
	The additional PCE contribution to margin works its way into additional PCE program offerings.				The additional PCE contribution to margin works its way into additional PCE program offerings.		
	Retrofitting one gas water heater to a Heat Pump Water Heater (HPWH) has following impacts						
	Gas savings	165	Therms/year		165	Therms/year	
	Gas bill savings	$ 158	$/year		$ 190	$/year	
Retail E1?	Electric usage	935	kWh/year		935	kWh/year	
Retail E1?	Electric bill increase	$ 140	$/year		$ 187	$/year	At full retail rates
Retail E1?	Net bill Savings	$ 18	$/year		$ 3	$/year	At full retail rates
Solar PV	Electric cost with solar PV sizing	$ 0.09	/kWh	Full price commercial PV 2018 After TC	$ 0.09	/kWh	Full price commercial PV 2018 After Tax Credit
Solar PV	Electric PV cost for HPWH life average	$ 84	$/year	Source: SunWork comparisons of installers	$ 84	$/year	Source: SunWork comparisons of installers
Solar PV	Net bill Savings with solar PV	$ 74	$/year	HPWH savings with solar PV	$ 106	$/year	HPWH savings with solar PV
Retail EV	Electric HPWH usage rate on Retail EV rate				$ 0.15	/kWh	Assumes 2/3 of recharging HPWH happens on low rate
Retail EV	Electric cost with Retail EV rate				$ 140	$/year	
Retail EV	Net bill Savings with solar PV				$ 49	$/year	HPWH savings with Retail Electric Vehicle rate
CO2 savings from combustion							
	Gas WH Therms combusted	165	Therms/year		165	Therms/year	Gas WH Therms combusted
	Combustion emissions at 100% combustion	11.7	lb. /Therm		11.7	lb. /Therm	Combustion emissions at 100% combustion
	Gas WH Combustion emissions	1,929	lb. CO2 /year		1,929	lb. CO2 /year	Gas WH Combustion emissions
				CA methane leakage well to residential burne	3.0%		Source CA Air Resources Board 6/7/2016
					https://www.arb.ca.gov/cc/oil-gas/Fischer2_CA-NG-CH4-Symposium-MLFischer-20160606.pdf		
				Methane Leakage saved by gas use reduction	4.95	Therms/year	
				GWP of Leaked Methane vs. Combusted	31	times more potent when leaked vs. when combusted	
							Assumes CH4 GWP = 86
				GHGs of leakage saved	1,810	lb. CO2e /year	
					0.82	tonnes CO2e saved per year via leakge savings alone	
	Recognized emissions of gas WH	1,929	lb. CO2 /year	Recognized emissions of gas WH	3,739	lb. CO2e /year	
	Electric grid emissions (gas fired portion plus	0.14226	Lb. CO2e/kWh		0.07	Lb. CO2e/kWh	Assumes PCE transitions to 100% carbon free sales volume
	Electric consumption of HPWH	935	kWh/year		935	kWh/year	
	GHG Emissions for HPWH electricity	133	Lb. CO2e/year		65	Lb. CO2e/year	
	Annual CO2e savings from one HPWH	1,851	Lb. CO2e/year		3,729	Lb. CO2e/year	
	Life of HPWH	13	Years		13	Years	
	Life CO2e savings from one HPWH	24,066	Lb. CO2e/ HPWH life		48,473	Lb. CO2e/ HPWH life	
	Life CO2e savings from one HPWH	12.03	tons CO2e/HPWH life		24.24	tons CO2e/HPWH life	leakage savings
	Life CO2e savings from one HPWH	10.91	tonnes CO2e/HPWH life		21.97	tonnes CO2e/HPWH life	10.67
		21.6	tonnes CO2e/HPWH life if including methane leakage				
10 year	partial life savings from one HPWH	8.39	tonnes CO2e/HPWH in first 10 years				

		First Year	Second year	Third year	Third year
Grant		$ 75,000	0	0	0
Cumulative Grants		$ 75,000	$ 75,000	$ 75,000	$ 75,000
New Trainees		20	0	0	0
Cumulative Plumbers or contractors trained		20	20	20	20
Number of first year HPWH installs per trainee	installs/year	5	10	18	18
		First Year	Second year	Third year	Third year
HPWHs installed during that year	installs/year	100	200	360	360
Total HPWHs installed	Total Fleet	100	300	660	1020
Lifetime savings of one HPWH under PCE references	Tonnes/HPWH	10.9	10.9	10.9	10.9
lifetime savings of first year HPWHs under PCE references	Tonnes	1,091	3,273	7,200	11,128
partial (10 year) savings of one HPWH	Tonnes/HPWH	8.4	8.4	8.4	8.4
10 year savings of first year HPWHs under PCE references	Tonnes	839	2,518	5,539	8,560
Grant $/ tonne of first 10 years savings from first year activity	$/tonne in 10 year	$ 89.37	$ 29.79	$ 13.54	$ 8.76
Lifetime savings of one HPWH including leakage	Tonnes/HPWH	22.0	22.0	22.0	22.0
Lifetime savings of first year HPWHs including leakage	Tonnes	2,197	6,592	14,502	22,413
Grant $/ tonne of first 13 years savings from first year activity	$/tonne CO2e	$ 34.13	$ 11.38	$ 5.17	$ 3.35

												13 year life	9 year career				10 Year life		
	Trainees	Class Trainings	Grant usage	$/plumber	Installs/ year per plumber	Partial savings (10 years) Tonnes/ HPWH	HPWHs counted total	10 year savings from 1st year activity (tonnes per plumber)	10 year savings from 1st year activity all trainees (tonnes)	Grant $/10 year savings from 1st year activity $/tonnes		CO2e combustion savings tonnes/ HPWH	Tonnes CO2e/ plumber career	$/tonne CO2e saved	Total Tonnes CO2e saved			Years of advancement	Number of HPWHs/ plumber career
Base Case	20	10	$ 75,000	$ 3,750	5	8.4	100	420	8,392	$ 8.94		10.9	491	$ 7.64	9,819	8,182.10		9	45
Total Succes:	20	10	$ 75,000	$ 3,750	5	8.4	100	420	8,392	$ 8.94		10.9	545	$ 6.87	10,909			10	50
	19	10	$ 75,000	$ 3,947	5	8.4	95	420	7,972	$ 9.41		10.9	27,285	$ 0.14	518,407			10	2501
	18	9	$ 75,000	$ 4,167	5	8.4	90	420	7,553	$ 9.93		10.9	27,285	$ 0.15	491,123			10	2501
	17	9	$ 75,000	$ 4,412	5	8.4	85	420	7,133	$ 10.51		10.9	27,285	$ 0.16	463,838			10	2501
	16	8	$ 75,000	$ 4,688	5	8.4	80	420	6,714	$ 11.17		10.9	27,285	$ 0.17	436,553			10	2501
	15	8	$ 75,000	$ 5,000	5	8.4	75	420	6,294	$ 11.92		10.9	27,285	$ 0.18	409,269			10	2501
	14	7	$ 75,000	$ 5,357	5	8.4	70	420	5,874	$ 12.77		10.9	27,285	$ 0.20	381,984			10	2501
	13	7	$ 75,000	$ 5,769	5	8.4	65	420	5,455	$ 13.75		10.9	27,285	$ 0.21	354,700			10	2501
	12	6	$ 75,000	$ 6,250	5	8.4	60	420	5,035	$ 14.90		10.9	27,285	$ 0.23	327,415			10	2501
	11	6	$ 75,000	$ 6,818	5	8.4	55	420	4,616	$ 16.25		10.9	27,285	$ 0.25	300,130			10	2501
Half Full	10	5	$ 75,000	$ 7,500	5	8.4	50	420	4,196	$ 17.87		10.9	27,285	$ 0.27	272,846			10	2501
	9	5	$ 75,000	$ 8,333	5	8.4	45	420	3,776	$ 19.86		10.9	27,285	$ 0.31	245,561			10	2501
	8	4	$ 75,000	$ 9,375	5	8.4	40	420	3,357	$ 22.34		10.9	27,285	$ 0.34	218,277			10	2501
	7	4	$ 75,000	$ 10,714	5	8.4	35	420	2,937	$ 25.53		10.9	27,285	$ 0.39	190,992			10	2501
	6	3	$ 75,000	$ 12,500	5	8.4	30	420	2,518	$ 29.79		10.9	27,285	$ 0.46	163,708			10	2501
	5	3	$ 75,000	$ 15,000	5	8.4	25	420	2,098	$ 35.75		10.9	27,285	$ 0.55	136,423			10	2501
	4	2	$ 75,000	$ 18,750	5	8.4	20	420	1,678	$ 44.69		10.9	27,285	$ 0.69	109,138			10	2501
	3	2	$ 75,000	$ 25,000	5	8.4	15	420	1,259	$ 59.58		10.9	27,285	$ 0.92	81,854			10	2501
	2	1	$ 75,000	$ 37,500	5	8.4	10	420	839	$ 89.37		10.9	27,285	$ 1.37	54,569			10	2501
	1	1	$ 75,000	$ 75,000	5	8.4	5	420	420	$ 178.74		10.9	27,285	$ 2.75	27,285			10	2501
Total Failure	0	0	$ 75,000	#DIV/0!	5	8.4	-	420	-	#DIV/0!		10.9	27,285	#DIV/0!	-			10	2501

# count	County Serve	Firm Name	Street Address	Sorted By Location	Phone	Email		Price /average	Relative Price	Satisfaction	Price/Satisf.	# of Ratings	A Customer Comment
1	SM	George Salet Plumbing	200 Valley Dr #51	Brisbane, CA 94005	415-334-0733			15% higher	$115	76%	$151	21 Ratings	Prices a bit high but understood my problem and solved it quickly
2	SM	San Francisco Plumbing	200 Valley Dr #3	Brisbane, CA 94005	415-664-2345		Top Rated for Quality	2% higher	$102	83%	$123	32 Ratings	I would trust them with both big and small jobs. They always arrive on time! And one time they didn't charge me when it turned out my problem was just...
3	SM	Franks All City Plumbing	2560 Turnberry Dr	San Bruno, CA 94066	415-407-2140		Top Rated for Quality	6% lower	$94	91%	$103	25 Ratings	Hired this company to completely replace a faucet and shower assembly in a lathe and plaster tiled bathroom. Frank showed up on time, along with a...
4	SM	Lo Reaux & Son Plumbing	570 San Bruno Ave W	San Bruno, CA 94066	650-588-5756					52%		22 Ratings	Great, reliable dependable reasonable and pleasant plumbers
5	SM	Southwood Plumbing & Heating	1059 San Mateo Ave	San Bruno, CA 94066	650-583-0391		Top Rated for Quality	16% higher	$116	83%	$140	31 Ratings	Very experienced and knowledgeable people.
6	SM	Jerry Moreland & Son Plumbing	339 El Camino Real	Millbrae, CA 94030	650-589-2500		Top Rated for Quality	24% lower	$76	81%	$94	31 Ratings	I've used this plumbing service for years. They usually show up the same day, do the work quickly and are easy to get along with. They are quite knowledgeable...
7	SM	All Flow Plumbing & Rooter	PO Box 464	San Mateo, CA 94401	650-343-2214		Top Rated for Quality	22% higher	$122	85%	$144	56 Ratings	its very good
8	SM	Dittmann Plumbing	941 S Claremont St	San Mateo, CA 94402	650-343-2159			37% higher	$137	73%	$188	46 Ratings	Family owned. They know my old plumbing and keep it working.
9	SM	James Caccia Plumbing	917 N Amphlett Blvd	San Mateo, CA 94401	650-342-5363					71%		57 Ratings	A bit expensive
10	SM	Lindstrom Plumbing	1121 Bayswater Ave	San Mateo, CA 94401	650-343-4542			6% higher	$106	75%	$141	53 Ratings	Expensive but do quality work...
11	SM	Bel-Carlos Plumbing	240 Harbor Blvd #D	Belmont, CA 94002	650-598-9055			6% higher	$106	56%	$189	18 Ratings	My water heater quit heating. I called Bel-Carlos. They came out and re-lit the heater. He refused payment of any type. I will certainly reward Bel-Carlos...
12	SM	Bell Plumbing of San Mateo	611 Industrial Rd #8	San Carlos, CA 94070	650-697-3000			19% higher	$119	47%	$253	16 Ratings	Blocked sewer cleaned out quickly and neatly
13	SM	Sewer Rat Plumbing	751 Laurel St #704	San Carlos, CA 94070	650-343-7575		Top Rated for Quality			86%		23 Ratings	This was a maintenance cleanout of a common sewer line. Good quality work.
14	SM	Rosenberg Plumbing	445 Old County Rd #100-205	Pacifica, CA 94044	650-355-6319					63%		39 Ratings	Excellent work. Pricey.
15	SM	Simms Plumbing & Water Equipment	PO Box 9	Pescadero, CA 94060	650-879-0739		Top Rated for Quality			94%		34 Ratings	Great company - wouldn't use anyone else for our plumbing needs!
16	SM	Bayshore Plumbers	3158 Rolison Rd	Redwood City, CA 94063	650-323-6464		Top Rated for Quality	14% higher	$114	100%	$114	12 Ratings	
17	SM & SC	Smelly Mel's Plumbing	300 Shaw Rd	South San Francisco, CA 94080	650-738-2030		25% higher		$125	78%	$160	19 Ratings	Great and prompt service and a senior discount
18	SM & SC	Rush Rooters	1 Mandelay Pl	South San Francisco, CA 94080	415-550-0777					43%		15 Ratings	Reliable; good work.
19	SM & SC	Regina Plumbing	811 Kaynyne St #B	Redwood City, CA 94062	650-363-9109		6% lower		$94	77%	$122	13 Ratings	
20	SM & SC	Boudreau Plumbing & Heating	868 Warrington Ave	Redwood City, CA 94063	650-592-1170			6% lower	$94	66%	$142	38 Ratings	Pricey but did an excellent job and came at the last minute to install a new shower controller and copper pipes during our remodel process.
21	SM & SC	Dale Plumbing & Heating	2925 Crocker Ave	Redwood City, CA 94063	650-366-4675		Top Rated for Price	17% lower	$83	72%	$115	19 Ratings	Dale Plumbing has been extremely responsive when I've needed emergency plumbing work at my elderly mother's house.
22	SM & SC	Discount Plumbing & Rooter	1330 Valota Rd	Redwood City, CA 94061	650-369-8400			24% higher	$124	55%	$225	20 Ratings	came late, wouldn't do the work, jacked up the price. don't waste your time.
23	SM & SC	Roto-Rooter of Menlo Park	220 Demeter St	East Palo Alto, CA 94303	650-259-7712					47%		77 Ratings	He padded the order time wise. Added an extra 30 minutes which cost my landlord $131 more then it should. Did not change when confronted about it.
24	SM & SC	Guy Plumbing & Heating	1265 El Camino Real	Menlo Park, CA 94025	650-323-8415		Top Rated for Quality	Same as Average	$100	91%	$110	223 Ratings	Fantastic job. They showed up the same morning we called to replace our water heater. Did great work, and explained things along the way.
25	SM & SC	He-Man Plumbing	PO Box 51297	Palo Alto, CA 94303	650-222-7953		Top Rated for Quality	11% lower	$89	100%	$89	13 Ratings	
26	SM & SC	Palo Alto & Dahl Plumbing Heating Air	716 San Antonio Rd #F	Palo Alto, CA 94303	650-967-4328		Top Rated for Price	18% lower	$82	74%	$111	56 Ratings	They have a tendency, in our experience, to not get it right the first time, but they do come back and make things right, which is better than most. With...
27	SM & SC	Ed's Plumbing		Mountain View, CA 94041	650-965-0934		Top Rated for Quality			86%		23 Ratings	Very reasonable prices, pleasant, competent person.
28	SM & SC	Master Plumbing	650 Vaqueros Ave	Sunnyvale, CA 94085	408-945-1000					40%		10 Ratings	Initial work is more competitive - once they have you as an account, expect the prices to rise.
29	SM & SC	Around The Clock Service	1180 Miraloma Way #B	Sunnyvale, CA 94085	650-968-1100			3% lower	$97	59%	$164		
30	SM & SC	Drain Doctor	480 Aldo Ave	Santa Clara, CA 95954	800-921-1151			23% higher	$123	62%	$198	54 Ratings	This year's experience with Drain Dr was markedly inferior to the first experience more than a year ago. This year's was a leaking water heater, and...
31	SM & SC	Rapid Plumbing	307 Laurel Wood Rd	Santa Clara, CA 95054	800-997-2743					50%		34 Ratings	Left drains open and toilet was not bolted down properly.
32	SM & SC	Smart Plumbers & Rooters	2175 Ronald St	Santa Clara, CA 95050	408-247-2400		Top Rated for Quality			86%		59 Ratings	Late multiple times for estimate that was over 2X the other bid and they would not even put it in writing.
33	SM & SC	Aquatek Plumbing	1236 N 5th St	San Jose, CA 95153	408-295-7767		Top Rated for Price	13% lower	$87	67%	$130	30 Ratings	Quoted one price and charged higher price. Paid with credit card and receptionist who took card used it for online purchases. When complained to company...
34	SM & SC	Mike Counsil Plumbing	1915 O'Toole Way	San Jose, CA 95131	408-272-4900					54%		57 Ratings	Pricy, but reliable.
35	SM & SC	Blossom Valley Plumbing	1254 Butterfly Dr	San Jose, CA 95120	408-997-1970		Top Rated for Quality	13% lower	$87	88%	$99	26 Ratings	Very professional on time, quality and price. The price was less than half the other bid. This was for a shower valve replace and re-pipe to sprinkler...
36	SM & SC	ARS/Rescue Rooter	2305 Paragon Dr	San Jose, CA 95131	408-982-0405					51%		38 Ratings	
37	SM & SC	Rayne Plumbing & Sewer Service	517 Madera Ave	San Jose, CA 95112	408-283-0600		10% higher		$110	67%	$164	14 Ratings	After using quite a number of plumbing services over the years, I've learned that Rayne Plumbing offers the best combination of responsiveness (timeliness),...
38	SM & SC	Cefalu Plumbing	PO Box 612765	San Jose, CA 95161	408-296-5514		Top Rated for Quality	28% lower	$72	90%	$80	100 Ratings	Dan Pettit owns business & does the work. Never had a more reliable plumber. A pleasant man to do business with. A gem. Unfortunately in great demand.
39	SM & SC	Cupertino Plumbing	2784 S Bascom Ave	San Jose, CA 95124	408-253-0618		Top Rated for Price	7% lower	$93	52%	$179	32 Ratings	The basic work on the copper pipes seemed fine but their peripheral work was inferior: insulating the pipes, installing a drain for a wash basin, marginal...
40	SM & SC	Water Quality Plumbing	1716 Stone Ave #E	San Jose, CA 95125	408-267-9330		Top Rated for Quality	7% lower	$93	80%	$116	66 Ratings	On time, diligent, professional. Price competitive, not low end.
41	SC	A & A Plumbing	1030 E El Camino Real #248	Sunnyvale, CA 94087	408-738-8878		Top Rated for Quality	Same as Average	$100	87%	$115	39 Ratings	Had a problem with tankless heater. Mike walked us through how we could resolve the problem. Kind Patient Knowledgeable We are truly grateful to him....
42	SC	Pennington Plumbing Services	2784 Homestead Rd #386	Santa Clara, CA 95051	408-217-8352					75%		16 Ratings	Pennington is the best. I regret using any others, I'm always happy with their work. Reliable and honest.
43	SC	Roto-Rooter	356 Matthew St	Santa Clara, CA 95050	408-727-9850					54%		38 Ratings	I had a backup occur mid-day on Saturday after Christmas and called my home protection carrier Homeserve. After waiting 4 hours hey were unable to find...
44	SC	Alfred Williams Plumbing	1076 Reeve St #1	Santa Clara, CA 95050	408-247-7878		Top Rated for Quality	17% lower	$83	94%	$88	221 Ratings	Only does small jobs. Would not bid on shower valve replace.
45	SC	ABE Plumbing	325 Silvera St	Milpitas, CA 95035	408-946-0870		Top Rated for Quality	13% lower	$87	83%	$105	24 Ratings	Van- Was on time and professional. I do not know what others would have charged, but he seemed fair. I would highly recommend. Kyle
46	SC	Scott & Tom's Plumbing	PO Box 362	Saratoga, CA 95071	408-867-6010		Top Rated for Quality	18% higher	$118	83%	$142	46 Ratings	
47	SC	Speed Drain at Los Gatos		Los Gatos, CA 95030	408-378-5309		Top Rated for Quality			83%		13 Ratings	Excellent service. On time arrival, very efficient (speedy :-) repair at reasonable rates, very neat work. Firm was recommended by two different friends...
48	SC	Thorne's Plumbing	PO Box 33231	Los Gatos, CA 95031	408-356-8500					76%		64 Ratings	Top-notch plumbing company.
49	SC	$15 Sewer & Drain Service	PO Box 26942	San Jose, CA 95159	408-279-1515		Top Rated for Price	10% lower	$90	61%	$148	47 Ratings	they can really rip you off. I had them remove a garbage disposal and they went to Ace hardware for the parts they needed. I noted that they quadrupled...
50	SC	AB/JDD Plumbing Heating & Air Conditioning	390 S White Rd	San Jose, CA 95127	408-251-1820	http://www.abjdd.net	Top Rated for Quality	8% lower	$92	91%	$101	11 Ratings	great services
51	SC	San Jose Plumbing	19970 McKean Rd	San Jose, CA 95120	408-296-1820		Top Rated for Quality			84%		112 Ratings	We have used San Jose Plumbing for many years and have been very satisfied.One caveat, when they replaced our pipes with copper they left the old pipes...
52	SC	Almaden Valley Plumbing	1152 Lansdale Ct	San Jose, CA 95120	408-268-6923		Top Rated for Price	15% lower	$85	63%	$135	31 Ratings	Courteous, fair and professional. Even adjusted the fee downward because the job was simple and took about 15 minutes.
53	SC	Drain Master	542 Tuscarora Dr	San Jose, CA 95123	408-629-1453		Top Rated for Quality	8% lower	$92	82%	$112	29 Ratings	Very pleasant to deal with. They are prompt, courteous, and went about their work in a very professional manner. Top notch in my estimation.
54	SC	Eagle Plumbing	3532 Boeger Ln	San Jose, CA 95148	408-270-2279		Top Rated for Quality	1% higher	$101	83%	$122	42 Ratings	Brought out copper to replace a galvanized line repair without my having to mention it! Did NOT try and "convince" me that galvanized was good enough...
55	SC	Frank's Plumbing	305 E Dunne Ave	Morgan Hill, CA 95037	408-779-3737		Top Rated for Price	10% lower	$90	73%	$123	28 Ratings	No raters have left a written comment.
56	SC	Ernie's Plumbing	7411 Railroad St	Gilroy, CA 95020	408-847-3274		Top Rated for Quality	11% lower	$89	93%	$96	14 Ratings	The best and most reasonable in town.

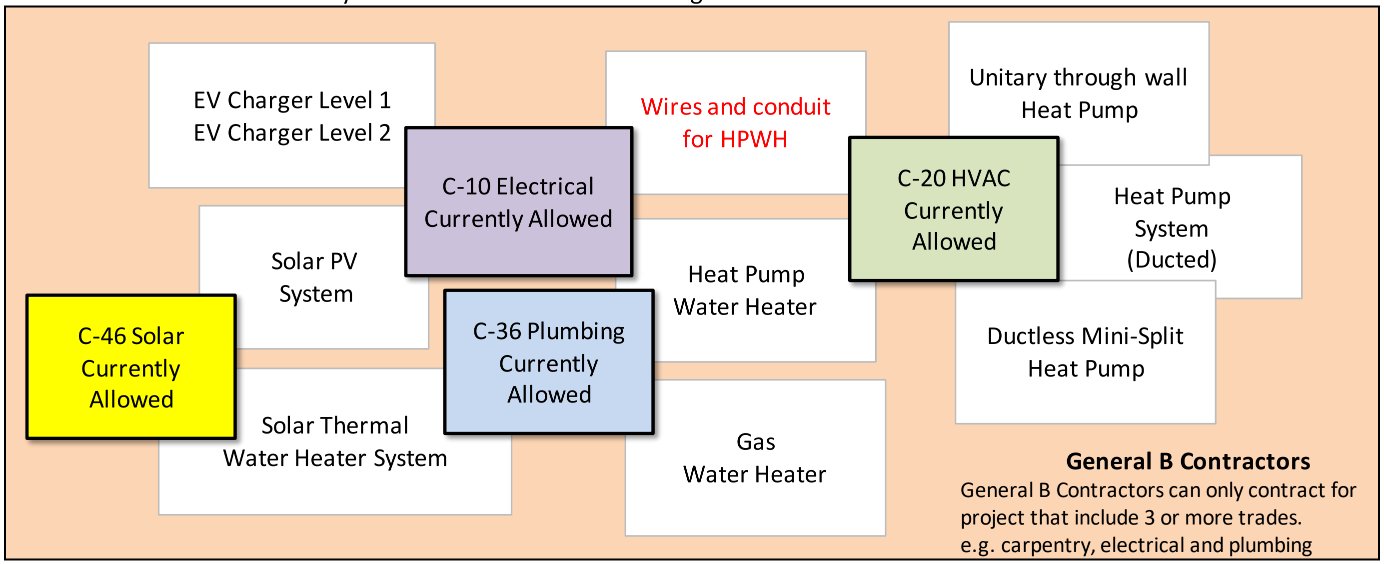
Website	County Serve	Name		Sorted By Location		Email		Price /average	Relative Price	Satisfaction	Price/Satisf.	# of Ratings	A Customer Comment
n/a	SM & SC	Cefalu Plumbing	PO Box 612765	San Jose, CA 95161	408-296-5514		Top Rated for Quality	28% lower	$72	90%	$80	100 Ratings	Dan Pettit owns business & does the work. Never had a more reliable plumber. A pleasant man to do business with. A gem. Unfortunately in great demand.
n/a	SC	Alfred Williams Plumbing	1076 Reeve St #1	Santa Clara, CA 95050	408-247-7878		Top Rated for Quality	17% lower	$83	94%	$88	221 Ratings	Only does small jobs. Would not bid on shower valve replace.
n/a	SM & SC	He-Man Plumbing	PO Box 51297	Palo Alto, CA 94303	650-222-7953		Top Rated for Quality	11% lower	$89	100%	$89	13 Ratings	
n/a	SM	Jerry Moreland & Son Plumbing	339 El Camino Real	Millbrae, CA 94030	650-589-2500		Top Rated for Quality	24% lower	$76	81%	$94	31 Ratings	I've used this plumbing service for years. They usually show up the same day, do the work quickly and are easy to get along with. They are quite knowledgeable...
https://www	SC	Ernie's Plumbing	7411 Railroad St	Gilroy, CA 95020	408-847-3274		Top Rated for Quality	11% lower	$89	93%	$96	14 Ratings	The best and most reasonable in town.
http://www.	SM & SC	Blossom Valley Plumbing	1254 Butterfly Dr	San Jose, CA 95120	408-997-1970		Top Rated for Quality	13% lower	$87	88%	$99	26 Ratings	Very professional on time, quality and price. The price was less than half the other bid. This was for a shower valve replace and re-pipe to sprinkler...
://www.abjd	SC	AB/JDD Plumbing Heating & Air Conditioning	390 S White Rd	San Jose, CA 95127	408-251-1820		Top Rated for Quality	8% lower	$92	91%	$101	11 Ratings	great services
http://www.	SM	Franks All City Plumbing	2560 Turnberry Dr	San Bruno, CA 94066	415-407-2140		Top Rated for Quality	6% lower	$94	91%	$103	25 Ratings	Hired this company to completely replace a faucet and shower assembly in a lathe and plaster tiled bathroom. Frank showed up on time, along with a...
n/a	SC	ABE Plumbing	325 Silvera St	Milpitas, CA 95035	408-946-0870		Top Rated for Quality	13% lower	$87	83%	$105	24 Ratings	Van- Was on time and professional. I do not know what others would have charged, but he seemed fair. I would highly recommend. Kyle
https://www	SM & SC	Guy Plumbing & Heating	1265 El Camino Real	Menlo Park, CA 94025	650-323-8415		Top Rated for Quality	Same as Average	$100	91%	$110	223 Ratings	Fantastic job. They showed up the same morning we called to replace our water heater. Did great work, and explained things along the way.
http://paloal	SM & SC	Palo Alto & Dahl Plumbing Heating Air	716 San Antonio Rd #F	Palo Alto, CA 94303	650-967-4328		Top Rated for Price	18% lower	$82	74%	$111	56 Ratings	They have a tendency, in our experience, to not get it right the first time, but they do come back and make things right, which is better than most. With...
http://www.	SC	Drain Master	542 Tuscarora Dr	San Jose, CA 95123	408-629-1453		Top Rated for Quality	8% lower	$92	82%	$112	29 Ratings	Very pleasant to deal with. They are prompt, courteous, and went about their work in a very professional manner. Top notch in my estimation.
http://www.	SM	Bayshore Plumbers	3158 Rolison Rd	Redwood City, CA 94063	650-323-6464		Top Rated for Quality	14% higher	$114	100%	$114	12 Ratings	
http://www.	SC	A & A Plumbing	1030 E El Camino Real #248	Sunnyvale, CA 94087	408-738-8878		Top Rated for Quality	Same as Average	$100	87%	$115	39 Ratings	Had a problem with tankless heater. Mike walked us through how we could resolve the problem. Kind Patient Knowledgeable We are truly grateful to him....
http://www.	SM & SC	Dale Plumbing & Heating	2925 Crocker Ave	Redwood City, CA 94063	650-366-4675		Top Rated for Price	17% lower	$83	72%	$115	19 Ratings	Dale Plumbing has been extremely responsive when I've needed emergency plumbing work at my elderly mother's house.
http://www.	SM & SC	Water Quality Plumbing	1716 Stone Ave #E	San Jose, CA 95125	408-267-9330		Top Rated for Quality	7% lower	$93	80%	$116	66 Ratings	On time, diligent, professional. Price competitive, not low end.
n/a	SC	Eagle Plumbing	3532 Boeger Ln	San Jose, CA 95148	408-270-2279		Top Rated for Quality	1% higher	$101	83%	$122	42 Ratings	Brought out copper to replace a galvanized line repair without my having to mention it! Did NOT try and "convince" me that galvanized was good enough...
n/a	SM & SC	Regina Plumbing	811 Kaynyne St #B	Redwood City, CA 94062	650-363-9109		6% lower		$94	77%	$122	13 Ratings	
n/a	SM	San Francisco Plumbing	200 Valley Dr #3	Brisbane, CA 94005	415-664-2345		Top Rated for Quality	2% higher	$102	83%	$123	32 Ratings	I would trust them with both big and small jobs. They always arrive on time! And one time they didn't charge me when it turned out my problem was just...
n/a	SC	Frank's Plumbing	305 E Dunne Ave	Morgan Hill, CA 95037	408-779-3737		Top Rated for Price	10% lower	$90	73%	$123	28 Ratings	No raters have left a written comment.
http://www.	SM & SC	Aquatek Plumbing	1236 N 5th St	San Jose, CA 95153	408-295-7767		Top Rated for Price	13% lower	$87	67%	$130	30 Ratings	Quoted one price and charged higher price. Paid with credit card and receptionist who took card used it for online purchases. When complained to company...
n/a	SC	Almaden Valley Plumbing	1152 Lansdale Ct	San Jose, CA 95120	408-268-6923		Top Rated for Price	15% lower	$85	63%	$135	31 Ratings	Courteous, fair and professional. Even adjusted the fee downward because the job was simple and took about 15 minutes.
http://www.	SM	Southwood Plumbing & Heating	1059 San Mateo Ave	San Bruno, CA 94066	650-583-0391		Top Rated for Quality	16% higher	$116	83%	$140	31 Ratings	Very experienced and knowledgeable people.
n/a	SM	Lindstrom Plumbing	1121 Bayswater Ave	San Mateo, CA 94401	650-343-4542			6% higher	$106	75%	$141	53 Ratings	Expensive but do quality work...
n/a	SC	Scott & Tom's Plumbing	PO Box 362	Saratoga, CA 95071	408-867-6010		Top Rated for Quality	18% higher	$118	83%	$142	46 Ratings	
http://www.	SM & SC	Boudreau Plumbing & Heating	868 Warrington Ave	Redwood City, CA 94063	650-592-1170			6% lower	$94	66%	$142	38 Ratings	Pricey but did an excellent job and came at the last minute to install a new shower controller and copper pipes during our remodel process.
http://www.	SM	All Flow Plumbing & Rooter	PO Box 464	San Mateo, CA 94401	650-343-2214		Top Rated for Quality	22% higher	$122	85%	$144	56 Ratings	its very good
	SC	$15 Sewer & Drain Service	PO Box 26942	San Jose, CA 95159	408-279-1515		Top Rated for Price	10% lower	$90	61%	$148	47 Ratings	they can really rip you off. I had them remove a garbage disposal and they went to Ace hardware for the parts they needed. I noted that they quadrupled...
http://www.	SM	George Salet Plumbing	200 Valley Dr #51	Brisbane, CA 94005	415-334-0733			15% higher	$115	76%	$151	21 Ratings	Prices a bit high but understood my problem and solved it quickly
http://www.	SM & SC	Smelly Mel's Plumbing	300 Shaw Rd	South San Francisco, CA 94080	650-738-2030		25% higher		$125	78%	$160	19 Ratings	Great and prompt service and a senior discount
http://rayne	SM & SC	Rayne Plumbing & Sewer Service	517 Madera Ave	San Jose, CA 95112	408-283-0600		10% higher		$110	67%	$164	14 Ratings	After using quite a number of plumbing services over the years, I've learned that Rayne Plumbing offers the best combination of responsiveness (timeliness),...
n/a	SM & SC	Around The Clock Service	1180 Miraloma Way #B	Sunnyvale, CA 94085	650-968-1100			3% lower	$97	59%	$164		
http://www.	SM & SC	Cupertino Plumbing	2784 S Bascom Ave	San Jose, CA 95124	408-253-0618		Top Rated for Price	7% lower	$93	52%	$179	32 Ratings	The basic work on the copper pipes seemed fine but their peripheral work was inferior: insulating the pipes, installing a drain for a wash basin, marginal...
http://www.	SM	Dittmann Plumbing	941 S Claremont St	San Mateo, CA 94402	650-343-2159			37% higher	$137	73%	$188	46 Ratings	Family owned. They know my old plumbing and keep it working.
N/a	SM	Bel-Carlos Plumbing	240 Harbor Blvd #D	Belmont, CA 94002	650-598-9055			6% higher	$106	56%	$189	18 Ratings	My water heater quit heating. I called Bel-Carlos. They came out and re-lit the heater. He refused payment of any type. I will certainly reward Bel-Carlos...
http://www.	SM & SC	Drain Doctor	480 Aldo Ave	Santa Clara, CA 95954	800-921-1151			23% higher	$123	62%	$198	54 Ratings	This year's experience with Drain Dr was markedly inferior to the first experience more than a year ago. This year's was a leaking water heater, and...
http://www.	SM & SC	Discount Plumbing & Rooter	1330 Valota Rd	Redwood City, CA 94061	650-369-8400			24% higher	$124	55%	$225	20 Ratings	came late, wouldn't do the work, jacked up the price. don't waste your time.
https://www	SM	Bell Plumbing of San Mateo	611 Industrial Rd #8	San Carlos, CA 94070	650-697-3000			19% higher	$119	47%	$253	16 Ratings	Blocked sewer cleaned out quickly and neatly
https://www	SM & SC	ARS/Rescue Rooter	2305 Paragon Dr	San Jose, CA 95131	408-982-0405					51%		38 Ratings	
n/a	SM & SC	Ed's Plumbing		Mountain View, CA 94041	650-965-0934		Top Rated for Quality			86%		23 Ratings	Very reasonable prices, pleasant, competent person.
https://www	SM	James Caccia Plumbing	917 N Amphlett Blvd	San Mateo, CA 94401	650-342-5363					71%		57 Ratings	A bit expensive
n/a	SM	Lo Reaux & Son Plumbing	570 San Bruno Ave W	San Bruno, CA 94066	650-588-5756					52%		22 Ratings	Great, reliable dependable reasonable and pleasant plumbers
http://www.	SM & SC	Master Plumbing	650 Vaqueros Ave	Sunnyvale, CA 94085	408-945-1000					40%		10 Ratings	Initial work is more competitive - once they have you as an account, expect the prices to rise.
https://www	SM & SC	Mike Counsil Plumbing	1915 O'Toole Way	San Jose, CA 95131	408-272-4900					54%		57 Ratings	Pricy, but reliable.
http://www.	SC	Pennington Plumbing Services	2784 Homestead Rd #386	Santa Clara, CA 95051	408-217-8352					75%		16 Ratings	Pennington is the best. I regret using any others, I'm always happy with their work. Reliable and honest.
https://rapid	SM & SC	Rapid Plumbing	307 Laurel Wood Rd	Santa Clara, CA 95054	800-997-2743					50%		34 Ratings	Left drains open and toilet was not bolted down properly.
n/a	SM	Rosenberg Plumbing	445 Old County Rd #100-205	Pacifica, CA 94044	650-355-6319					63%		39 Ratings	Excellent work. Pricey.
https://www	SC	Roto-Rooter	356 Matthew St	Santa Clara, CA 95050	408-727-9850					54%		38 Ratings	I had a backup occur mid-day on Saturday after Christmas and called my home protection carrier Homeserve. After waiting 4 hours hey were unable to find...
https://www	SM & SC	Roto-Rooter of Menlo Park	220 Demeter St	East Palo Alto, CA 94303	650-259-7712					47%		77 Ratings	He padded the order time wise. Added an extra 30 minutes which cost my landlord $131 more then it should. Did not change when confronted about it.
n/a	SM & SC	Rush Rooters	1 Mandelay Pl	South San Francisco, CA 94080	415-550-0777					43%		15 Ratings	Reliable; good work.
http://www.	SC	San Jose Plumbing	19970 McKean Rd	San Jose, CA 95120	408-296-1820		Top Rated for Quality			84%		112 Ratings	We have used San Jose Plumbing for many years and have been very satisfied.One caveat, when they replaced our pipes with copper they left the old pipes...
n/a	SM	Sewer Rat Plumbing	751 Laurel St #704	San Carlos, CA 94070	650-343-7575		Top Rated for Quality			86%		23 Ratings	This was a maintenance cleanout of a common sewer line. Good quality work.
n/a	SM	Simms Plumbing & Water Equipment	PO Box 9	Pescadero, CA 94060	650-879-0739		Top Rated for Quality			94%		34 Ratings	Great company - wouldn't use anyone else for our plumbing needs!
http://www.	SM & SC	Smart Plumbers & Rooters	2175 Ronald St	Santa Clara, CA 95050	408-247-2400		Top Rated for Quality			86%		59 Ratings	Late multiple times for estimate that was over 2X the other bid and they would not even put it in writing.
http://www.	SC	Speed Drain at Los Gatos		Los Gatos, CA 95030	408-378-5309		Top Rated for Quality			83%		13 Ratings	Excellent service. On time arrival, very efficient (speedy :-) repair at reasonable rates, very neat work. Firm was recommended by two different friends...
n/a	SC	Thorne's Plumbing	PO Box 33231	Los Gatos, CA 95031	408-356-8500					76%		64 Ratings	Top-notch plumbing company.

Handyman Company Contact List

General B Contractor Contact list

The Licensing Landscape Related to Electrification Who can contract to do what

The shaded Contractor License holders are currently allowed to contract for installing items in the boxes that touch their licenses



The Red Text Box refers to the Conduit and Wire task SunWork proposes to teach to C-36 Plumbers and possibly C-20 Mechanicals and General B Contractors including Handyman companies

Electrification Job	C-10 Electrical	C-36 Plumber	C-20 Mechanical	C-46 Solar	General B Alone	General B With Subs
	License					
Install PV	Y			Y		Y
Install Solar Water		Y		Y		Y
Install Solar Heat			Y	Y		Y
HPWH Tank		Y	Y		Y**	Y
HPWH Circuit *	Y	?	Y ?		Y**	Y
Gas Water heater		Y		As Solar backup		Y
Electric Resistance Water Heater		Y		As Solar backup	Y**	Y
EVSE L1 or L2	Y			Should Be Y		Y
Combined Inverter EVSE	Y			Y		Y
Battery System	Y			Should Be		Y
Induction cooktop circuit	Y					Y
Mini-Split HP vacuum			Y			Y
Mini-Split HP DIY					Y**	Y
Central HP system			Y			Y
Main Electric Panel Upgrade	Y					

* 220V circuit could be very similar to EVSE Circuit, Clothes Dryer Circuit or Cooktop Circuit
** General B Contractor can pull permit for HPWH contract only if it involves wood bracing of WH or platform, and electrical to make 3 tasks (Plumbing, Electrical and Carpentry)

Participant Name	Week 1 Class Checkmark or notes	__/__/2018 Instructor Initials	Week 2 Checkmark or notes	__/__/2018 Instructor Initials	Week 3 Checkmark or notes	__/__/2018 Instructor Initials	Week 4 Checkmark or notes	__/__/2018 Instructor Initials
Session one overview								
Safety Tailgate								
Electric Panel Assessment								
Circuit Breaker Selection								
Arranging Breakers								
Wire gauge sizing								
Conduit Path Design								
Conduit Bending								
Conduit Assembly								
Conduit Strapping								
Wire Pulling								
Wire Connection								

Tool Use List

Gloves and Safety Glasses
Tape Measure & Level
Conduit Bender
Conduit Saw
Conduit De-Burring tool
Wire Strippers
Fish Tape (wire fisher)
Torque Screw Driver
Other (tool name)

Comments By instructors

Comments by Participants
e.g. What areas do you want to focus on?

End Use	Millions of Therms/Year	% of Total
Air Conditioning	52	1.00%
Cooking	304	5.70%
Dishwashers (water heating)	368	6.90%
Domestic Hot Water	1,200	22.50%
Dryers	166	3.10%
Miscellaneous	189	3.50%
Pools & Spas	287	5.40%
Space Heating	2,228	41.70%
Washers (water heating)	543	10.20%
Total	5,337	

Summary of Gas Water Heating

Domestic Hot Water	1,200	22.5%
Dishwashers (water heating)	368	6.9%
Washers (water heating)	543	10.2%
Water Heating	2,111	39.6%

Residential Electric End Use	Peak Demand	% of Total	Annual GWh	% of Total
Air Conditioning	12,660	50%	7,252	8%
Cooking	1,098	4%	2,888	3%
Dishwashers	502	2%	2,805	3%
Domestic Hot Water	246	1%	1,691	2%
Dryers	805	3%	4,497	5%
Freezers	352	1%	2,251	2%
Misc (includes lighting)	4,955	20%	36,901	41%
Pools & Spas	1,151	5%	5,415	6%
Refrigerators	2,214	9%	15,218	17%
Space Heating	-	0%	3,662	4%
TVs	1,004	4%	6,409	7%
Washers	279	1%	1,658	2%
Waterbeds	-	0%	-	0%
Total	**25,266**	**100%**	**90,647**	**100%**

Summary of Electric Water Heating

Domestic Hot Water	246	1%	1,691	2%
Dishwashers	502	2%	2805	3%
Washers	279	1%	1658	2%
Water Heating	1,027	4%	6,154	7%

2012 electric and gas retail rates

Table 5: Standardized Emission Factors for Electricity and Gas

	Emissions Factor (CO2e)	Emissions Factor(CO_2e)
Electricity[1] (PCE service)	0.14226 lbs/kWh	0.000064528 metric tons/kWh
Electricity[2] (state average)	0.588 lbs/kWh saved	0.000283 metric tons/kWh
Gas[3]	11.7 lbs/therm saved	0.0053 metric tons/therm

Energy Costs from 2012

	Average Statewide Residential	Average Statewide Commercial	Average Statewide Industrial
Electricity[4]	$ 0.15/kWh	$ 0.1418/kWh	$ 0.1054/kWh
Natural Gas[5]	$ 0.96/therm	$ 0.676/therm	$ 0.565/therm

[1] Peninsula Clean Energy staff estimates for 2017 EcoPlus service.
[2] California Energy Commission staff estimate.
[3] California Air Resources Board staff calculations.
[4] U.S. Energy Information Administration (EIA) 2012 summaries, tables 6 through 10. http://www.eia.gov/electricity/sales_revenue_price/.
[5] U.S. Energy Information Administration, www.eia.gov/dnav/ng/ng_pri_sum_dcu_SCA_a.htm.

CO2e Savings Estimate

Example CO2e Savings per plumber trained											
Number of HPWHs installed by plumber	5	per year									
										Total # of plumbers	
HPWHs/year	5	HPWH/year				245,282	lbs. CO2e/ year/ plumber			20	
						123	tons per year per plumber				
Years by which we accelerated the future training of plumbers	10	Years				1,226	Tons saved per plumber trained				
Hot Water usage per Water Heater per day	50	gallons/day								$ 82,980	grant size
Temperature Rise	75	degrees F								24,528	tons CO2e saved by grant
Gas Water Heater Energy Factor (EF)	0.62			GWP	Lb. CO2e/Therm	lb. CO2e /year		tons/CO2e/year		$ 3.38	cost per ton of CO2e saved
Gas Therms saved	184.12	Therms/year	Combusted	1	11.7	2,154	from combustion	1.08	tons/year		
Gas leakage (From well thru burner ranges from 2-11%	3.0%	info source CA ARB									Cost under a dollar per ton of CO2e saved
Gas leakage saved	5.52	Therms/year	Leaked	86	365.9	2,021	From leakage	1.01	tons/year		
					Total	4,175	lb. CO2e /year	2.09	tons/year		
Life of HPWH	13	Years			Total / gas WH	54,278	lbs. CO2e / GasWH	27.14	tons/year		
HPWH Energy Factor (EF)	3.0										
Electric consumption	1,114	kWh/year									
Electric grid emissions (gas fired portion plus losses)	0.14226	Lb. CO2e/kWh Info Source PCE 2017				158.51	lb. CO2e/year	0.08	tons/year		
			lb. of R-401A	GWP of refrigerant							
Worst Case Refrigerant leakage	100%		1	1100 https://www.en		1,100	lbs. CO2e	0.55	tons/year		
					Total CO2e emitted/ HPWH	3,161	lbs. CO2e / HPWH lifetime	1.58	tons/year		
		Worst Case refrigerant break even CO2e savings time				9	months (months of operating to save equivalent CO2e associated if all refrigerant was to leak away)				
			HPWHs			**CO2e Savings**					
			1		Total CO2e Savings	49,056	lbs. CO2e / HPWH	24.53			
			1		Total CO2e Savings	25	tons CO2e / HPWH				
			5 / plumber-yr		Total CO2e Savings	123	tons CO2e / plumber-year				
			50 /plumber		Total CO2e Savings	1,226	tons CO2e / plumber			$ 67.66	grant required per ton of CO2 saved if only one plumber did it.
			1,000 for program		Total CO2e Savings	24,528	tons CO2e for full program of 1 year training			$ 3.38	grant required per ton of CO2 saved if we get 24 plumbers.

Low-income Smart Thermostat Pilot

Prepared for

Peninsula Clean Energy,
Innovative Energy Program Grant

Prepared By

blue strike environmental

SAN FRANCISCO - PENINSULA ENERGY SERVICES

Contents

Description of Project

Market and Policy Context

At the forefront of California's transition to a low-carbon economy is the efforts of Community Choice Aggregators like Peninsula Clean Energy (PCE) working to implement innovative and impactful clean energy programs. This transition is driven by both regulated and mission driven objectives to create a more affordable, sustainable, and just energy future for the community and customers served by CCAs.

Key Challenges

However, despite the opportunities provided by the CCA movement, PCE faces several challenges on the path to achieving voluntary and mandatory climate protection, clean energy, and community benefit goals including:

- A lack of granular data and capacity for data analytics needed to inform data driven program design.
- Increasing over generation of renewable energy during peak solar production periods, and large evening ramps resulting in imbalanced supply and demand.
- Higher than necessary carbon-intensity (embedded GHG emissions) from residential gas and electric heating and cooling systems.
- A disproportionate financial burden of electricity costs on PCE's most vulnerable customers, including low-income, medical baseline, and otherwise disadvantaged community members.

Project Objectives and Opportunity

The Low-income Smart Thermostat Pilot aims to address these challenges by equipping participating disadvantaged community members within the PCE service area with a free smart thermostat. Once in place, these devices will create increased awareness of energy use and be supported by educational and community engagements that will catalyze energy savings, subsequent electric bill reductions, and the mitigation of greenhouse gas (GHG) emissions.

PCE will also directly benefit from the pilot by deploying a network of dispatchable DER's, and gaining valuable and granular data insights on customer energy use. The resulting energy use and billing data collected by PCE during this pilot can be used to lay the foundation for future targeted load shaping services, automated demand response, rebate and incentive programs, building retrofits, or rate design pilots designed to unlock deeper energy savings for customers while providing procurement, risk management, settlement, and scheduling benefits to PCE and its portfolio manager.

Key Pilot Features

The Low-Income Smart Thermostat program provides:

- Free smart thermostats (including installation) for up to 200 residential customers living in designated disadvantaged communities as defined by the San Mateo County Community (SMC) Vulnerability Index (VI).
- Educational materials and device use training designed to inform customers about opportunities for electricity, bill, and GHG savings that leverage the smart thermostats.
- A focus on data collection, integration, and analysis to support data driven recommendations for cost-effective programmatic implementation and ongoing innovation.
- A brand agnostic approach to smart thermostats designed to promote the best customer outcomes and user experience able to provide rate protection for PCE's most vulnerable customers while contributing to PCE's load serving needs.

- Partnership with San Francisco Peninsula Energy Services (SFPES) as the pilot installation and device compatibility assessment partner. SFPES is currently administrating the Low Income Housing Energy Assistance Program (LIHEAP) and providing energy efficiency measure installations throughout San Mateo County. Their participation in this pilot enables smart thermostat device installation at no cost for up to 100 PCE customers earning a median income of less than or equal to 60% of CA's median household income, as defined by LIHEAP assistance requirements and simultaneously provides no-cost implementation of LIHEAP energy efficiency measures to this group.

Technology Details

According to energystar.gov *"A smart thermostat is a Wi-Fi enabled device that automatically adjusts heating and cooling temperature settings in your home for optimal performance."* While feature set may vary across system most thermostats provide the user the ability to program temperature preferences, set automated schedules for heating and cooling, control the device through smart phone interfaces, have a low-power standby mode, provide energy use data for tracking and management purposes, respond to software updates, and the ability operate with or without internet connection.[1] It is also important to note here that many smart thermostats available on the market today allow control and integration with additional appliances beyond HVAC (including hot water heaters), which offers opportunities to extend the beneficial impacts of this pilot in meaningful ways over time.

Energy Star certified smart thermostats must meet a performance requirement showing an annual percent reduction in run time for heating systems (HS) of greater than or equal to 8**%** and a reduction of greater than or equal to 10% for cooling systems (CS)**. This standard results in electricity or natural gas savings for customers dependent upon system design of at least 8% per year.** Additional standard requirements for energy star certification include the ability for the device to:

- Work as a basic thermostat in absence of connectivity to the service provider.
- Give residents some form of feedback about the energy consequences of their settings.
- Provide information about HVAC energy use, such as monthly run time.
- Provide the ability to set a schedule.
- Provide the ability to work with utility programs to prevent brownouts and blackouts, while preserving consumers' ability to override those grid requests[2].

While our team is manufacturer agnostic we strongly recommend that as a result of the standards work provided by Energy Star any procured smart thermostat device is Energy Star certified. This leaves several options available to PCE including devices from Nest, Siemens, Ecobee, Honeywell, and a growing market of other device manufacturers. In addition to meeting certification standards Energy Star thermostats are eligible for PG&E rebates, which are accessible to CCA customers even if enrolled in CCA service, effectively lowering the capital costs of the pilot.

Customer Eligibility:

In order to be eligible to receive a free Smart Thermostat the following customer conditions should be met (note- additional criteria can be added based on PCE staff input):

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[1] Energystar.gov, *Smart Thermostats, https://www.energystar.gov/products/heating_cooling/smart_thermostats.*

[2] Energy star, *Program Requirements for Connected Thermostat Products. https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Program%20Requirements%20for%20Connected%20Thermostats%20Version%201.0.pdf*

- Existing residential wiring and heating system compatible with selected Smart Thermostat device, including C-wire availability.
- Existing in-home Wi-Fi system for data transfer, and user interaction with the device.
- Resident and device installation located within a defined DAC, or alternatively the customer is a CARE, FERA, or Medical Baseline customer, or from another priority population group identified by San Mateo County's Vulnerability Index.

KEY OUTCOMES

Energy and gas use savings from smart thermostat installations have been observed as ranging between 5-20% per year depending on literature source. A conservative estimate of 8% savings per year provided by Energy Star is assumed for both customers with electric and gas heating and cooling systems. Based on this assumption the tables below highlights the varying potential impact of a smart thermostat device on energy savings, customer bills, and GHG emissions when deployed across customer sub-segments separated by heating system type.

Viable Energy Savings Per Household Per Year and at Pilot Scale (Therms or KWh)			
Customer Sub-Segment	**Baseline Electric use**	**Savings per household**	**Savings @ 200 participants**
Customer with Gas Cooling (Therms)	4.2	0.336	**67.2**
Customer with Gas Heating Systems (Therms)	180.5	14.44	**2888**
Customer with Electric Cooling (KWh)	587.4	46.992	**9398.4**
Customer with Electric Heating (KWh)	296.6	23.728	**4745.6**

Viable GHG Savings Per Household Per Year and at Pilot Scale (Tons Co2e)			
Customer Sub-Segment	**Baseline GHG Tons Co2e**	**Savings per household**	**Savings @ 200 participants**
Customer with Gas Cooling	0.022	0.002	**0.357**
Customer with Gas Heating Systems	0.957	0.077	**15.304**
Customer with Electric Cooling	0.038	0.003	**0.606**
Customer with Electric Heating	0.019	0.002	**0.306**

Viable Bill Savings Per Household Per Year and at Pilot Scale (Dollars)			
Customer Sub-Segment	**Baseline Bill**	**Bill Savings[3]**	**Savings @ 200 participants**
Customer with Gas Cooling	$4.04	$0.32	**$64.51**
Customer with Gas Heating Systems	$173.26	$13.86	**$2,772.48**
Customer with Electric Cooling	$88.11	$7.05	**$1,409.76**
Customer with Electric Heating	$44.49	$3.56	**$711.84**

The tables above show that there is a range of outcomes possible resulting from the Low-income Smart Thermostat program dependent upon customer system type and PCE's priorities for environmental or economic tradeoffs. Our team intends to engage with PCE to identify the proportion of priority customer sub-segments for involvement in the pilot. However, we ultimately recommend including a mix of both electric and gas system equipped customers in order to capture a balance of environmental, social, and economic program benefits, and to establish a more inclusive baseline for future load control and shifting programs.

[3] Assumes the statewide residential average cost per KWh or cost per Therm. BSE is aware that CARE customers are billed at a separate discounted rate. The statewide average was selected for purposes of this analysis to be inclusive of other priority population designations that may not be on the CARE rate assistance program.

In addition to savings resulting directly from thermostat deemed savings from LIHEAP measure installation to be provided to 100 qualified PCE customers provides deemed energy and ghg savings based on measure installed. Deemed savings will be compared to real consumption data based on 12 months of historical customer energy use data to evaluate real-world savings from installed measures.

Pilot Support of PCE's Load Serving Needs

While standalone Smart Thermostats can create energy savings that result in environmental, economic, and social benefit they also act as an enabling technology able to facilitate the creation of dynamic data sets that can be used to inform further program design recommendations, deeper savings, and continued innovation within the residential built environment.

Specifically, the near-term benefits of the Low-income Smart Thermostat Pilot include:

- Rate protection and immediate savings for PCE's most vulnerable customers.
- Load reduction from energy conservation.
- Support for PCE's SB350, RA, and RPS compliance.
- Granular data collection, integration, and analysis relating to participating customer energy use profiles and conservation outcomes.

The long-term load serving benefits of the Low-income Smart Thermostat Pilot directly result from the value Smart Meter data and its ability to inform and support the development and implementation of customer facing programs and innovations including:

- Targeted load control, automated demand response, and virtual power plant aggregation able to shape and shift load to flatten load curves and mitigate issues related to the "duck-curve" (i.e., mid-day renewable over generation and steep evening demand ramp).
- Rate design pilots designed to provide load-shaping benefits and customer-facing financial incentives through time of use rates, transactive energy tariffs, or real time price signals to incent customer response to critical times of need such as extreme heating and cooling smart day pricing or wholesale market price volatility.
- Integration of smart thermostat device as a core interface for Home Energy Management Systems (HEMS) that include advance control of ground source heat pumps, pool pumps, lighting, occupancy sensors, water heaters, appliances, and other IoT equipped devices.

These long-term services are especially valuable for their ability to flatten load curves, manage peak power consumption, provide frequency regulation and grid services, and to align renewable resource generation with customer energy use patterns, all of which can support PCE's Energy Risk Management (ERM) policies. Blue Strike Environmental will provide analytics of green button (aka, smart meter), billing, and smart thermostat data to create a strategic recommendations report designed to highlight opportunities for additional innovation able to benefit PCE's load serving needs as well as to create greater social, environmental, and economic impact for pilot participants.

<u>PILOT WORKPLAN</u>

The implementation of the Low-income Smart Thermostat Pilot will occur in five phases of over an 18-month period. The five phases include: 1) Pre-pilot community engagement process, 2) Participant selection and enrollment, 3) Device installation & customer support, 4) Customer follow-up engagement, and 5) Data analysis, reporting, and final recommendations.

Two surveys will be conducted during the pilot study including, 1) a preliminary demographics and heating system type survey to screen for qualified customers, and 2) a follow-up survey asking participants about satisfaction, comfort, ease of use, and how they interacted with the smart thermostat.

Phase 1: Pre-pilot engagement (Months 1-3)
Phase 1 will establish pilot details and define the final eligible target customer participation. BSE will coordinate with PCE to query PCE data to identify a shortlist of CARE, FERA, Medical Baseline, and/or customers from other priority populations to which the preliminary customer engagement survey will be distributed through existing PCE customer communication channels. During this phase, BSE will engage with PCE to select the smart thermostat device brand and identified educational and community outreach materials will be created and reviewed with PCE for approval and inclusion throughout the next phases of pilot implementation. In addition, any/all shipping activities, device support, and needed technical details concerning the device will be managed by BSE with minimal support from PCE staff. All necessary contracting relating to data access permissions and scope of work will be established and matched to legal and technical requirements of PCE.

<u>Data collection goals of Qualification Survey:</u>

1) Number of occupants.
2) Year home built.
3) Square footage.
4) Make of existing thermostat (photo).
5) Existing thermostat wiring and heating system type (photo).
6) Identification of existing in-home Wi-Fi network.

<u>Educational and community outreach materials to be created by BSE include:</u>

- Pre-launch communication and outreach materials including, PCE newsletter article to communicate ongoing pilot with PCE stakeholders and customers.
- Selection and enrollment letters to guide the customer experience from launch to pilot completion.

Phase 2: Participant Selection and Enrollment (Months 4-5)
Phase 2 will use data gathered from the eligibility survey to identify eligible customers based on survey responses and alignment with PCE goals and parameters. Should the number of eligible customers be greater than the number of devices available customers will be selected on first come first served basis. Phase 2 will also trigger the release of selection letters for those qualified for the project as well as follow up communication with customers not eligible or selected. A final in-person assessment will be scheduled SFPES followed by device installation as applicable. SFPES will also facilitate gathering of Owner Waivers authorizing measure installation. The selected brand of thermostats will also be purchased during this phase and shipped to install partner SFPES for direct installation during phase 3.

Key communication documents released during this phase include:

- Enrollment letter and next step guide for eligible and selected customers.
- Follow up letter informing those applicants that were not selected.
- PCE-branded smart thermostat user orientation video, highlighting tips and tricks for managing energy use and maximizing savings benefits with the new device.
- Collateral and educational material delivery as defined in Phase 1.

Phase 3: Device Installation and Customer Support (Months 5-6)
Phase 3 is the installation phase during which San Francisco Peninsula Energy Services (SFPES) will provide direct install support to selected pilot participants. During this phase the device will be installed, connected to Wi-Fi and registered for linkage with a data tracking platform. Match funding from the LIHEAP program will be utilized to cover the cost of installation and ongoing customer support for (a minimum of) 100 of the 200 selected pilot participants. This

group of 100 is qualified for LIHEAP funding should their annual income be less than or equal to 60% of CA's median household income of $64,500. Ongoing customer support after installation will be provided at no additional cost by SFPES and by existing customer support services provided by the selected device manufacturer.

Essential to phase 3 is the linkage and integration of real-time smart thermostat device data streams to maximize the value and impact of the smart thermostat deployments for PCE. BSE will utilize the industry-leading GPT Solvryn Enterprise platform[4] to integrate the smart thermostat data with other valuable data streams available to PCE, including: real-time local weather station data, customer-level account data (i.e., Green Button interval meter data, monthly usage data, billing data, cost savings, etc.), and CAISO market data (i.e, locational marginal pricing data, congestion data, settlement data, etc.) to facilitate granular data analysis of opportunities and outcomes for PCE and participating customers.

Phase 4: Follow-up Customer Engagement (Month 17)
Phase 4 will distribute the second customer survey in order to gather qualitative and quantitative data on customer satisfaction and device interaction throughout the course of the pilot. Follow up Survey Data Collection Goals include evaluation of customer satisfaction, level of comfort, ease of use and ranking of the most valuable smart thermostat features. Resulting data will be used to evaluate pilot performance and to inform the identification of pilot outcomes and to develop recommendations for next steps.

Phase 5: Data analysis and Recommendations (Months 17-18)
Phase 5 will act to evaluate both qualitative and quantitative data established from the pilot. BSE will highlight the value and application of these integrated data streams, and how they can support expansion of the pilot over time to include further innovations such as: customized rate designs, automatic demand response (including possible participation in the CAISO Demand Response Auction Mechanism), and DER aggregation and control (aka, Virtual Power Plant technologies). Customer energy use profiles will be evaluated using granular load analysis and statistical regression to identify the resulting energy conservation, financial savings, and GHG reductions attributable to participating customers' smart thermostat usage. In addition peak load data will be used to formulate recommendations for continued pilot innovation resulting in a final pilot report designed to capture recommendations for innovative rate design, active load management, beneficial load-shaping, and automated demand response potential. For Group 1, the 100 PCE pilot participants who receive LIHEAP support, the deemed saving projections used in this report will be compared to real world energy use profiles to determine granular savings resulting from implementation of the pilot.

PCE IMPLEMENTATION REQUIREMENTS

BSE's goal is to establish a customer facing pilot that customers identify as a PCE branded program (aka, "white labeled"). Our goal as project manager is to facilitate the program transparently, in order to establish community trust and build PCE's brand recognition. For this reason PCE will be engaged with all customer interactions throughout all phases of the pilot project, but most heavily during the planning process structured into Phase 1.

Specific decision points and actions required from PCE include but are not limited to:

- Distribution of educational materials created by BSE through existing customer communication channels including newsletter, website, or call center.

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[4] For detailed information about the GPT Solvryn Enterprise platform and its capabilities, see: http://greenplanet.tech.

- Input into customer segmentation and enrollment ratios across priority population groups and heating and cooling system type for participation of 100 non-LIHEAP qualified community members.
- The release of twelve months of electric energy consumption data to support pre and post install savings analytics.
- Data access for the integration of smart thermostat device data with billing data and internal data management systems.

EVALUATION

Phase 5 of the project work plan is dedicated to program evaluation, including the creation of savings and cost effectiveness performance metrics (aka, key performance indicators, or KPI's) to gauge success of the pilot. 12 months of historical baseline energy usage will be compared to 12 months of energy use data after the smart thermostat device has been installed. The BSE team will use statistical regression to identify the variability and statistical significance of changes in energy use behavior and its impacts on energy conservation, bill savings, and GHG reductions. In addition, any installed LIHEAP measures performed by SFPES during installation visits will be recorded and reported to PCE.

This analysis will be used for final reporting purposes, as well as to inform program recommendations and next steps designed to create deeper energy savings and social and economic benefits for participating customers as well as to extrapolate the impacts possible from the program if scaled to include a wider customer base or expanded to include additional program design parameters (i.e., special rate designs, hot water heater integration, demand response incentives, fuel switching incentives, etc.).

METRICS AND ASSUMPTIONS

Savings Assumptions:

While our team is device brand agnostic we strongly recommend that as a result of the standards work provided by Energy Star any procured smart thermostat device is Energy Star certified. As a result, **the 8% minimum savings per year coefficient provided by Energy Star is applied to our electricity and gas savings calculations** (dependent upon customer heating system type) for the purposes of this proposal.

Our pilot survey to be implemented in Phase 1 of the pilot process will look to identify real world data on the ratio of gas to electric heating and cooling systems within the pilots targeted customer segment, at which point savings calculations will be updated.

Emission coefficients and CO2e conversions are built upon underlying inputs and coefficients provided by PCE in the *References for Calculating Energy Use Electricity Demand and GHG Emissions* attachment of this solicitation.

Baseline Energy Use Assumptions

Statewide averages provided by PCE in Attachment 12 of the grant packet are utilized to estimate baseline energy savings. A calculation model has been attached to provide the calculations, sources, and final savings estimates. BSE plans to update the model using PCE specific energy use data as part of Phase 1 of the pilot project.

Budget Assumptions:

A bulk pricing cost **of $140 is assumed per thermostat** is assumed. It is assumed that Energy Star certified Smart Thermostats are also eligible for up to **$50 in PG&E rebates per device** for which PCE customers are eligble as this pilot does not use CPUC administrated/ratepayer funds from Public Goods Charge funding sources. Under the pilot PCE will provide upfront funding to purchase the device and reimbursed directly from BSE who will facilitate rebates.

Dwelling Assessments can be scheduled and conducted by Central Coast Energy Services/SFPES to identify additional Health & Safety, and Energy Efficiency feasible measures. **Assessments leveraged with LIHEAP funds would be conducted at no cost to PCE**. **Assessments on sites not-qualified for LIHEAP funds can be completed at $75 per assessment visit**. Both options would include a Combustion Appliance Safety (CAS) test to identify any dwelling hazards before completing the direct measure install.

Smart Thermostat assessment and installations are assumed at $120 plus materials. Participant Group 1 consisting of 100 customers qualified for LIHEAP funding will receive financing using LIHEAP match funding. Participant Group 2 consisting of non-LIHEAP qualified participants will be installed using funds provided by the PCE grant. Call in "tech" support would be offered post installation at no added charge by SFPES.

<u>PARTNERS & QUALIFICATIONS</u>

Blue Strike Environmental – Project Manger

The BSE team has an impeccable record for calculating, tracking, and reporting a wide range of sustainability metrics in electricity consumption, fuel consumption, waste diversion, and greenhouse gas emissions. Working with sustainability metrics provides our CCA, local government, and utility clients with a concrete understanding of many state policies, regulations, and funding opportunities able to support their ongoing operations.

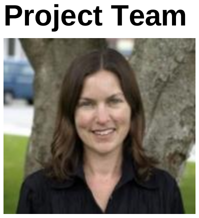
BSE co-chairs the Monterey Bay Regional Climate Action Compact, a network of 21 regional jurisdictions working collaboratively to reduce regional greenhouse gas emissions. Compact collaborations include Monterey Bay Community Power, Monterey Bay Electric Vehicle Alliance, and climate protection strategies for local cities and counties.

Most recently our team has acted senior project manager, consultant, and stakeholder engagement coordinator for East Bay Community Energy's (EBCE) Local Development Business Plan (LDBP) project. The resulting work products were the outcome of an extensive stakeholder engagement process. This approach was the first of its kind and allowed an unprecedented level of stakeholder engagement with the development of the plan. The public engagement process was then supported by comprehensive data driven analysis designed to align EBCE's local development goals with long term organizational stability and reliability.

The BSE team developed a robust integrated data platform using a comprehensive energy data management system (Solvryn Enterprise) that leveraged multiple years of AMI interval data along with historical weather data, CAISO market pricing data, county parcel data, portfolio and rate structure data, geospatial data, socio-economic data, and environmental indicators. This facilitated the development of targeted Demand Side Management and Distributed Energy Resource (DER) program design recommendations in the areas of Energy Storage, Energy Efficiency, Integrated Resource Planning, Risks and Mitigations, Procurement and Scheduling, Renewable Generation, Transportation and Building Electrification, Rate Design, and has evaluated the financial and community impact of DERs on EBCE's energy mix and cost of service. If awarded the Low-income Smart Thermostat Pilot will be facilitated with current staffing.

BSE is not a device manufacturer or smart thermostat device reseller. As a result we retain a product agnostic approach to device selection and deployment. Our device selection priorities are driven by the technological feature set, and user experience benefits that can result when deployed in targeted applications that meet CCA and end costumer needs.

Project Team

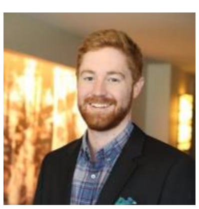


Kristin Cushman's, focus is to build climate action strategies that reduce GHG emissions, identify community priorities and create local resources. She helped coordinate the community outreach for East Bay Community Power to determine local renewable energy portfolio strategies. In 2010, she established the first state-wide carbon fund, Monterey Bay Carbon Fund, which has reduced 370 tons of greenhouse emissions to date. Kristin has extensive experience managing Council for Responsible Sport certification for PGA TOUR Events and marathons. Her value is combining an on-the-ground perspective with a top-down approach that can support the goals set by sponsors, promoters and venues. Kristin founded The Offset Project, a Monterey, CA nonprofit in 2007 to innovate local sustainable initiatives for the Monterey Bay, CA region using a grassroots approach. She is now launching Blue Strike Environmental with a new focus to implement sustainability standards and frameworks on a national level.

Chris Sentieri is Clean Energy, Climate Change and Sustainability policy consultant and program manager. Mr. Sentieri has extensive knowledge regarding Community Choice Aggregation and related local clean energy programming options and systems-level planning. His areas of expertise include distributed energy resource planning, microgrid technologies, GHG quantification and mitigation planning, stakeholder engagement, community organizing, and public policy development. He works to accelerate the transition to a more resilient & sustainable energy ecosystem by fostering market & policy solutions that pave the way for integrated, community-focused energy planning & rapid deployment of advanced clean energy infrastructure.

Chris led and managed the Association of Monterey Bay Area Governments (AMBAG) Energy and Climate Action Planning services for the Monterey Bay region, where he developed draft Energy Action Strategies and Greenhouse Gas (GHG) Inventories for all 21 jurisdictions in the tri- county AMBAG territory. Chris was instrumental in developing The Offset Project's (TOP) Monterey Bay Carbon Fund, which has resulted in innovative, local greenhouse gas reduction projects (including Solar PV installations at local schools). Chris has also led the development of TOP's Net Zero Energy Communities initiative, which is working to accelerate the transition to a more resilient and sustainable energy ecosystem by fostering market and policy solutions that pave the way for integrated, community-focused energy planning and rapid deployment of advanced clean energy infrastructure.

Most recently, Mr. Sentieri played a central role in the implementation of the East Bay Community Energy (EBCE) Local Development Business Plan (LDBP), developing the proposal and building the project team by leveraging his professional relationships and subject matter expertise. Chris is the Senior Project Manager for the LDBP project.



Sam Irvine has a proven record of assisting municipal utilities, CCAs, and local governments to achieve results on a range of strategic energy projects including energy efficiency, job creation, collaborative procurement, program finance, climate risk mitigation, electric vehicle programs, energy storage, and renewable energy planning. Most recently he was a lead contributing author on the development of East Bay Community Energy's Local Development Business Plan where he has evaluated the opportunities for creating competitive rates, local economic development, and virtual power plant aggregation designed to offset wholesale procurement and peaker plant usage. He also was lead technical writer on City of Boulder's Solar Action Plan where he quantified the impact of 20 procurement strategies designed to generate 175 MW of new local renewable energy generation projects by 2050.

Mr. Irvine has also created price forecasting and rate models to size battery storage technology for a Net Zero PG&E training center and the County of Alameda, has developed Title 24 building code compliance energy efficiency programs for the San Francisco Public Utilities

Commission and implemented a successful advocacy campaign to extend California's cap and trade program and state emission reduction goals through 2030.

San Francisco Peninsula Energy Services – Installation Partner
San Francisco Peninsula Energy Services will act as the Smart Thermostat Device installer throughout the pilot engagement. San Francisco Peninsula Energy Services (SFPES) is a complement of Central Coast Energy Services, sharing administration. From an office and a warehouse in San Francisco, Low Income Home Energy Assistance Program (LIHEAP) payment assistance and free weatherization services are provided to eligible low income households in the County of San Mateo and the City and County of San Francisco. In San Mateo County in 2017 SFPES provided 5169 households with $1,657,332.00 in payment assistance and weatherized 100 homes with the value of $179,771.

Partners in their payment assistance program include all of the San Mateo Emergency Safety Net Assistance Core Service Agencies and Salvation Army service centers. With weatherization service, 51 health and safety and energy measures may be installed after and eligible dwelling is assessed. These measures run from Combustion Appliance Safety Checks and heater and water heater replacements to carbon monoxide alarms and duct testing and repair.

SFPES crews are dispatched from their warehouse near Bayshore and Industrial near 280/101 and have over 50 combined years' experience in measure installation. They have excellent support in use of the best safety practices and are paid high wages with insurance benefits. Of the ten total staff of SFPES, three currently reside in San Mateo County, five in San Francisco, one in Alameda, and one in Stanislaus.

Dennis Osmer serves as Executive Director of Central Coast Energy Services, which administrates SFPES. He has led the organization in helping those in need meet home health and safety and energy efficiency needs since the nonprofit was incorporated 14 years ago. As part of his statewide work, he developed a service software currently used by 32 energy agencies and state that helps manage and streamline service delivery. ServTraq© software is an enterprise that supports the mission of CCES. The team that works with him also provides service as San Francisco Peninsula Energy Services in the City and County of San Francisco and HERS rating services through 831 Conserve. Dennis is committed to realizing equity in access to energy efficiency opportunities and measures for low income people in California.

He was elected to 2 terms on the City Council and was Mayor of Watsonville in 1998. He served on the Board of Directors of the Paro Valley Water Management Agency and the Santa Cruz County Planning Commission. He is currently a member of the Board of Directors of Bay Federal Credit Union and the Monterey Bay Community Power Community Advisory Committee.

APPENDIX

LIHEAP Measure list

LIHEAP Measure Name	
Dwelling Assessment	Glass Replacement and Window Repair
Energy Audit	Hot Water Flow Restrictor
Combustion Appliance Safety Test	LED Replacement Bulbs
Blower Door Test	LED Night Lights
Duct Leakage Test	Mechanical Ventilation
HERS Rater	Kneewall Insulation
Contractor Post-Weatherization Inspection	Microwave Oven
Carbon Monoxide Alarm	Minor Envelope Repair
Smoke Alarm	Limited Home Repair
Cooking Appliance Repair or Replacement, Range or Cook Top	Occupancy Sensors
Cooling Repair or Replacement	Power Strips
Heating Source Repair or Replacement	Refrigerator Replacement
Kitchen Exhaust Installation, Repair and Replacement	Smart Thermostat
Water Heater Repair or Replacement	Thermostat
CVA - CVA Venting Repair/Addition	Vent Cover, Interior
Attic Ventilation	Water Heater Blanket
Caulking	Water Heater Pipe Wrap
Ceiling Insulation	Weatherstripping
Compact Fluorescent Lamps	Window Replacement
Cover Plate Gaskets	Low Flow Toilet
Doors, Exterior (All Other Types)	Ceiling Fans
Sliding Glass Door	Exterior Water Pipe Wrap
Duct Insulation, Repair and Replacement	Floor Foundation Venting
Furnace Filter Replacement	Floor Insulation
Fluorescent Torchiere Lamp Replacement	Mechanical Ventilation

Blue Strike Envioronmental
CARE-Free Low Income Smart Thermostat Pilot
8/1/18
Community Pilots

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	Requested from PCE	$75,000	**$75,000**	39%	Requested
Income #2	PG&E Rebate *(Match funding)*	$10,000	**$10,000**	5%	Estimated
Income #3	LIHEAP assesment and smart thermostat device Installation Cost Match for 100 homes *(Match funding)*	$19,500	**$19,500**	10%	Pledged
Income #4	LIHEAP measure instalation *(match)*	$89,885	**$89,885**	46%	Pledged
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$194,385**	**$194,385**		

REVENUE SUMMARY		
Total Requested	**$75,000**	39%
Total Pledged	**$109,385**	56%
Total Received	**$0**	0%
Total Estimated	**$10,000**	5%
TOTAL PROPOSAL REVENUE	**$194,385**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Smart Thermostat device purchase *(post rebate)*	$ 18,000	**$18,000**	24%	10
Expense #2	Smart Thermostat device combatability assessment & instalation *(for 100 non-LIHEAP qualified homes)*	$ 19,500	**$19,500**	26%	
Expense #3	Installation materials specific to thermostat installation	$ 500	**$500**	1%	
Expense #4	Project Management	$ 8,000	**$8,000**	11%	
Expense #5	Participant engagement video, participant engagement documents, marketing and outreach materials	$ 7,500	**$7,500**	10%	
Expense #6	Customer engagement surveys	$ 4,000	**$4,000**	5%	
Expense #7	Data integration, validation, and analysis	$ 10,000	**$10,000**	13%	
Expense #8	Mid term report, final report, and final strategic recommendations	$ 7,500	**$7,500**	10%	
Expense #9	n/a		**$0**	0%	
Expense #10	n/a		**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$75,000**	**$75,000**	**100%**	

Net Income - Expenses	**119,385**	**119,385**

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

INPUTS		Unit	Description	Source
	200	Number of participants	Pilot Input	
	8%	Percent electricity savings	Savings from smart thermostat	Energy Star
	8%	Percent Therms Savings	Savings from smart thermostat	Energy Star
	0.000064528	metric tons/kWh	PCE Eco Plus Emisison Coefficient	[1] Peninsula Clean Energy staff estimates for 2017 EcoPlus service.
	0.0053	metric tons/therm	metric tons/therm	California Air Resources Board staff calculations.
$	0.15	dollars	Average statewide residntial cost per kWh	U.S. Energy Information Administration (EIA) 2012 summaries, tables 6 through 10. http://www.eia.gov/electricity/sales_revenue_price/.
	$0.96	Dollars	Cost per therm state average	[1] U.S. Energy Information Administration, www.eia.gov/dnav/ng/ng_pri_sum_dcu_SCA_a.htm
$	140.00	Dollars	Price per Theromostat	https://marketplace.pge.com/thermostats/
$	195.00	Dollars	Price per asesment and install	
	50%	Percent	percent direct install support	
$	50.00	Dollars	Rebate	https://marketplace.pge.com/thermostats/

Coefficients

90647	GWh/Yr	Total california residential energy use	References for calculating energy end-use, electricity demand, and ghg emissions
12345233	homes	Number of homes surveyed	References for calculating energy end-use, electricity demand, and ghg emissions
0.007342672	GWh/Yr/home	Energy use per home per year in GWh	References for calculating energy end-use, electricity demand, and ghg emissions
7342.672269	KWh/yr/home	Energy use per home per year in KWh	References for calculating energy end-use, electricity demand, and ghg emissions
0.473807956	Tons Co2e/home/yr	Tons Co2e per year per household for all electric use	References for calculating energy end-use, electricity demand, and ghg emissions
2228	Million Therms/year	Statewide Gas space heating	References for calculating energy end-use, electricity demand, and ghg emissions
52	Million Therms/year	Statewide Gas Air Conditioning	References for calculating energy end-use, electricity demand, and ghg emissions
3662	GWh/Yr	Statewide Electric Space heating	References for calculating energy end-use, electricity demand, and ghg emissions
7252	GWH/yr	Statewide Electric Air Conditioning	References for calculating energy end-use, electricity demand, and ghg emissions
180.47452	**Therms/yr/home**	**Gas space heating per home per year**	References for calculating energy end-use, electricity demand, and ghg emissions
4.212152172	Therms/yr/home	gas air conditioning per home per year	References for calculating energy end-use, electricity demand, and ghg emissions
296.6327165	KWh/yr/home	electric space heating per home per year	References for calculating energy end-use, electricity demand, and ghg emissions
587.4332222	KWh/yr/home	electric AC per home per year	References for calculating energy end-use, electricity demand, and ghg emissions
0.956514956	**Tons Co2e/home/yr**	**Tons co2e per year per home from Gas Space Heating**	References for calculating energy end-use, electricity demand, and ghg emissions
0.022324407	Tons Co2e/home/yr	Tons co2e per year per home from Gas Air Conditioning	References for calculating energy end-use, electricity demand, and ghg emissions
0.019141116	Tons Co2e/home/yr	Tons co2e per year per home from electric Space Heating	References for calculating energy end-use, electricity demand, and ghg emissions
0.037905891	Tons Co2e/home/yr	Tons co2e per year per home from electric air conditioning	References for calculating energy end-use, electricity demand, and ghg emissions

Total Pilot Hard Costs

$	18,000.00	Dollars	Device costs Less rebate
$	19,500.00	Dollars	Install Costs
$	**37,500.00**	Dollars	**Total Costs**

Viable Energy Savings Per Household Per Year and at Pilot Scale (Therms or KWh)			
Customer Sub-Segment	**Baseline Electric use**	**Savings per household**	**Savings @ 200 participants**
Customer with Gas Cooling (Therms)	4.2	0.336	67.2
Customer with Gas Heating Systems (Therms)	180.5	14.44	2888
Customer with Electric Cooling (KWh)	587.4	46.992	9398.4
Customer with Electric Heating (KWh)	296.6	23.728	4745.6

Viable GHG Savings Per Household Per Year and at Pilot Scale (Tons Co2e)			
Customer Sub-Segment	**Baseline GHG Tons Co2e**	**Savings per household**	**Savings @ 200 participants**
Customer with Gas Cooling	0.022	0.002	0.357
Customer with Gas Heating Systems	0.957	0.077	15.304
Customer with Electric Cooling	0.038	0.003	0.606
Customer with Electric Heating	0.019	0.002	0.306

Viable Bill Savings Per Household Per Year and at Pilot Scale (Dollars)			
Customer Sub-Segment	**Baseline Bill**	**Bill Savings**	**Savings @ 200 participants**
Customer with Gas Cooling	$4.04	$0.32	$64.51
Customer with Gas Heating Systems	$173.26	$13.86	$2,772.48
Customer with Electric Cooling	$88.11	$7.05	$1,409.76
Customer with Electric Heating	$44.49	$3.56	$711.84

blue strike environmental

Peninsula Clean Energy (PCE)
2075 Woodside Rd.
Redwood City, CA 94061

August 2, 2018

Dear PCE,

Blue Strike Environmental is thrilled to provide our proposal for the Low-Income Smart Thermostat Pilot. It's our hope that from the proposal you will find that we have the qualifications, work-plan, and passion needed to bring energy savings and rate protection through the provision of free smart thermostat devices to disadvantaged community members and priority populations. Once installed smart thermostat devices can create immediate energy, GHG, and bill savings while providing enhanced comfort and energy to low-income community members.

By partnering with San Francisco -Peninsula Energy Services, a local installation partner that currently administrates the Low-Income Home Energy Assistance Program (LIHEAP) we are able to provide free smart device installation and simultaneous assessment and installation of energy efficiency measures including weatherization, and appliance upgrades for up to 100 PCE customers earning less than or equal to 60% of California's median household income. This will result in up to $194,385 in match funding and additional GHG and bill savings resulting from qualified measure installation.

We look forward to hearing from your team and the opportunity to offer an impactful program able to bring innovative means of saving energy to San Mateo County.

Sincerely,

Kristin Cushman, CEO

Blue Strike Environmental
126 Bonifacio Pl. Ste. G
Monterey, CA 93940
Phone: 831.277.0167

Central Coast Energy Services
PO BOX 2707
Watsonville, Ca. 95077
(831) 761-7080
www.EnergyServices.org

San Francisco – Peninsula Energy Services
1426 Fillmore St, Suite #318
San Francisco, Ca. 94115
(415) 749-5600
www.SFPES.org

August 1st, 2018

Dear Peninsula Clean Energy Community Pilot Program Team,

I am writing to indicate full support of Blue Strike Environmental's proposal for the Low Income Smart Thermostat Pilot and to indicate San Francisco Peninsula Energy Services' (SFPES) ability to support the installation of up to 200 Smart Thermostat Devices with in-person home installation, set up, and customer device use training.

Our team is qualified by our ongoing management and implementation of the federal Low Income Home Energy Assistance Program (LIHEAP) program within San Mateo County. As well as by our implementation of PG&E's Refrigerator Replacement and CARE Outreach programs.

SFPES is able to provide matching funds to cover these installation costs through funding sourced from our administration of the LIHEAP Utility Payment Assistance and Weatherization Assistance Program for 100 PCE customers qualified by a household income at or below 60% of California's median household income of $64,500[1]. SFPES is able to provide our records of low income households within San Mateo County to support the identification of qualified pilot participations.

We look forward to engaging with your team and to the opportunities to promote community benefits paired with energy and GHG savings through the implementation of the Low Income Smart Thermostat Pilot.

Sincerely,

Dennis Osmer

Executive Director

[1] US Census Bureau, 2016 CA Household Median Income Adjusted for 2018 Inflation. Retrieved from: https://www.census.gov/quickfacts/fact/table/ca/PST045217

BRIGHT ENERGY 101™
ENERGY EFFICIENCY & RENEWABLE ENERGY

August 3, 2018

Dear PCE Leadership,

As the founders of Bright Energy 101 (BE101), we are thrilled to submit a proposal for PCE's Community Pilot Grant Program. We founded BE101 to create and drive paths toward a clean energy economy, while providing exciting opportunities for youth to shape those paths. We are 100% focused on delivering energy management software and services to public schools. We are committed to driving our economy towards Deep Decarbonization, while meeting the increasing demands to innovate in Science, Technology, Engineering and Math (STEM) education in our communities.

There is a clear overlap between our mission and the mission and strategic goals of PCE. If selected by PCE, we will provide a great opportunity for PCE to advance its mission for a relatively modest investment. As detailed in our project narrative, the Bright Energy 101 Program is an opportunity to expand the PCE team's reach in achieving your strategic goals:

- Deep Decarbonization of public schools in San Mateo County, aiming to accelerate GHG emissions at schools to 80% reduction by 2030.
- Demonstrating the technical and economic efficacy of dramatic reductions in GHG emissions, and positioning for the support and advocacy of supporting public policy in California, especially for 'clean electrification' of building heating loads.
- Establishing the great community benefit in advancing STEM education, and aiming students towards colleges and careers in STEM fields with great experience in clean technology.

Here is information requested in this cover page:

- Project Name: **Deep Decarbonization of San Mateo County Schools**
- Applicant organization: **Bright Energy 101**
- Key partner: **U.C. Davis Energy & Environment Institute** (contact: Ben Finkelor, Executive Director)
- Point of contact: **William T. Kelly,** Chief Executive Officer, Bright Energy 101
  510-504-0469, bill.kelly@brightenergy101.com

We greatly appreciate your consideration of our grant proposal, and look forward to working with you, and supporting PCE's great mission.

Sincerely,

William Kelly & Stelli Munnis
Bright Energy 101, Inc.

PCE Grant Proposal

Contents

BRIGHT ENERGY 101™
ENERGY EFFICIENCY & RENEWABLE ENERGY

1. DESCRIPTION OF PROJECT: Deep De-Carbonization for San Mateo County Schools

We are excited to submit a proposal for the PCE Community Pilot Program to fund key components of a BE101's Comprehensive Energy and Environmental Program (Program) for public schools in San Mateo County. This section of the grant proposal focuses on answering two questions: 1) Why is BE101 requesting funding from PCE?, and 2) What will be provided by the BE101 Program if grant funding is secured?

***Why is BE101 requesting funding from PCE*?** Our Program will help public schools in San Mateo County meet these critical goals: bettering the **Environment**, improving **STEM Education** and achieving **Operational Cost Savings**, all of which overlap with PCE's Mission and Strategic Goals.

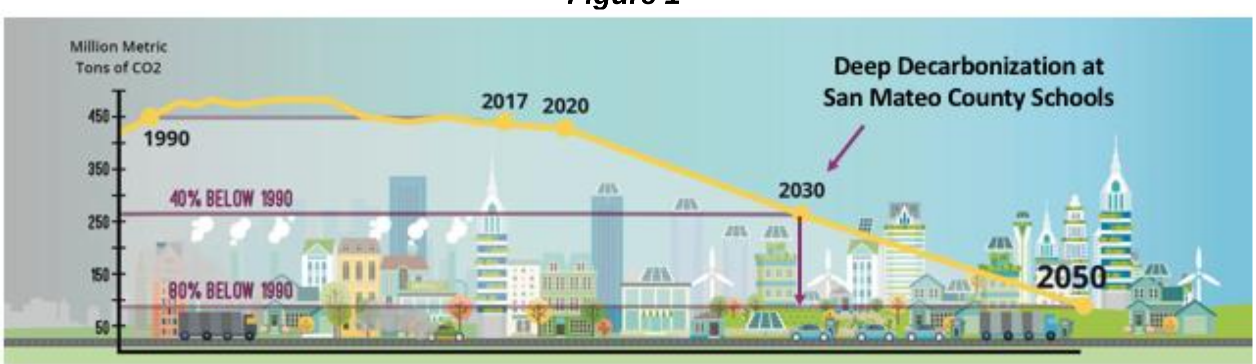
Environment. A motivating force behind our Program is the pressing need to reduce global greenhouse gas (GHG) emissions. California is playing an inspirational role in leading the world towards a future with dramatically lowered GHG emissions. The California public policy guiding this leadership, established in 2006, is the California Global Warming Solutions Act (AB 32). Using 1990 as the baseline, AB 32 set forth these reductions in California's GHG emissions: 0% by 2020, 40% by 2030, and 80% by 2050.

Figure 1 illustrates this path using data from the California Air Resources Board (CARB). Certain countries, environmental groups and research groups characterize this drastic GHG reduction as 'Deep Decarbonization', which is the name we have adopted to illustrate the pathway BE101 is promoting, and is included in the name of our grant proposal to PCE.

The BE101 Program will create and implement a path for public school districts to achieve an 80% reduction in GHGs by 2030. The reason we are advocating for an accelerated reduction for public schools in California is

- It is technically and economically feasible, with the lighting, HVAC and solar electric systems available to schools to meet an accelerated timeline for GHG emissions reduction.
- Although additional public policy support will be necessary, including incentives for clean electrification, there is momentum and support for establishing these policies.
- In this manner, schools become a model, proving the efficacy of the Deep Decarbonization pathway.

Figure 1



Meeting California's GHG Reduction Goals *(Source: California Air Resources Board [CARB])*

To achieve Deep Decarbonization, schools will be required to increase levels of energy efficiency; convert fossil fuel heating loads and transportation to electricity; and transition their electricity supply to renewables. The electric service provided by PCE will play an absolutely critical role in achieving these Deep Decarbonization goals.

Essential to achieving Deep Decarbonization is the technical and economic viability of implementing efficiency measures, electrification measures and renewable electricity. The BE101 Program leverages the public policy and technical research supported by the California Energy Commission, U.C. Davis Energy & Efficiency Institute and the Natural Resources Defense Council (NRDC) to ensure goals for the public schools are realistic and achievable.

STEM Education. BE101's Program also addresses the need to advance STEM (science, technology, engineering and math) in primary and secondary education, readying students for college and careers. In California, public schools are implementing Career Technology Education (CTE), a program of study that integrates core academic knowledge with technical and occupational knowledge, providing students with a pathway to postsecondary education and careers. Important to the success of CTE programs is partnerships with business to provide students work based learning opportunities. This professional exposure provides students motivation to succeed and excel in STEM studies, as they recognize the importance and application of their schoolwork. Figure 2 provides illustrations from the U.S. Department of Education's STEM 2026, A Vision for Innovation in STEM Education.

Figure 2

U.S. Department of Education: STEM 2026 | A Vision for Innovation in STEM Education

The BE101 Program is to be implemented in collaboration with a high school STEM academy, ideally an Engineering Academy such as those supported by Project Lead the Way. Fortunately, environment, health and facilities is a focus area of these high school engineering academies. We train, and hire as interns, students from these academies. Our collaboration with high school academies is a tremendous advantage to schools, providing exciting work based learning experiences for their students. Public school districts clearly recognize the opportunity to innovate in STEM education presented with the BE101 Program.

Operational Cost Savings. Critical to the adoption and sustenance of the BE101 Program is delivering a net savings to school districts' operating expenditures. In essence, all elements described as included in the Program will need to more than pay for themselves. The great news is that technological progress in lighting, HVAC and controls continue to advance. Energy management software, energy efficiency technologies, electrification technologies and renewable energy generate considerable savings when effectively designed and implemented.

A key element of the savings delivered by the BE101 Program is energy conservation savings, which is facilitated by BE101 software, in combination with the work of the student interns.

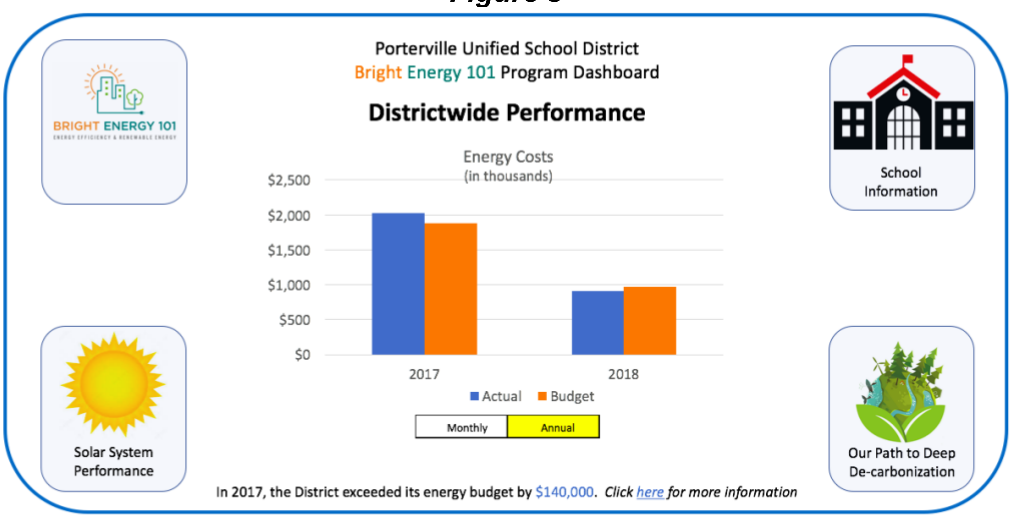
What is provided with the BE 101 Program? The BE101 Program is a 10-year program. With this proposal, we are requesting funding from PCE to fund the (1) software and (2) internship elements of the program for the first 18-months, described below, for a pilot high school. The subsequent years of the Program would be funded and paid from operational savings. The Program will be implemented at a single high school in San Mateo County, and includes the following integrated elements:

1. **BE101 Energy Intelligence Software** will be provided, with a tracker driving customers to 80% GHG reductions by 2030.

   The BE101 Software is to be installed by January 1, 2019, with eighteen months of service provided through June 30, 2020 for the pilot school with funding provided by PCE through the proposal. The BE101 Software will provide the school these valuable capabilities:

   (a) ***Financial Energy Management***. Commercial customers in California are faced with increasing complexity in managing energy costs, especially as they implement investments in renewable energy, energy efficiency and the electrification of vehicles and heating loads. Electric rates are changing significantly as the grid transitions to renewable resources.

Figure 3



The BE101 software will greatly simplify managing the district's energy budget, and provide clear reporting and tracking of actual versus budget energy costs, on a monthly and an annual basis. The reporting includes natural gas and electric accounts. Financial performance can be provided at a district level, and a site by site basis. The tracking of costs for each school will use a rate engine which captures all Peninsula Clean Energy's Commercial Rates, including options for ECOplus or ECO100.

(b) **Environmental Energy Management**. The BE101 Software environmental management features are focused on GHG emissions. In setting up the software, using historical data from the district, PG&E and the California Energy Commission (CEC), BE101 will estimate and establish a 1990 GHG emissions baseline from which a path towards 80% reduction by 2030 will be developed and tracked.

(c) **Measurement & Verification**. The BE101 Software will track the performance of energy efficiency (EE), Renewable Energy (RE) Investments completed. It is critical to the continued investment in EE and RE projects that the projected savings are realized, and the investment performance is clearly reported back to the district management and its governing board.

2. Included will be a **High School Internship Program** established in collaboration with the pilot high school's STEM education program. The internship program will include hiring three (3) students each academic year. Working in collaboration with the engineering team at BE101, the internship program includes the following elements:

(a) **Training**. The student interns will be trained in facility auditing and energy modeling at the outset of their internship. We will train in using the tools developed by UC Davis' Energy & Environment Institute in collaboration with the California Conservation Corps. Through funding provided by the CEC, these auditing and modeling tools have been successfully used at over 1,300 California K-12 public schools.

(b) **Facility Auditing**. Under the supervision of a professional engineer, students will participate in the performance of ASHRAE compliant whole building energy audit for the school. This survey provides on-site collection of data for building envelope, lighting, heating, ventilation, air conditioning, plug loads and energy management systems.

(c) **Energy Modeling**. Using the data collected in the facility audit, the students will develop an energy model for the school using DOE2 and eQuest. This will provide an hourly profile of the electrical and natural gas usage for the school.

(d) **Gap Analysis**. Once the 'model' energy consumption for the school is completed, that data is then compared to the 'actual' energy consumption as provided by the FEEMS. The 'gap' between model and actual is then analyzed, and the model is tuned to match actual. Typically, the initial model predicts lower consumption than the actual, as energy consuming equipment is often operating out of specification or out of schedule. The gap analysis, and model tuning provides critical information in developing the Conservation Plan and EE measures.

(e) **Establishing and Implementing an Energy Conservation Plan**. Once the audit, model and gap analysis are complete, the student team develops an energy conservation plan for the school. For clarity, conservation is defined in the Program as an operational or behavioral change achieved at no cost to the school, beyond minimal staff time. Once the energy conservation measures are identified and an implementation plan agreed upon with the school facility staff, the student team oversees its implementation. The development and implementation of the conservation plan provide the students opportunities to develop their non-technical skills, as their success will requires effectively marketing, communicating and 'selling' their plan to key stakeholders at the school and district. Sustained energy conservation programs in K-12 schools save, on average, between 5 and 15% of energy consumption. The Alliance to Save Energy's PowerSave Schools program has had extensive experience working with students on conservation plans, providing a good reference for the savings potential, and other benefits for schools.

(f) **Recommending EE, RE and Electrification Measures**. Once the energy conservation plan is in place, in close collaboration with BE101 engineers, the student team develops a list of potential energy efficiency, renewable energy and electrification measures. These are implemented in the next phase, and third element of the BE101 program.

The grant funding requested of PCE will pay for Program elements described above.

3. With the BE101 Software operational, and the energy conservation plans in place at the school through the internship program, **Implementation of Energy Efficiency, Renewable Energy and Clean Electrification Measures** commence. These are expected to begin approximately twelve (12) months after the start of the Program, with projects being implemented each year of the Program, starting with the highest priority measures. Though NO FUNDING IS REQUESTED for this element of the Program, the additional savings achieved through these measures is made possible, and the foundation set, by the funding provided from the grant for the BE101 Software and High School Internship Program.

   Though not funded by the grant, the implementation of EE, RE and Clean Electrification are key elements of the Program, which are elaborated upon briefly here.

   The ***EE strategy*** will be a comprehensive approach, lowering HVAC load through envelope improvements, then installing efficient lighting and HVAC systems. We will leverage the technology advancement in HVAC and lighting controls towards cost effective modular units, which will provide customized sizing for the classroom, and individualized lighting and HVAC controls, with 'cloud based' master scheduling and set-point control. The goal of the Program is to improve the energy efficiency of the school by 27.5% over the 10-year program, an average of 2.75% per year.

   The ***RE strategy*** is expected to be the deployment of PV solar systems, or potentially collaborating with PCE for off-site solar installations within PCE service territory. The goal of the Program is to install 1,420 kW of PV solar over the 10-year program, an average of 142 kW per year.

   The ***Clean Electrification strategy*** will focus on converting space and hot water heating loads to high efficiency heat pump technology. The clean electrification measures will be implemented together with the EE HVAC measures at the school. The Program goals is to electrify 80% of the natural gas loads at the school by 2030. We will also investigate electrification of the district's transportation fleet.

2. OUTCOMES

a) **Accelerates GHG reductions and renewables**. A key objective of the BE101 Program is to accelerate GHG emissions reductions above and beyond the path established in California's Global Warming Solutions Act (AB 32), and achieving 80% GHG emissions by 2030 (as compared with 80% reduction by 2050 in AB 32). As a starting point for discussions with PCE, we propose the baseline year for emissions from electricity and natural gas for San Mateo County schools to be the year 2017. The table below summarizes the potential GHG CO2 reductions achieved by 2030, 10 years after implementation of the Program at a single high school in San Mateo County, assuming the high school has approximately 1,800 students and a 250,000 square foot facility. The potential of the Program, assuming the the total addressable market is all public schools in San Mateo County, is provided in Section 7 of this proposal.

Table 1
Project GHG Reductions, Electric & Natural Gas Savings

Item	Baseline	2030	Savings[(3)]	
kWh	1,606,410	1,360,079	246,331	15.3%
CO2 lbs per kWh[(1)]	0.588	0.133		
CO2 Emissions Electricity (lbs)	944,569	180,852	763,718	80.9%
Therms	34,454	7,580		
CO2 lbs per Therm[(2)]	11.7	11.7		
CO2 Emissions Natural Gas (lbs)	403,110	88,684		
Total CO2 Emissions (lbs) (metric tons)	**1,347,679** **611.3**	**269,536** **122.3**	**1,078,143** **489.0**	**80.0%**

Table 1 Notes:

(1) California Energy Commission Staff estimates of statewide average for Baseline. The CO2 emissions rate (lbs per kWh) in 2030 are the maximum value, which cannot be exceeded to meet the 80% reduction target. Given that PCE estimates its current EcoPlus service at 0.142 lbs per kWh, the target appears easily achievable with PCE service.

(2) California Air Resources Board staff calculations.

(3) The electric efficiency kWh savings is partially offset by incremental increase in electric usage with the electrification of heating loads.

In addition to the potential to reduce of CO2 emissions by approximately 1.1 million lbs., the Program will include the installation of approximately 300 kW of solar PV capacity, supporting PCE's goal of 20 MW of locally installed renewable energy.

b) **Delivers community benefits.** In addition to the impressive environmental benefits, measured by GHG reductions, the BE101 Program provides benefits to the community's public education program as detailed in the prior section. These benefits include advancing the STEM education programs in San Mateo County and reducing operational expenditures.

c) **Supports PCE's load serving needs**. A key aspect of the Program is BE101's Energy Intelligence Software. This will support PCE's customers in establishing strategies to better manage their electrical usage profiles, and encourage investments to better their profile to meet PCE's supply and demand constraints and opportunities. BE101 will work closely with PCE and the school to shape its energy efficiency, renewable energy and clean electrification measures to optimize those measures in consideration of PCE's Integrated Resource Plan.

d) **Additional Benefits**. BE101, a startup Public Benefit Corporation, is focused on advancing the clean energy economy. The energy intelligence software and internship program is designed to scale to serve all public education customers. Funding this grant proposal therefore is an opportunity to keep San Mateo on the forefront of innovation, and develop a program with a local school scalable to all education customers in PCE service territory.

Additionally, as a catalyst for achieving the Deep Decarbonization goals, the BE101 Program will identify and leverage incentives available from the State aimed at encouraging innovative programs in energy and education. The incentives for these energy programs are typically administered by the CPUC or the CEC. These programs are often preceded by State legislation, which we monitor. Examples of recently proposed California legislation that could provide incentives for advancing the Deep Decarbonization program include:

- AB 3001 (Bonta): Remove barriers to building de-carbonization. Press Release: https://a18.asmdc.org/press-releases/20180216-bonta-introduces-california-zero-emissions-buildings-act-harness-clean
- AB 3232 (Friedman): Set goals to reduce GHG emissions in the building sector by half by 2030, and that all new buildings will be zero emissions by 2030. Co-authors include Senators Allen and Stern and Assemblymembers Chiu, Stone and Bloom. Info Link: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB3232
- SB 1477 (Stern): Funding for zero-emissions buildings market transformation. Legislative Info Link: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1477

4. PCE IMPLEMENTATION REQUIREMENTS.

The support we would be requesting of PCE's, beyond contract administration, will be:

- Supporting the **establishment of a GHG baseline** for the pilot high school, and reviewing and approving the methodology for measuring and verifying (M&V) the school's actual GHG emissions during the 10-year Program implementation. We are expecting that the baseline and M&V are consistent with the California Energy Commission and California Air Resource Board's implementation of AB 32.
- Advance **electrification of school transportation fleet**, and helping the pilot school district identify and implement opportunities to cost effectively convert its buses and light duty vehicles to electric powered.
- Collaborate with BE101, and our public school customers, to **advance California public policy** with incentive programs, particularly targeted towards Clean Electrification. BE101 expects that such policies are needed, especially in converting natural gas loads in buildings to electricity, to achieve the targets in our Program.
- After success of the pilot, support BE101 in **marketing Program to public school districts** throughout the County.

5. QUALIFICATIONS

Bright Energy 101 is a Public Benefit Corporation, founded in May 2018 by Stelli Munnis and Bill Kelly. The mission of BE101 is to create and drive paths toward a clean energy economy, and provide exciting opportunities for youth to shape those paths.

Stelli and Bill decided to launch Bright Energy 101 because of these compelling reasons:

- **Environment**: To drive our economy towards Deep De-Carbonization
- **Education**: To meet increasing demands to innovate in STEM education in schools
- **Customer Demand**: To provide better energy management tools for schools

Prior to founding BE101, Stelli and Bill worked together for ten (10) years at a leading solar manufacturer, SunPower Corporation. At SunPower, Stelli and Bill developed innovative products and services for public school districts, and helped launch and implement its STEM Education program for public schools, SunPower Horizons, now serving over 50 school districts in California. In addition to their experience collaborating, Stelli and Bill bring their personal experience, know-how and passion to advance BE101's mission:

Bill Kelly, cofounder of Bright Energy 101, is a professional engineer with 25-years' experience working in energy efficiency, renewable energy and energy management. Bill has a mechanical engineering degree from Stanford University. Bill is passionate about protecting the environment and has dedicated his career towards ensuring environmental protection goes hand in glove with growing our economy and creating great jobs.

Stelli Munnis, cofounder of Bright Energy 101, has over 20 years' experience growing companies, ten of which have been focused on advancing the clean energy economy. Stelli has a Ph.D. in psychology from Sofia University. She is passionate about developing programs that advance energy sustainability and public health, and that strengthen communities.

In order to accelerate the BE101 Program, to position ourselves to scale rapidly and meet our vision to have our Program available to public school districts throughout the U.S., BE101 has partnered with the **U.C. Davis Energy & Efficiency Institute** (EEI). The EEI at UC Davis is a leading university institution advancing impactful energy and energy efficiency solutions. We focus on addressing critical energy challenges and improving energy use through research, education, and engagement. The EEI is home to innovative research centers and programs in buildings and transportation to support our recommendation to schools towards high efficiency lighting, HVAC and clean electrification.

6. EVALUATION.

BE101 is providing measurement and verification (M&V) of GHG emissions reductions through our Energy Intelligence Software. To establish the baseline and actual GHG reduction, we will align with the standards established by the California Energy Commission and California Air Resources Board.

7. METRICS AND ASSUMPTIONS.

We are requesting funding to complete a pilot Program at a single high school in San Mateo County. The estimates of GHG emissions reductions, electrical, and natural gas savings are provided in Table 1, with notes below on the assumptions behind those estimates. Assuming success with the pilot program, the potential of the Program, assuming the the total addressable market is all public schools in San Mateo County, is provided below in Table 2.

Table 2
Program Potential Across Total Addressable Market
GHG Reductions, Electric & Natural Gas Savings

Item	**Baseline**	**2030**	**Savings(3)**	
kWh	85,812,812	72,654,057	13,158,755	15.3%
CO2 lbs per kWh(1)	0.588	0.133		
CO2 Emissions Electricity (lbs)	50,457,934	9,660,912	40,797,021	80.9%
Therms	1,840,489	404,908		
CO2 lbs per Therm(2)	11.7	11.7		
CO2 Emissions Natural Gas (lbs)	21,533,724	4,737,419		
Total CO2 Emissions (lbs)	**71,991,658**	**14,398,332**	**57,593,327**	**80.0%**

Notes: See notes below Table 1.

BRIGHT ENERGY 101, INC.
DEEP DECARBONIZATION OF SAN MATEO COUNTY SCHOOLS
3-Aug-18
Community Pilots

		YEAR 1	TOTAL		STATUS*
REVENUE SOURCE	SOURCE				
Income #1	Requested from PCE		$64,952	79%	Requested
Income #2	BE101 Investment (for work performed by UCD EEI)		$17,500	21%	
	Total	$0	$82,452		

REVENUE SUMMARY		
Total Requested	$64,952	79%
Total Pledged	$0	0%
Total Received	$17,500	21%
Total Estimated	$0	0%
TOTAL PROPOSAL REVENUE	$82,452	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Software Development		$31,528	38%	N/A
Expense #2	High School Internship Program		$33,424	41%	
Expense #3	UC Davis Energy & Efficiency Institute Technical Support		$17,500	21%	
TOTAL PROPOSAL EXPENSES		$0	$82,452	100%	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description. (SEE WORKSHEETS IN THIS EXCEL FILE WITH REQUESTED DETAILS)

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Column	(1)	(2)	(3)	(4)	
	Expenses				
Month	Development Subcontractor	Metering API Service	Salaries & OH	Misc. Expenses	TOTAL
Jan-19	$5,600.00	$36.00	$4,376.40	$117.72	$10,130.12
Feb-19	$5,600.00	$0.00	$4,376.40	$117.72	$10,094.12
Mar-19	$5,600.00	$48.00	$4,376.40	$117.72	$10,142.12
Apr-19	$0.00	$48.00	$0.00	$29.43	$77.43
May-19	$0.00	$48.00	$0.00	$29.43	$77.43
Jun-19	$0.00	$48.00	$0.00	$29.43	$77.43
Jul-19	$0.00	$48.00	$0.00	$29.43	$77.43
Aug-19	$0.00	$48.00	$0.00	$29.43	$77.43
Sep-19	$0.00	$48.00	$0.00	$29.43	$77.43
Oct-19	$0.00	$48.00	$0.00	$29.43	$77.43
Nov-19	$0.00	$48.00	$0.00	$29.43	$77.43
Dec-19	$0.00	$48.00	$0.00	$29.43	$77.43
Jan-20	$0.00	$48.00	$0.00	$29.43	$77.43
Feb-20	$0.00	$48.00	$0.00	$29.43	$77.43
Mar-20	$0.00	$48.00	$0.00	$29.43	$77.43
Apr-20	$0.00	$48.00	$0.00	$29.43	$77.43
May-20	$0.00	$48.00	$0.00	$29.43	$77.43
Jun-20	$0.00	$48.00	$0.00	$29.43	$77.43
					$31,527.81

Software Developer Billng Rate (per hour)	$140
Annual Salaries	
Product Development Manager	$125,040
Overhead rate on BE101 Staff	40%

Notes by column
(1) Assumes 40 hours per month for the first three months of the Program to customize software for PCE Community Pilot.
(2) Assumes 2 electric meters, and one gas meter at pilot site, with daily downloads starting in month 3 of the Program.
(3) Assumes 30% of Product Development Manager time during the first three months of the Program.
(4) Travel expenses.

Column	(1)	(2)		
	Expenses			
Month	Salaries & OH	Intern Pay	TOTAL	
Jan-19	$6,254.85	$252.00	$6,506.85	
Feb-19	$6,254.85	$252.00	$6,506.85	
Mar-19	$6,254.85	$252.00	$6,506.85	
Apr-19	$674.92	$252.00	$926.92	
May-19	$674.92	$252.00	$926.92	
Jun-19	$674.92	$252.00	$926.92	
Jul-19	$674.92	$252.00	$926.92	
Aug-19	$674.92	$252.00	$926.92	
Sep-19	$674.92	$252.00	$926.92	
Oct-19	$674.92	$252.00	$926.92	
Nov-19	$674.92	$252.00	$926.92	
Dec-19	$674.92	$252.00	$926.92	
Jan-20	$674.92	$252.00	$926.92	
Feb-20	$674.92	$252.00	$926.92	
Mar-20	$674.92	$252.00	$926.92	
Apr-20	$674.92	$252.00	$926.92	
May-20	$674.92	$252.00	$926.92	
Jun-20	$674.92	$252.00	$926.92	
			$33,424.35	

Annual Salaries	
Energy Engineer	$96,000
Education Program Manager	$65,000
Overhead rate on BE101 Staff	40%

Notes by column

(1) BE101 staff to support internship program include Energy Engineer, and Education Program Manager, each allocating 80 hours in three months, then 24 hours each month for the balance of the Program from the Education Manager only

(2) Three high school interns averaging 4 hours per week.

PCE Community Pilots Project for Developing Local Distributed Energy

Applicant Organization: CAST Energy Solutions

Key partners: Forest Mao,

Point of contact: Dr. John Heibel

Title: Managing Director

Phone: 831 345 6868

Email: Heibel.john@gmail.com

1. Description of Project

Peninsula Clean Energy (PCE) is opening a request for proposal in building an environmentally friendly power system among communities. The objective of this project is to find an executable and practical solution to build a GHG-free power system in the future. Our objective in this project is to propose a project implementation plan which is both economical and equitable, with substantiated calculations of GHG reductions. The long term expectation of this project is to support PCE's procurement goals for achieving zero GHG emissions by 2021, 100% renewable energy by 2025, and a minimum of 20 MWs of new local power by 2025. This proposal analyzes the situation of San Mateo County area and derive an implementation plan of this project.

This proposal is a combination of five separate parts: solar PV, wind power, energy storage, and EV charging stations, and an energy management system. PCE could choose the entire package of four projects, or a subset of that total, along with the energy management system. CAST Energy Solutions (CES) will agree to achieve certain quantifiable outcomes, including GHG reductions. These projects will also be targeted at scaling-up county-wide, and develop maximum economic, social, environmental, and health benefits to (and replicable in) all San Mateo County communities.

2. Scope of work

As our scope of work is to design an implementation plan for this project, we will generate a report after in-site survey. The report will include in-site survey, implementation plan, drawings, procurement list, economic estimation, analysis and evaluation, and in-site service.

3. Status Quo Analysis

PCE is the electricity provider for all electricity accounts in the 20 communities in San Mateo County as well as the unincorporated county. PCE's customer base includes almost 300,000 accounts, including 262,900 residential accounts, serving a population of 765,000, with a total electrical load of almost 4 million megawatt-hours. Residential customers make up about 270,000 of the accounts, and 37% of the electrical load, with commercial/industrial making up about 30,000 accounts and 63% of the electrical load.

PCE's load in 2016 was 277 gigawatt hours (GWh) and in 2017, PCE was projecting 3,026 GWh. The projected load for 2018 and going forward is approximately 3,700 GWh.

This project will provide 20 MW of GHG-free power generation.

4. Consideration of Project Location

CES will work with existing PCE's resources and prepare all the hardware, installation, construction and commission with our local resources. CSE only needs PCE's approval to conduct the above work together with PCE. CSE/PCE will offer Economic Incentive Package in working with PCE's clients, who will be motivated to cooperate with CSE/PCE.

In summary, CSE will perform all the works with PCE's existing resources and does not require PCE with additional investment. Based on CSE's rich experience in the Electric Power sector, we are more than well-qualified to commission the work in time and within budget.

While seeking to develop this project within a disadvantaged community of San Mateo County, the project should be installed in an area where people and businesses are nonetheless capable of paying slightly higher tariffs, and are concomitantly supportive of renewable energy.

CES has analyzed the Community Vulnerability Index for San Mateo County, as well as the CalEnviroScreen 3.0 map of Disadvantaged Communities (DAC) in San Mateo County. From the Community Vulnerability Index map, the Districts 2 and 4 appear less favorable for this project at the initial stage (but suitable at a later stage). Additionally, the PCE project to develop community microgrids (Peninsula Advanced Energy Communities) in Redwood City obviates any need for this project in District 4. However, District 5, South San Francisco, appears to be well suited as a DAC, while likely having the ability to pay, as District 5 has the minimum percentage of population of paying more than 35% income for house rent. Moreover, the higher opt-outs in South San Francisco (and other northern San Mateo county locations) is another reason to focus on this area. Consequently, District 5 is recommended as the candidate for the initial project location, although we can discuss other potential project locations which PCE may also prefer.

This project could be scaled-up and replicated in all other locations of San Mateo County in an incremental fashion, upon identifying with PCE the preferred communities.

5. Capacity and Consistence of Project Power System Power Generation

5.1.1. PV Module Design

In this project, based on the current industrial status and production capacity of the solar cell market, the performance technology of the mainstream crystalline silicon solar cell in the current market is compared between single crystal silicon and polysilicon.

Taking into account component efficiency, technology maturity, market share, and project construction period, we recommend using monocrystalline silicon solar module with a specification of 280 Wp (where "p" indicates peak capacity) for this project.

5.1.2. Design of PV Array

The total installed capacity of this project would be 14,000 kWp, and it is recommended to adopt a block power generation and centralized grid-connection scheme. The cell assemblies are made of single crystal silicon solar cells (280 Wp) and are mounted on fixed steel supports.

The 14,000 kWp solar cell array consists of a number of generating electron arrays, each of which is composed of a number of circuit solar cells in series and in parallel. Each photovoltaic unit consists of a solar battery pack, a confluence device, an inverter, and a booster device.

Single crystal photovoltaic modules are used for solar panels, each with a capacity of 280 Wp, a total of 50,000 pieces. The PV module is connected by 22 pieces in a series, 6 series in a group, totaling 1330.56 kW.

5.1.3. PV Power Plant Annual Power Generation Calculation

This project has 50,000 photovoltaic modules, totaling 14,000 kW.;

(1) First year theoretical generation

Photovoltaic power generation can be calculated as follows:

$$E_{\mathrm{p}} = H_{\mathrm{A}} \times \frac{P_{\mathrm{AZ}}}{E_{\mathrm{s}}} \times K$$

Horizontal photovoltaic module generation: EP -- power generation of power station (kWh), HA -- total annual radiation amount of horizontal solar energy (this project is 2,284 kWh/m2*y), PAZ -- installation power of components (this project is 14,000 kWp), ES -- irradiance (constant =1 kWh/m2), and K --

comprehensive efficiency coefficient (this project is preferable to 0.818). The first year was calculated to generate 25,480 MWh (1,820 hours).

For this project, the theoretical power generation is 25,480 MWh in the first year.

(2) PV Project overall generation efficiency η:

Item	Name	Correction Factor
$\eta 1$	Photovoltaic module efficiency	86.66%
$\eta 2$	Low converter converters and inverter efficiency	97.71%
$\eta 3$	AC grid-connection efficiency	96.00%
η	Overall efficiency of PV generation system ($\eta 1 \times \eta 2 \times \eta 3$)	81.8%

5.1.4. PV Power Plant Theoretical Generation Per Year

There is attenuation of monocrystalline silicon photovoltaic modules, and the actual annual power generation decreases gradually. According to the technical specification of the photovoltaic module, its attenuation property is 3% in the first year and less than 18% in the remaining 24 years, which is linear attenuation. According to this linear attenuation method, the annual power generation is shown in the following table.

Table. 1 Annual power generation

Year	Generation (MWh)
0	25,480
1	25,207
2	25,064
3	24,921
4	24,772
5	24,629
6	24,486
7	24,343
8	24,200
9	24,057
10	23,914
11	23,771
12	23,628
13	23,478
14	23,335
15	23,192
16	23,049
17	22,906
18	22,763
19	22,620
20	22,477
21	22,334
22	22,185

Year	Generation (MWh)
23	22,042
24	21,899
Total	590,746
Annual	23,628
The number of hours actually used per year	1,820

In 25 years of operation, the theoretical total capacity of the photovoltaic power station is 590,746 MWh, the theoretical average annual output is 23,628 MWh, and the theoretical average annual online hours are 1,820 h.

5.1.4 **Wind Power Generation**

5.1.5. Selection Of Wind Turbines

At the current stage, no project specific address information is available. At this stage, the project site was considered with wind speed of 5.6 m/s, average wind power density of 200 W/M2 (40 meters from the ground) and wind shear index of 0.177.

According to the project objective, by investigating the situation of small and medium-sized wind turbines in the industry, the technical characteristics and performance of small and medium-sized horizontal axial wind turbines are more mature than those of vertical axial wind turbines. It is recommended to select small and medium-sized horizontal axis wind turbines, and consideration should be given to the coordination of grid connection, energy storage and EV charging systems. Therefore, the selected wind turbine meets the basic safety conditions (wind speed and lightning protection, etc.), and the control system, grouting control, yaw control, full-power inverter system, under voltage ride through, blade anti-fouling and SCADA remote monitoring system to meet the requirements of intelligent micro-grid control.

In the implementation stage of the project, large-scale construction would be carried out according to the wind resources at the project location. It is recommended to build a pilot project based on the combination of wind-energy storage and EV charging system, so as to determine the scale of the wind farm. After determining the project scale and the selected model, it is recommended to take into account the overall planning of the project area and the layout of the community, so as to achieve the project goals while minimizing the environmental impact. The installed capacity of this project is temporarily considered as 20 small and medium sized 300 kW horizontal axial wind turbines.

According to the survey, the price of 300 kW horizontal shaft small and medium sized wind turbine is around 1600 $/kW, and the specific price varies according to the brand of wind turbine, the control system, tower drum, infrastructure construction and so on.

5.1.6. Arrangement of wind turbines

The standard hub height of the recommended model is 24 m and 30 m, and the impeller diameter is 22 m. However, considering that there may be high-rise buildings around the project location, there are some towering trees on the surface, and the wind shear index is high (0.177), considering the future development and changes of the surrounding environment, the wind speed will change more significantly with the height. According to the comprehensive analysis of the above factors, the height

of wheel hub is tentatively determined at this stage to be 40 m.
According to the characteristics of wind resources, the position of the wind turbine is preliminarily determined considering the utilization of wind energy and comprehensive demonstration purposes. Then through the on-site survey, the wind turbine position is determined according to the field topography and coordinate measurement is carried out.

5.1.7. Wind Power Plant Theoretical Production Per Year

The annual theoretical power generation of 20 sets of 300 kW horizontal axis small wind turbines is about 16,000 MWh, taking into account various factors, the comprehensive discount coefficient is set as 65%, and it is estimated that the annual online power is 10,400 MWh, which corresponds to 1,733 hours of equivalent full capacity.

5.2. Energy Storage System

Moreover, to support PCE's load serving needs, many solutions can be proposed. Diesel generator, battery storage, and small hydro power plant area few options for meeting the peak load. However, diesel generators cannot store surplus energy. When the sunlight provides high insolation or wind speed is robust, the output of PV and wind turbines will be greater than the actual load, while an energy storage system with a certain capacity can be built according to the actual load. On the other hand, development of new hydro power plants is typically not cost effective in California, therefore, we suggest using battery storage technology to solve the load serving problems.

5.2.1. Energy Storage Technology Selection

Considering the maturity of various energy storage technologies, equipment cost, land area, maintenance and engineering requirements, energy storage lead-acid batteries, lead-carbon batteries (super batteries) and lithium batteries are suitable at the present stage.

A comparison of the three storage batteries is shown in the following table.

Table. 2 Comparison of Storage Batteries

Battery Type	Energy Density (Wh/kg)	Cycle Life (times)	Transfer Efficiency (%)	Equipment Cost ($/kWh)
Energy Storage lead-acid batteries	30-50	800-1500	75-80	200-400
Lead carbon batteries	60-90	2000	75-80	350
Lithium battery	80-130	4000	90	580-810

According to the above comparison, lithium batteries have certain advantages in terms of energy density, circulation life, conversion efficiency, etc. From the perspective of life cycle, the disadvantages of equipment cost are not obvious, and it has the highest demonstration benefit. Therefore, lithium batteries are recommended to be used as energy storage components of the energy storage system. CES can work with a variety of lithium battery storage partners acceptable to PCE.

5.2.2. Design of the Energy Storage System

We propose selection of a battery module with a capacity of more than 200 Ah for grouping. The energy storage batteries can be arranged in a separate energy storage battery room or in a container with a fan. The energy storage battery room needs air conditioning equipment.

A battery management system (BMS) will be included to effectively monitor the state of battery monomer (monomer battery's voltage, current, temperature, State of Charge (SOC) and State of Health (SOH), internal resistance and other information). The BMS will also monitor the possible failure, abnormal operation condition for alarm and protect its ontology, optimize the battery monomer, monitor the performance of the module control mechanism to ensure the safe, reliable and stable operation of the batteries and maintain the service life of the batteries. CES will provide further information about the BMS upon request.

5.3. EV Charging Stations

PCE's customer base includes almost 300,000 accounts, serving a population of 765,000. Residential customers make up about 270,000 of the accounts, and 37% of the electrical load, with commercial/industrial making up about 30,000 accounts and 63% of the electrical load. At this stage, the status data is not complete. We are providing the general principle for EV charging stations.

5.3.1. EV Charging Station Overall Arrangement Principle

(1) Charging stations in public parking facilities, tourist attractions, industrial parks, crowded places and other places with existing site selection conditions, power construction conditions, supporting facilities, etc. should be selected first to carry out the EV charging stations. (2019-2023)

(2) Combine with urban planning, carry out the long-term construction task of charging stations in the planned roads, parking lots, industrial parks and other places. (2024-2025)

5.3.2. Construction situation and sites allocation

The proposed charging station construction fields contains the public parking lot, parking lots of scenic spots, hotels, resorts, parking lot, key enterprises, industrial zones and industrial parks, residential areas, central roadsides, bus stations, parks, sanitation trucks and commuter car parking spots, transfer hubs, main development projects, for a total of about 10 locations, or more as appropriate. CAST would work closely with PCE, and any preferred partners, to identify the preferred locations, and number of slow, fast, and shared charging stations. We have left the following table blank, because we are willing and capable to agree with PCE on the numbers to be filled-in.

EV Charging Stations Implementation Steps and Construction List

#	Street Name	Parking Lot	2019-2023			2024-2025			Total
			# of Slow Charging Stations	# of Fast Charging Stations	# of Sharing Stations	# of Slow Charging Stations	# of Fast Stations	# of Sharing Stations	Total Number of Charging Stations
1	——	——	——	——	——	——	——	——	——
2		——	——	——	——	——	——	——	——
3		——	——	——	——	——	——	——	——
——		——	——	——	——	——	——	——	——
Total			——	——	——	——	——	——	——

5.4. Multi-Energy Source Complementary System

Based on the distribution network situation, PV generation, wind generation, energy storage, EV charging stations, and customer demand response capabilities, a multi-energy complementary system can be developed. The system is based on community level PV generation that is supported by energy storage resources to promote renewable energy utilization, transportation electrification, and GHG emission reduction. Ultimately, the goal is to reach a GHG emission free and sustainable energy system.

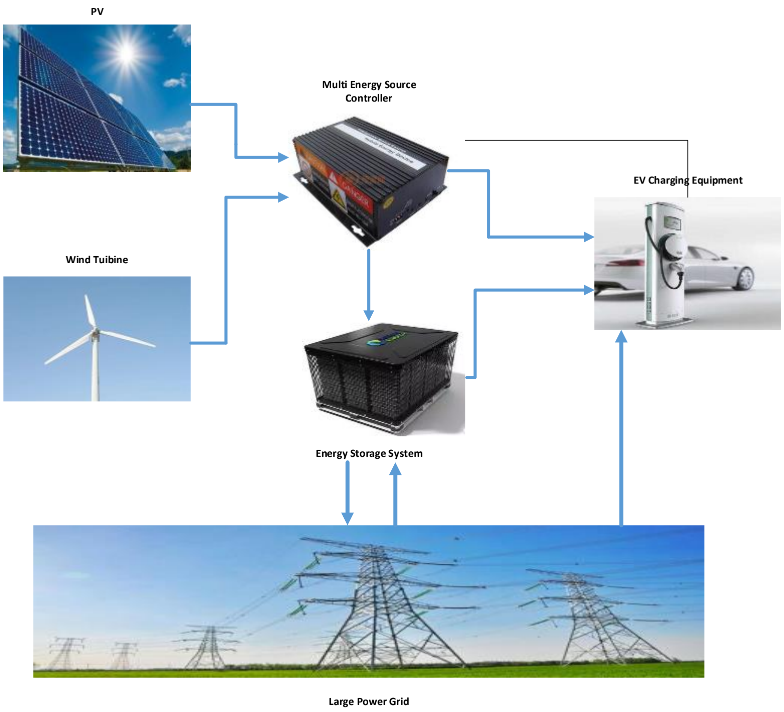


Fig.2 Multi-Energy Source Complementary System

If possible, an Energy Management System (EMS) can be introduced to manage the Multi-energy system. EMS is a local automation system to ensure that distributed generation, EV charging facilities and customers are operating in stable and optimal situation. The EMS includes energy information collection system, communication system, data operation system, and application system.

1) Energy information collection system
   Energy information collection system mainly collect energy data from distributed generation, connected customers and other intelligent terminals. Terminal devices are metering devices, intelligent interactive terminal and sensors.
2) Communication system
   Communication system serves the purpose of bio-direction communicating among distributed generation, customers and grid company. The communication infrastructure can be wired or wireless communication, which are optical fiber, 4G network or nb-lot communication.
3) Monitoring and management system
   Monitoring and management system will constantly monitor operation status and make control instruction to maintain system stability and reliability. System is based on hardware

such as servers, data storage devices and communication devices. The function of EMS should be customized by grid company's need.

4) Application system

Application system will provide extra service for customers and :generation companies. It can also provide data interface for both customers and external system. The application can support function like energy trading service, energy management, equipment maintenance and management. It can also provide data for government information system.

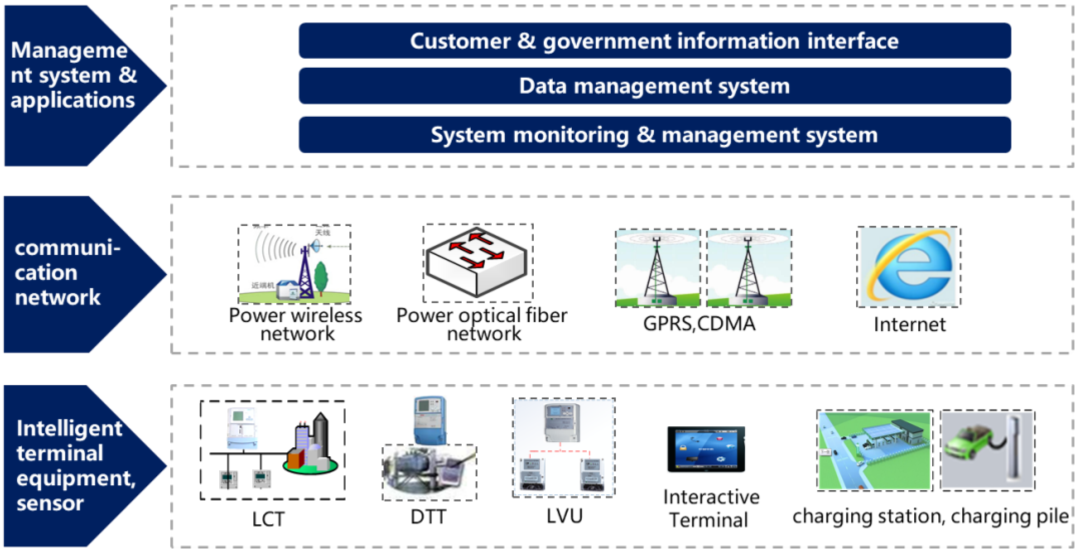


Fig 3 Overview of monitoring & management system

6. GHG emission reduction

The reduction of GHG emission can be calculated in the data shown as below.

Table. 3 Standardized Emission Factors for Electricity and Gas

	Emissions Factor (CO_2e)	Emissions Factor(CO_2e)
Electricity[1] (PCE service)	0.14226 lbs/kWh	0.000064528 metric tons/kWh
Electricity[2] (state average)	0.588 lbs/kWh saved	0.000283 metric tons/kWh
Gas[3]	11.7 lbs/therm saved	0.0053 metric tons/therm

The total annual output electricity of PV and wind turbine would be 34,028 MWh, so the total GHG emission reduction would 4840.8 lbs/2.1958 tons annually, the total reduction by 2025 is 38726.59 lbs/17.566 tons of GHG.

[1] Peninsula Clean Energy staff estimates for 2017 EcoPlus service.

[2] California Energy Commission staff estimate.

[3] California Air Resources Board staff calculations.

7. Conclusion

CES offers extraordinary resources and expertise in distributed energy resources, including from State Grid, the largest utility in the world. State Grid is considered a leader in many areas of distributed energy, including solar, wind, energy storage, and EV charging stations, having deployed these distributed energy resources at a scale much larger than any US electric utility. At the same time, CES has a strong presence in California, having partnered with several leading energy organizations in California. The vast economic resources of State Grid are available to ensure that any projects undertaken with PCE will be fully supported with the required financial resources without exception, and scaling-up to coverage of all areas within the PCE service territory is guaranteed.

CES is very flexible and will work directly with PCE to make any adjustments to the above proposal which better meet the objectives of PCE. CES understands that PCE has limited personnel to work on these projects. CES is able to provide the resources which will enable PCE to focus precious resources elsewhere. Although CES has extensive resources in all areas of distributed energy resources, if PCE wishes to have CES work in partnership with one or more local organizations, CES is pleased to do so.

CES is focused on meeting PCE's strategic objectives for the community pilots:

- Reducing GHG emissions
- Delivering local community benefits
- Advancing innovation
- Aligning energy supply and load

CES will work closely with PCE to ensure these strategic objectives are fulfilled.

Breakdown of Remuneration

Item	Title	Currency	Person-day Remuneration（Home）/ Person-day Remuneration Rate (Field)	Time Input in Person/Day Home / Time Input in Person/Day Field	Unit Price	Cost
	Task 1 On-site Data Collection and Survey: Collect current status information on site, select project construction sites, and carry out field investigation.					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	0	800	US$ -
2	Microw Grid Specialist	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
4	PV Specialist	USD	Home	0	450	US$ -
			Field	5	650	US$ 3,250.00
8	Support Engineer	USD	Home	0	400	US$ -
			Field	2	600	US$ 1,200.00
Sub-Total						US$ 7,250.00
	Task 2 Feasibility Study Report According to the survey situation, we need to reserve relevant personnel on the site and analyze detailed demands of the customer.Moreover, we will organize our specialized team to work professionally and intensively, and compile Feasibiltiy Study Report at home.					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	2	800	US$ 1,600.00
2	Microw Grid Specialist	USD	Home	2	600	US$ 1,200.00
			Field	2	800	US$ 1,600.00
4	PV Specialist	USD	Home	6	450	US$ 2,700.00
			Field	8	650	US$ 5,200.00
8	Support Engineer	USD	Home	2	300	US$ 600.00
			Field	2	500	US$ 1,000.00
Sub-Total						US$ 15,100.00
	Task 3 Primary Design Report, Construction Drawings Based on the Feasibility Study Report, we need to reserve relevant personnel on the site and analyze detailed demands of the customer.Moreover, we will organize our specialized team to work professionally and intensively, and compile Primary design report and constrcution drawings on site.					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	3	800	US$ 2,400.00
2	Microw Grid Specialist	USD	Home	2	600	US$ 1,200.00
			Field	3	800	US$ 2,400.00
4	PV Specialist 1	USD	Home	11	450	US$ 4,950.00
			Field	12	650	US$ 7,800.00
5	PV Specialist 2	USD	Home	11	450	US$ 4,950.00
			Field	12	650	US$ 7,800.00
12	Support Engineer 1	USD	Home	2	300	US$ 600.00
			Field	3	500	US$ 1,500.00
13	Support Engineer 2	USD	Home	2	300	US$ 600.00
			Field	3	500	US$ 1,500.00
Sub-Total						US$ 36,900.00
	Task 4 On-site Technical Guidance On-site Technical Guidance and technical trainning will be provided to customers.					
1	Team Leader	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
2	Microw Grid Specialist	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
4	PV Specialist	USD	Home	0	600	US$ -
			Field	8	800	US$ 6,400.00
8	Support Engineer	USD	Home	0	300	US$ -
			Field	2	500	US$ 1,000.00
Sub-Total						US$ 10,600.00
PV Design Cost						US$ 69,850.00

Breakdown of Remuneration

Item	Title	Currency	Person-day Remuneration (Home) / Person-day Remuneration Rate (Field)	Time Input in Person/Day Home / Time Input in Person/Day Field	Unit Price	Cost
	Task 1 On-site Data Collection and Survey: **Collect current status information on site, select project construction sites, and carry out field investigation.**					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	0	800	US$ -
2	Microw Grid Specialist	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
5	Wind Power Specialist	USD	Home	0	400	US$ -
			Field	8	600	US$ 4,800.00
8	Support Engineer	USD	Home	0	400	US$ -
			Field	2	600	US$ 1,200.00
Sub-Total						US$ 8,800.00
	Task 2 Feasibility Study Report **According to the survey situation, we need to reserve relevant personnel on the site and analyze detailed demands of the customer.Moreover, we will organize our specialized team to work professionally and intensively, and compile Feasibiltiy Study Report at home.**					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	2	800	US$ 1,600.00
2	Microw Grid Specialist	USD	Home	2	600	US$ 1,200.00
			Field	2	800	US$ 1,600.00
5	Wind Power Specialist	USD	Home	7	400	US$ 2,800.00
			Field	8	600	US$ 4,800.00
8	Support Engineer	USD	Home	2	300	US$ 600.00
			Field	2	500	US$ 1,000.00
Sub-Total						US$ 14,800.00
	Task 3 Primary Design Report, Construction Drawings **Based on the Feasibility Study Report, we need to reserve relevant personnel on the site and analyze detailed demands of the customer.Moreover, we will organize our specialized team to work professionally and intensively, and compile Primary design report and constrcution drawings on site.**					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	3	800	US$ 2,400.00
2	Microw Grid Specialist	USD	Home	2	600	US$ 1,200.00
			Field	3	800	US$ 2,400.00
6	Wind Power Specialist 1	USD	Home	11	400	US$ 4,400.00
			Field	13	600	US$ 7,800.00
7	Wind Power Specialist 2	USD	Home	12	400	US$ 4,800.00
			Field	14	600	US$ 8,400.00
12	Support Engineer 1	USD	Home	2	300	US$ 600.00
			Field	3	500	US$ 1,500.00
13	Support Engineer 2	USD	Home	2	300	US$ 600.00
			Field	3	500	US$ 1,500.00
Sub-Total						US$ 36,800.00
	Task 4 On-site Technical Guidance **On-site Technical Guidance and technical trainning will be provided to customers.**					
1	Team Leader	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
2	Microw Grid Specialist	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
5	Wind Power Specialist	USD	Home	0	400	US$ -
			Field	9	600	US$ 5,400.00
8	Support Engineer	USD	Home	0	300	US$ -
			Field	2	500	US$ 1,000.00
Sub-Total						US$ 9,600.00
Wind Turbine Design Cost						US$ 70,000.00

Breakdown of Remuneration

Item	Title	Currency	Person-day Remuneration（Home）/ Person-day Remuneration Rate (Field)	Time Input in Person/Day Home / Time Input in Person/Day Field	Unit Price	Cost
	Task 1 On-site Data Collection and Survey: Collect current status information on site, select project construction sites, and carry out field investigation.					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	0	800	US$ -
2	Microw Grid Specialist	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
7	Energy Storage Specialist	USD	Home	0	400	US$ -
			Field	8	600	US$ 4,800.00
8	Support Engineer	USD	Home	0	400	US$ -
			Field	2	600	US$ 1,200.00
Sub-Total						US$ 8,800.00
	Task 2 Feasibility Study Report According to the survey situation, we need to reserve relevant personnel on the site and analyze detailed demands of the customer.Moreover, we will organize our specialized team to work professionally and intensively, and compile Feasibiltiy Study Report at home.					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	2	800	US$ 1,600.00
2	Microw Grid Specialist	USD	Home	2	600	US$ 1,200.00
			Field	2	800	US$ 1,600.00
7	Energy Storage Specialist	USD	Home	8	400	US$ 3,200.00
			Field	8	600	US$ 4,800.00
8	Support Engineer	USD	Home	2	300	US$ 600.00
			Field	2	500	US$ 1,000.00
Sub-Total						US$ 15,200.00
	Task 3 Primary Design Report, Construction Drawings Based on the Feasibility Study Report, we need to reserve relevant personnel on the site and analyze detailed demands of the customer.Moreover, we will organize our specialized team to work professionally and intensively, and compile Primary design report and constrcution drawings on site.					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	3	800	US$ 2,400.00
2	Microw Grid Specialist	USD	Home	2	600	US$ 1,200.00
			Field	3	800	US$ 2,400.00
2	Energy Storage Specialist 1	USD	Home	12	400	US$ 4,800.00
			Field	14	600	US$ 8,400.00
11	Energy Storage Specialist 2	USD	Home	12	400	US$ 4,800.00
			Field	14	600	US$ 8,400.00
12	Support Engineer 1	USD	Home	2	300	US$ 600.00
			Field	3	500	US$ 1,500.00
13	Support Engineer 2	USD	Home	2	300	US$ 600.00
			Field	3	500	US$ 1,500.00
Sub-Total						US$ 37,800.00
	Task 4 On-site Technical Guidance On-site Technical Guidance and technical trainning will be provided to customers.					
1	Team Leader	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
2	Microw Grid Specialist	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
7	Energy Storage Specialist	USD	Home	0	400	US$ -
			Field	7	600	US$ 4,200.00
8	Support Engineer	USD	Home	0	300	US$ -
			Field	2	500	US$ 1,000.00
Sub-Total						US$ 8,400.00
Energy Storage Design Cost						US$ 70,200.00

Breakdown of Remuneration

Item	Title	Currency	Person-day Remuneratio n（Home）/ Person-day Remuneratio n Rate (Field)	Time Input in Person/Day Home / Time Input in Person/Day Field	Unit Price	Cost
	Task 1 On-site Data Collection and Survey: **Collect current status information on site, select project construction sites, and carry out field investigation.**					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	0	800	US$ -
2	Microw Grid Specialist	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
6	EV Charging Station Specialist	USD	Home	0	400	US$ -
			Field	8	600	US$ 4,800.00
8	Support Engineer	USD	Home	0	400	US$ -
			Field	2	600	US$ 1,200.00
Sub-Total						US$ 8,800.00
	Task 2 Feasibility Study Report **According to the survey situation, we need to reserve relevant personnel on the site and analyze detailed demands of the customer.Moreover, we will organize our specialized team to work professionally and intensively, and compile Feasibiltiy Study Report at home.**					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	2	800	US$ 1,600.00
2	Microw Grid Specialist	USD	Home	2	600	US$ 1,200.00
			Field	2	800	US$ 1,600.00
6	EV Charging Station Specialist	USD	Home	8	400	US$ 3,200.00
			Field	9	600	US$ 5,400.00
8	Support Engineer	USD	Home	2	300	US$ 600.00
			Field	2	500	US$ 1,000.00
Sub-Total						US$ 15,800.00
	Task 3 Primary Design Report, Construction Drawings **Based on the Feasibility Study Report, we need to reserve relevant personnel on the site and analyze detailed demands of the customer.Moreover, we will organize our specialized team to work professionally and intensively, and compile Primary design report and constrcution drawings on site.**					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	3	800	US$ 2,400.00
2	Microw Grid Specialist	USD	Home	2	600	US$ 1,200.00
			Field	3	800	US$ 2,400.00
8	EV Charging Station Specialist 1	USD	Home	11	400	US$ 4,400.00
			Field	10	600	US$ 6,000.00
9	EV Charging Station Specialist 2	USD	Home	13	400	US$ 5,200.00
			Field	15	600	US$ 9,000.00
12	Support Engineer 1	USD	Home	2	300	US$ 600.00
			Field	3	500	US$ 1,500.00
13	Support Engineer 2	USD	Home	2	300	US$ 600.00
			Field	3	500	US$ 1,500.00
Sub-Total						US$ 36,000.00
	Task 4 On-site Technical Guidance **On-site Technical Guidance and technical trainning will be provided to customers.**					
1	Team Leader	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
2	Microw Grid Specialist	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
6	EV Charging Station Specialist	USD	Home	0	400	US$ -
			Field	7	600	US$ 4,200.00
8	Support Engineer	USD	Home	0	300	US$ -
			Field	2	500	US$ 1,000.00
Sub-Total						US$ 8,400.00
EV Charging Station Design Cost						US$ 69,000.00

Breakdown of Remuneration

Item	Title	Currency	Person-day Remuneration（Home） / Person-day Remuneration Rate (Field)	Time Input in Person/Day Home / Time Input in Person/Day Field	Unit Price	Cost
	Task 1 On-site Data Collection and Survey： Collect current status information on site, select project construction sites, and carry out field investigation.					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	0	800	US$ -
2	Microw Grid Specialist	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
3	Minitor and Control System Specialist	USD	Home	0	450	US$ -
			Field	8	650	US$ 5,200.00
8	Support Engineer	USD	Home	0	400	US$ -
			Field	2	600	US$ 1,200.00
Sub-Total						US$ 9,200.00
	Task 2 Feasibility Study Report According to the survey situation, we need to reserve relevant personnel on the site and analyze detailed demands of the customer.Moreover, we will organize our specialized team to work professionally and intensively, and compile Feasibiltiy Study Report at home.					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	2	800	US$ 1,600.00
2	Microw Grid Specialist	USD	Home	2	600	US$ 1,200.00
			Field	2	800	US$ 1,600.00
3	Minitor and Control System Specialist	USD	Home	6	450	US$ 2,700.00
			Field	8	650	US$ 5,200.00
8	Support Engineer	USD	Home	2	300	US$ 600.00
			Field	2	500	US$ 1,000.00
Sub-Total						US$ 15,100.00
	Task 3 Primary Design Report, Construction Drawings Based on the Feasibility Study Report, we need to reserve relevant personnel on the site and analyze detailed demands of the customer.Moreover, we will organize our specialized team to work professionally and intensively, and compile Primary design report and constrcution drawings on site.					
1	Team Leader	USD	Home	2	600	US$ 1,200.00
			Field	3	800	US$ 2,400.00
2	Microw Grid Specialist	USD	Home	2	600	US$ 1,200.00
			Field	3	800	US$ 2,400.00
3	Minitor and Control System Specialist	USD	Home	12	450	US$ 5,400.00
			Field	15	650	US$ 9,750.00
12	Support Engineer 1	USD	Home	2	300	US$ 600.00
			Field	3	500	US$ 1,500.00
13	Support Engineer 2	USD	Home	2	300	US$ 600.00
			Field	3	500	US$ 1,500.00
Sub-Total						US$ 26,550.00
	Task 4 On-site Technical Guidance On-site Technical Guidance and technical trainning will be provided to customers.					
1	Team Leader	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
2	Microw Grid Specialist	USD	Home	0	600	US$ -
			Field	2	800	US$ 1,600.00
3	Minitor and Control System Specialist	USD	Home	0	450	US$ -
			Field	5	650	US$ 3,250.00
8	Support Engineer	USD	Home	0	300	US$ -
			Field	2	500	US$ 1,000.00
Sub-Total						US$ 7,450.00
Monitor and Control System Design Cost						US$ 58,300.00

GHG Emissions Reduction and Cost Effectivenes

Standardized Emission Factors for Electricity and Gas

	Emissions Factor (CO_2e)	**Emissions Factor(CO_2e)**
Electricity (PCE service)	0.14226 lbs/kWh	0.000064528 metric tons/kWh
Electricity(state average)	0.588 lbs/kWh saved	0.000283 metric tons/kWh
Gas	11.7 lbs/therm saved	0.0053 metric tons/therm

The total annual output electricity of PV and wind turbine would be 34,028 MWh, so the total GHG emission reduction would 4840.8 lbs/2.1958 tons annually, the total reduction by 2025 is 38726.59 lbs/17.566 tons of GHG.

Edward Cazalet
Dr. Cazalet has over forty years of electric power experience as an executive, board member, consultant, and entrepreneur.
In 2007 Dr Cazalet co-founded MegaWatt Storage Farms. MegaWatt deploys and manages grid-scale electricity storage farms for multiple applications in including integration of intermittent wind and solar generation.
Dr Cazalet was appointed by California Governor Schwarzenegger in 2004 to a three-year term as a member of the five-person Board of Governors of the CAISO. The CAISO is charged with safe and reliable real-time operation and planning of the high voltage transmission system in California.
Dr. Cazalet founded APX in 1996 and served for many years as CEO. Dr. Cazalet conceived the business opportunity, and raised $66 million in investment capital in three rounds. APX provides independent transaction services for electric power and environmental registries.
Dr. Cazalet founded Decision Focus, Inc. (DFI) in 1976 and led DFI to become a leading firm in energy and electric power market modeling and decision analysis consulting. Previously at SRI International he was an early member of the pioneering Decision Analysis Group at SRI International. With both companies, and also as an independent consultant, Dr. Cazalet has participated in and led high-level consulting and decision analysis engagements for several of the world’s largest corporations and many government agencies.
Dr. Cazalet holds a PhD from Stanford University focused on economics, decision analysis and power system planning and degrees in engineering from the University of Washington.

Stephen Lee

Stephen T. Lee, Senior Technical Executive, Electric Power Research Institute. Dr. Lee has over 40 years of electric power industry experience. He received his S.B., S.M., E.E. and Ph.D. degrees from M.I.T. in Electrical Engineering, majoring in Power System Engineering, in 1969, 1970, 1971 and 1972, respectively. He worked for Stone & Webster Engineering Corporation in Boston, and Systems Control, Inc. in Palo Alto, California, and he was Vice President of Consulting for Energy Management Associates (EMA). Before joining EPRI in 1998, Dr. Lee was an independent Consultant in utility planning and operation. At EPRI, Stephen Lee has managed and directed technical research programs for power system analysis, planning and operations, and has been actively developing new concepts and tools for power system operation and transmission planning. He is considered one of the top Thought Leaders of EPRI. Dr. Lee actively participates in activities of the North American Electric Reliability Corporation (NERC) in the Operating Committee and reliability standards and is a co-chair of the Reliability Fundamentals Working Group. Recently, he is active in the research of the Holistic Vision of the Smart Grid. Stephen is a board member of The 1990 Institute and a Smart Grid task force co-chair of the US-China Green Energy Council.

Pei Zhang • 3rd

Director of Smart Grid at Accenture
Cupertino, California

Connect

Accenture
Imperial College London
See contact info
500+ connections

Program Manager with 10-year experience of business operation, project management, research and technology development at internationally well-known research institution and utility company. Extensive knowledge of power system operation and planning, proficient in technology development and implementation, expertise in application and training. Powerful leader with proven ability to create vision, develop strategic plans, propose innovative solutions, and lead a team to achieve outstanding performance. Excellent interpersonal, communication, presentation and organizing skills.

Specialties: Power System Operation and Planning, Power System Stability & Control,

Show less

Experience

Director of Smart Grid
Accenture
Aug 2010 – Present • 8 yrs 1 mo

Program Manager
Electric Power Research Institute (EPRI)
2007 – 2010 • 3 yrs

- Effectively directed day-to-day operation of gird operation and planning area and managed a technical team up to 10 members.
- Successfully designed program vision, roadmap and annual portfolio, which resulted in the number of funders increased from 29 to 42 (45% increase).
- Strategically extended value chain by offering application and training services and increased annual revenue from $5.6M to $8.2M (46% increase).
- Built a productive and innovative team with strong internal technical capabilities.
- Significantly improved customer satisfaction through launching a series of initiatives including forming task forces, improving website, and issuing monthly newsletter.
- Developed sustainable working relationship with industry vendors, academic universities, and government organizations.

People Also Viewed

Shay Bahramirad - (I
Vice President- Engineer
Smart Grid at ComEd

Mohammad Shahide
Bodine Chair Professor a
Robert W. Galvin Center
Innovation,Illinois Institu
Technology

Zhi Chen • 3rd
Visiting Faculty at Lawre
Livermore National Labo

Bowen Hua
Operations Research Sci
at Facebook

Yilu Liu
Governor's Chair at Univ
Tennessee and Oak Ridg
Laboratory

Wencong Su • 3rd
Assistant Professor at Ur
Michigan-Dearborn

Zhao Junbo • 3rd
Research Assistant Profe
Chair of IEEE TF Power S
Dynamic State and Parar
Estimation

Lisa Beard
Director

Liang Che • 3rd
Engineer at MISO

Bo Yang • 3rd
Director at Hitachi Amer

Learn the skills Pei has

Strategic Plann Foundations
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Outlook 2013: Email Manager
Viewers: 8,946

government RFPs and won multi-million dollar contracts to support R&D of PMU applications.
• Led a crossing department team to manage strategic technology innovation program – ElectricNet.

Senior Project Manager/Project Manager
Electric Power Research Institute (EPRI)
2000 – 2007 • 7 yrs

• Demonstrated excellence in managing a variety of R&D projects that develop advanced technologies in grid operation and planning area.
• Consistently achieved high scores in technical field. Produced 7 software packages, completed 28 technical reports, and published 13 journal papers and 57 conference papers.
• Proposed the measurement-based voltage stability monitoring and control concept and invented two technologies that are applied for patents.
• Led the development of Probabilistic Risk Assessment (PRA) program, formed PRA user group and designed PRA annual support and maintenance package that raised $1M revenue over 5 years.
• Initiated measurement-based load modeling project and led an internal technical team to develop Load Model Parameter Derivation (LMPD) program.
• Successfully organized many industry conferences and workshops, acted as the organizing committee member and session chair of international conferences.
• Invited as the honor speaker by prestigious universities and international conferences.
• Received 1 Intellectual Property Award, 5 Performance Recognition Awards and 4 Excel Awards.

Power System Engineer
National Grid Company, United Kingdom
1999 – 2000 • 1 yr

• Investigated system security limits and developed remedial actions to critical contingencies.
• Developed data conversion program and dynamic reduction program to significantly improve work efficiency.
• Performed dynamic simulations using Eurostag program to identify system stability boundaries.

Education

Imperial College London
PhD, Power System
1996 – 1999

Tianjin University
Master, Power System
1994 – 1996

Tianjin University
Bachelor, Electrical Engineering
1990 – 1994

Skills & Endorsements

Smart Grid · 90
Endorsed by **Marianna Vaiman and 28 others who are highly skilled at this**
Endorsed by **23 of Pei's colleagues at Electric Power Research Institute (EPRI)**

Program Management · 56
Endorsed by **15 of Pei's colleagues at Electric Power Research Institute (EPRI)**

Renewable Energy · 50

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Recommendations

Received (15) Given (3)

Z.Y. Dong
SHaRP Professor at The University of NSW, Sydney; Fellow IEEE
August 16, 2010, Z.Y. reported directly to Pei

Pei is a natural leader who can inspire colleagues and always stays in a leading position in the profession. Pei is highly effective in management as well as engineering analysis of different programs & projects. He wins his reputation in the industry through hard working, highly successful people skills and outstanding management ability. He can manage the overall program, as well as look into the details of a project with helpful inputs. It is a great pleasure working with Pei.

Bruce Rogers
Technical Executive, Distribution Research at Electric Power Research Institute
May 16, 2010, Bruce was a client of Pei's

Pei has supported my company's research activities for several years. His work product is high-quality and applicable to improving our business performance.

Show more

Accomplishments

1 Patent

Application of Phasor Measurement Units (PMU) for Controlled System Separation
Filed May 17, 2012 • us 12/948,188

This invention relates to a PMU-based controlled system separation method to protect against a catastrophic blackout. The method includes the steps of performing an offline analysis of an electrical transmission network to partition generators into a number of coherent groups, performing online monitoring of the transmission network to determine a separation interface and frequencies and damping ratios of dominant inter-area modes, and estimating the risk of system separation to perform real-time control.

Other inventors

See patent

Interests

ABB
1,170,761 followers

IEEE Smart Grid
40,471 members

Tianjin University
49,539 followers

Accenture
3,444,508 followers

Imperial College London
182,048 followers

Messaging

Peninsula Clean Energy
2075 Woodside Road
Redwood City, CA
94061

August 3, 2018

Dear Peninsula Clean Energy:

I have worked closely with CAST Energy Solutions on several projects, and have been thoroughly impressed by their extensive expertise, professionalism, and ability to develop complex energy projects in a timely fashion. They have successfully participated with several other leading California institutions and organizations in bids for California Energy Commission Requests for Proposals, including partnerships with OSIsoft, SDG&E, SunSpec Alliance, UC Davis, and ChargeBliss.

I would be pleased to provide further details of their participation in many successful energy projects in California.

Sincerely,

Dr. John Heibel

LOMA PRIETA SYSTEMS LLC

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Proposal for PCE's Community Pilot Program:

Bridging the Gap:

Energy Project Financing

August 3, 2018

Submitted to

Peninsula Clean Energy

Submitted by

Design – Manage – Sustain

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DESCRIPTION OF PROJECT

The Problem

Comprehensive energy projects are often prohibitively expensive for most customers. Although rebate and incentive programs can help alleviate the substantial cost that frequently comes with installing energy improvements, customers across market sectors still cite the affordability of these projects as the single most significant barrier to implementation.

According to Peter Krajsa, CEO at AFC First, "The average single-family customer has $5,000-$10,000 in discretionary savings at any one time and the average cost of an energy efficiency upgrade is $5,000-$10,000." Whole building comprehensive upgrades are even more costly. "Therefore, you are asking them to spend all of their available money. It's a big ask."

Many financing options are currently available in the market today – options that fit many different needs, circumstances and market sectors. In fact, many of these are specifically made to finance energy efficiency and renewable energy projects. The problem is that many of Peninsula Clean Energy's customers don't know what kind of energy project financing is available, nor do they know where to go to find it.

The Solution

Design-Manage-Sustain (DMS) proposes to create a one-stop shop resource for PCE's residential, business and multifamily customers to discover and explore available financing options for energy related projects and products – the **Financing Finder**. It will coordinate with, complement and enhance many of the region's existing energy programs. Energy financing influences energy savings by enabling customers to overcome the "first-cost" barrier to completing projects driving energy efficiency, renewable energy and energy storage – allowing additional and more comprehensive projects to be completed. And, PCE's Financing Finder can be executed quickly by leveraging an existing financing database and incorporating lessons learned from previous implementation.

Since developing a custom financing product for PCE customers is costly, takes significant time and resources and is redundant (there are already many available financing options), this proposal presents a unique opportunity for PCE to offer energy financing options directly to its customers without the unnecessary burden of becoming a lender or managing a complicated financial program.

Financing energy projects has many benefits:

- ✓ Financing removes the first-cost barrier to implementing energy projects.
- ✓ Comprehensive projects can be undertaken creating more energy savings or generation.
- ✓ More efficient equipment can be installed, saving more energy.
- ✓ Cashflow is preserved by spreading the payment over time.

The benefits of connecting PCE customers with an easy, unbiased and trusted resource for financing their energy projects are numerous. Property owners want access to a variety of financing options so that they can choose the one that best fits their needs. Contractors often rely on financing to "close the deal" and get a customer to say "yes" to an energy project. And, public agencies need financing to help their constituents lower utility bills and to achieve their mandated energy goals. Investing in the Finance Finder is a simple and straightforward way to stimulate the adoption of energy projects in PCE territory and create a cascade of positive impacts that complement existing programs while addressing PCE's pilot program objectives.

The Financing Finder will support several of Peninsula Clean Energy's strategic goals including:

- Stimulate development of new renewable energy projects by providing easy access to financing;
- Demonstrate regional economic benefits by creating local jobs for contractors and equipment vendors and more customers for local lenders;
- Reduce GHG emissions through more completed energy efficiency and renewable energy projects and more electric/hybrid vehicles; and,
- Partner effectively with local programs through the County Office of Sustainability, the CPUC, BayREN and PG&E.

Our Approach

Energy project financing has shown more success when it is marketed in conjunction with other programs since customers need a reason to require financing, like a new equipment purchase. Therefore, this proposal includes marketing, education and outreach (ME&O) components that leverage DMS's existing relationships with the region's energy program administrators (County Office of Sustainability, BayREN, PG&E, CPUC and community-based organizations) to incorporate PCE's finance messaging into their current and planned outreach efforts using a simple, clearly articulated call-to-action.

For approximately two years, DMS created and managed a statewide database and website similar to this pilot program proposal for a CPUC contract (Statewide Finance ME&O Program[1]). It housed over 300 financing products with nearly 100 unique data points (rate, term, FICO, etc.) collected for each. The first year, the website successfully attracted 75,000 unique visits with over 1,200 visitors contacting a lender to complete an application. In early 2018, the website was taken down and the program stopped due to lack of funds. For this proposal, DMS proposes to create a stream-lined version of the database and website. By building on this past experience and leveraging the information and lender contacts previously collected, DMS can quickly implement and launch the Financing Finder as a custom solution for PCE and its customers.

Pilot Goals and Objectives

The main goal of the Financing Finder is to increase the volume and comprehensiveness of completed energy projects by providing access to financing options that can address many different needs and market sectors. To achieve this goal, the proposed pilot will accomplish the following key objectives:

- ✓ Develop a database of available financing options for residential, small business, multifamily and commercial customers;
- ✓ Increase renewable energy and energy efficiency project volume by providing easy access to financing;
- ✓ Improve customer experience and provide a community benefit as a non-biased informational resource; and,
- ✓ Complement existing energy programs in PCE territory by offering a "fully packaged" solution, resulting in greater program participation with deeper claimable energy savings – additionality.

The Process

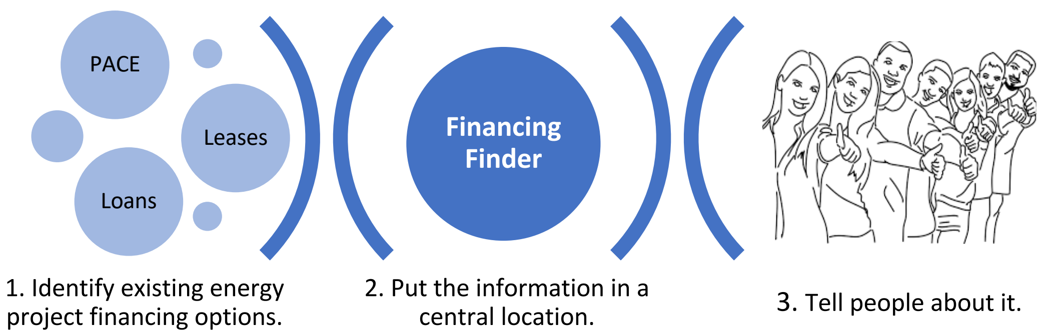
Put simply, DMS will identify existing energy project financing options for residential, small business and commercial customers, make the information available in a central web location in

[1] AKA "GoGreen Financing". In January 2018, the GoGreen Financing website and resources as described in this proposal was shut down, and the GoGreen Financing brand and web domain was transferred to CA's energy efficiency financing pilots (CHEEF).

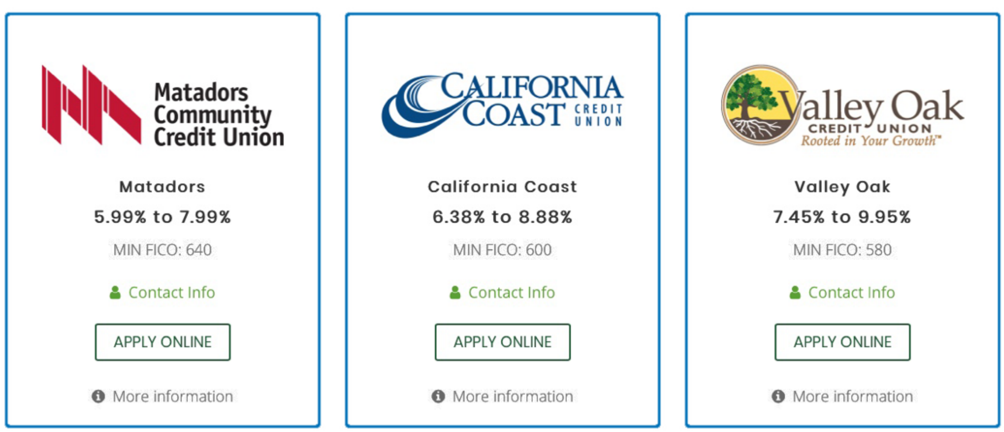
an easy-to-search format, create materials to market the product and communicate to PCE customers by leveraging other CPUC-funded and regional programs.

1. Identify existing energy project financing options
   At the start of the project, DMS will work with PSE staff to define the types of financing that will be included on the website and to determine the specific product information to be displayed (for example, interest rate, payback terms, contact information, etc.). Once this information has been mapped, DMS will create a custom database for PSE leveraging the finance product information it currently has. While creating PSE's financing database, DMS will verify the current details of each financing product and search to see if there are any new products to add.

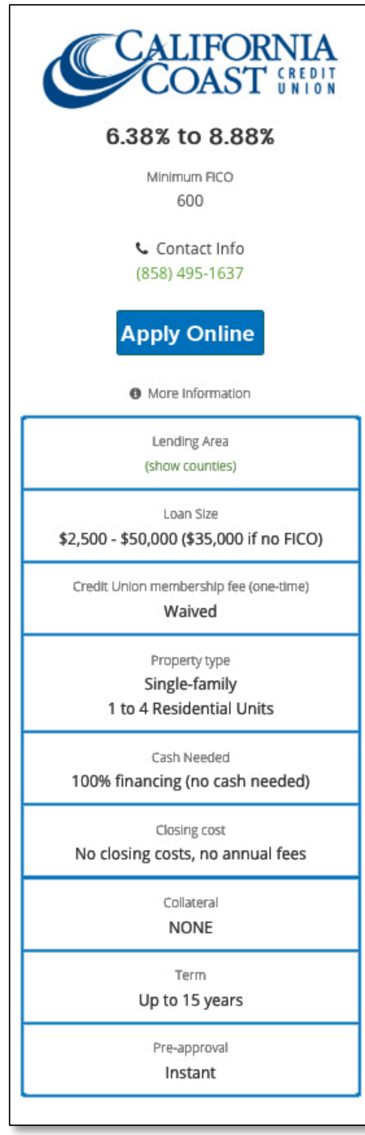
   Figure 1: Process



2. Create the Financing Finder
   The Financing Finder is the main focus of this proposal. It can exist as a standalone mobile-optimized website or as a sub-page within PCE's existing website. It will tap into the financing database displaying financing products in an easy-to-read "business card" format as shown below.



   Customers will be able to filter the database by property type and the business cards will link directly to the lender's website or web-based application through the "Apply Online" button. Through these buttons, PSE will be able to track the number of clicks providing one of the most important Key Performance Indicators (KPIs) to track the effectiveness of the program. From the business card, users can click the "more information" link to access a product profile page which would include a brief description and additional product characteristics, such as interest rate, available terms and fees (see image to right). Finally, a resource page will be created to house FAQs and marketing collateral.



Once PSE and DMS begin a partnership and DMS has evaluated PSE's IT and website, an accurate assessment of what is needed (resources, budget and timeline) to create the coding for the Financing Finder, the web page that hosts it, and the Application Programming Interface (API) that uploads data from the database will be provided. For the purpose of this proposal, DMS has provided two options which are detailed in the section titled *PCE Implementation Requirement.*

- Option A: PSE's IT department/ vendor codes the Financing Finder, web page(s) and API. DMS leads creative direction, user experience and management of the final product.
- Option B: DMS brings in a web developer to create a microsite that hosts the Financing Finder. It will include a backend administration portal able to import Excel data into a Mongo database using an API with Node Express. This will allow the administrator to add, edit and view products and search products by keyword, location and/or type. Items will be optimized for mobile use.

3. Marketing, Education and Outreach

Implementers within the PCE region already offer customers a robust portfolio of educational materials, rebates and incentive opportunities, energy advisors, direct install programs and free energy assessments. Positioning financing as an additive and complementary solution to other regional programs has proven to be effective and cost-efficient. It improves customer experience by offering a "fully packaged" solution, resulting in greater program participation with deeper claimable energy savings - additionality.

To accomplish this objective, DMS will leverage existing relationships with program implementers for PG&E, BayREN, CPUC, the County Office of Sustainability and community-based organizations to incorporate PCE's financing message into their outreach efforts using a simple, clearly articulated call-to-action. A marketing toolkit will be created that will include items that can be used by any stakeholder including, but not limited to:

- Flyer
- Talking points and FAQs
- PowerPoint slides and script
- Web button
- Social media posts
- Blog/ newsletter filler
- Text for inclusion on resources pages of stakeholder websites

Financing Finder's Future

Based on the team's previous experience creating and managing a program similar to the Financing Finder and on feedback from contractors, lenders and customers, DMS has identified several potential areas for future expansion of the Financing Finder's functionality. These include:

- Creating a comparison tool that views several lending products side-by-side;
- Development of a Financing Concierge that asks the customer a few simple questions to prioritize the financing products shown to them; and,
- Integrating a lender update feature allowing lenders to login to update their product profiles themselves.

THE PLAYERS

Design-Manage-Sustain is an energy and sustainability strategy consulting firm focused on helping companies and governments find solutions that are innovative, measurable and good for the environment. DMS provides sustainability planning, program design, training and marketing with a special focus on energy financing and working with local governments and community-based organizations. Through a systematic approach to leadership, strategy, innovation and client development, we have built a reputation for leading complex projects, building consensus and being tenacious about getting results. DMS is a California woman-owned micro-business. For more information, please visit www.Design-Manage-Sustain.com.

The majority of Design-Manage-Sustain's experience has been concentrated on rate-payer programs. DMS has worked with all of the investor-owned utilities and several publicly-owned utilities. Since 2012, DMS has held subcontracting agreements to work on the following rate-payer programs:

- Southern California Regional Energy Network
- Bay Area Regional Energy Network
- Statewide Financing ME&O Program (formerly GoGreen Financing)
- California Hub for Energy Efficiency Financing (CHEEF)
- Energy Upgrade CA
- Home Upgrade incentive program
- PACE financing for BayREN, San Diego County and Los Angeles County

For this proposal, the bulk of the work will be completed by Nathalie Nestor and Mark O'Brien, a sub-consultant. As needed, DMS also has working relationships with outside vendors who provide copy editing, more complex front-end and back-end web development and custom database design.

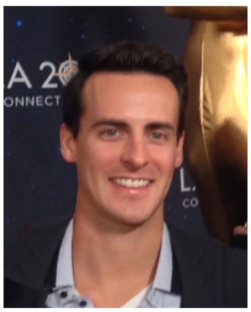
Nathalie Nestor

Nathalie Nestor has nearly 20 years of experience in energy, sustainability and program management for some of the largest local and state governments in the United States, as well as private companies. She has a proven ability to develop, design and implement innovative techniques to reach target groups and support business goals.

Known for her ability to work with a diverse group of stakeholders to reach consensus and implement solutions, Nathalie is well-known throughout the industry. She is a passionate speaker and subject matter expert in energy project financing. Nathalie uses a systematic approach to leadership, strategy, innovation and client development. Her successful track record demonstrates her unique ability to analyze numerous disparate amounts of information and design a solution that is elegant, efficient and good for the environment, while still accomplishing organizational goals.

Nathalie's credentials include a Master of Architecture from the University of Washington, architectural licenses in multiple states, Project Management Professional certification and LEED Accredited Professional certification. She has been involved in the US Green Building Counsel since 2001 and was the founder for the Los Angeles chapter's South Bay branch.

Mark O'Brien



Mark O'Brien is a seven-year veteran of California's sustainable energy industry. Combining diverse expertise in marketing and content development, Mark excels in helping organizations establish and grow their brand influence through clear, strategic and impactful communications. During his five years at the Center for Sustainable Energy, Mark assumed lead and support marketing roles for a variety of clean energy initiatives including: California Solar Initiative, Energy Upgrade California, SunShot, CSI-Thermal, Self-Generation Incentive Program among many others. Most recently, Mark focused his efforts on promoting energy efficiency financing solutions in California through the California Hub for Energy Efficiency Financing and GoGreen Financing. As a key contributor in the Statewide Financing ME&O Program, Mark developed an innovative cooperative marketing campaign, collateral materials and enhanced user experience for the Financing Finder. Along the way, Mark has gained significant experience working with key energy stakeholders in California including CPUC staff, IOUs, regulators and most importantly – the citizens of California.

OUTCOMES

As discussed earlier, the proposed Financing Finder supports many of PCE's strategic goals as well as PCE's desired outcomes for these pilot programs.

1. Accelerates GHG reductions and renewables

This proposal provides indirect GHG reductions and/or renewables by influencing the number of and the comprehensiveness of the energy efficiency and renewable projects that are completed and the number of electric/ /hybrid vehicles in the region.

2. Delivers community benefits to all customers

Service to all PCE customers

The Financing Finder provides energy project financing options for all types of PCE customers – residential, small business, multifamily and large commercial. It can even provide financing options for electric and hybrid vehicle purchases. Consequently, **all PCE customers can participate**.

Low income, vulnerable and disadvantaged communities

Although, traditionally, it is not advisable to market financing to low income and disadvantaged customers, there are indeed instances where the programs available, such as LIHEAP and weatherization, are unable to help these customers. Consequently, the Financing Finder includes financing options that are available for customers with no or little equity in their property, low credit or higher debt-to-income ratio. If PCE desires, DMS can work with community-based organizations who service low/middle income customers and vulnerable communities to market the Financing Finder in an appropriate and sensitive manner.

Local workforce and jobs development

With easy access to financing for energy projects, more energy projects will be completed, and more hybrid and electric cars will be purchased. These construction projects and purchases will create regional economic benefits by creating local jobs for contractors and more sales for equipment vendors and car dealerships. It will also support local green lenders offering energy project financing.

3. Supports PCE's load serving needs

The Financing Finder will indirectly support PCE's load-serving needs. It will stimulate development of new renewable energy projects and energy storage by providing easy access to financing. Also, with the aid of financing, additional energy efficiency projects can be completed as well as more comprehensive projects that save extra energy. With a more energy efficient community, PCE will require less energy infrastructure to serve the territory.

4. Additional benefits

The Financing Finder is an innovative tool that leverages private financing to provide a community benefit by producing more renewable energy, achieving greater energy efficiency and reducing carbon emissions. Other benefits include:

- ✓ Previous implementation success on a state-wide platform demonstrating that the Financing Finder is scalable and replicable on both a small and larger scale;
- ✓ Rapid deployment by leveraging financing information already collected and past experience with a similar tool;
- ✓ Harnesses the power of the private financing sector;
- ✓ Supports all market sectors of PCE's customers;
- ✓ Provides additionality by filling a missing gap (the first-cost barrier of energy projects) in other regional energy programs and future PSE programs;
- ✓ Reduces GHG emissions by supporting additional energy efficiency and renewable projects, more comprehensive projects and electric vehicle purchases; and,
- ✓ Leverages marketing and outreach from other CPUC ratepayer funded programs with local program administrators (the County Office of Sustainability, the CPUC, BayREN and PG&E). Programs include, but are not limited to:
  - Statewide Financing ME&O Program
  - Multifamily Capital Advance
  - Energy Advisors and Home Upgrade
  - Small business technical assistance
  - Multifamily technical assistance and rebate program
  - CSM Green Business Program

Note: Additional detail is provided about the previous implementation of the Financing Finder and its innovation, scalability and replicability in the following sections of this proposal: The Solution, Financing Finder's Future, Similar Work and Evaluation.

PCE IMPLEMENTATION REQUIREMENTS

DMS expects that PCE's role in project implementation will be limited to two potential areas:

1. Guidance regarding which finance product information will be displayed; and,
2. Web development (if option A is chosen).

As discussed previously under the "Create the Financing Finder" section, the required level of IT coordination can be provided after gaining detailed understanding PSE's website architecture, IT and coding capacity, and desired level of involvement. This directly relates to the following tasks: 1) creating the web page(s) or micro-site, 2) coding the Financing Finder and 3) creating the API. For the purpose of this proposal, DMS has provided two options with each addressing a different level of PCE involvement. Both are detailed in the Budget spreadsheet accompanying this proposal. Please see below.

OPTION A: PSE's IT department/ vendor codes the Financing Finder, web page(s) and API, which transfers updates from the database to the Financing Finder. DMS drives creative direction, user experience and management of the final product.		
Task Description	**% of Budget**	**Budget**
Researching and verifying additional financing sources	25	$ 18,750
(2) Semi Annual database updates	13	$ 9,750
Working with PCE staff to add financing pages to website	17	$ 12,750
Creating outreach materials & training	25	$ 18,750
Expenses: Travel, printed materials	8	$ 6,000
Training/ coordinating with existing programs	12	$ 9,000
	100	**$ 75,000**

OPTION B: DMS provides a web developer to create a microsite that hosts the Financing Finder and financing web pages including an API for the database.		
Task Description	**% of Budget**	**Budget**
Researching and verifying additional financing sources	25	$ 18,750
(2) Semi Annual database updates	13	$ 9,750
IT work: web pages/ microsite, coding, API	33	$ 25,000
Creating outreach materials & training	12	$ 9,250
Expenses: Travel, printed materials	4	$ 3,000
Training/ coordinating with existing programs	13	$ 9,250
	100	**$ 75,000**

Building PCE's Capacities

The Financing Finder will provide additionality to the region's current programs and PCE's future programs. It will go a long way towards alleviating the often-hefty price tag that comes with implementing energy improvements, and it will influence the number of and the comprehensiveness of the projects that are completed helping PCE quickly achieve its energy goals. The Financing Finder is low risk to PCE because it leverages private lenders and allows financing options to be available immediately to customers driving increased action and energy savings from installed projects. It will improve PCE's customers' satisfaction of its other programs.

The data collected from the Financing Finder will allow PCE to determine which financing products are more relevant to customers by tracking the options users consider and choose. This information can then be used to improve PCE's offerings driving higher engagement levels and to work with lenders to create better, more relatable and more useful financing products. Throughout the process, PCE will create relationships with local lenders by steering more customers to them and by listing them in the Financing Finder. Data, in conjunction with lender surveys, may also have the ability to determine if there is fall-out in the pipeline between customers seeking energy project financing, if they actually acquire it and if they go through some of the other regional or PCE programs.

Minimizing Administrative Burdens

Depending on PCE's desired level of involvement (Option A or Option B), DMS believes the project can be implemented with little burden to PCE staff. If it is desired, the program can easily be managed by PCE staff with little effort. No PCE policy changes will needed to implement the project.

QUALIFICATIONS

The Design-Manage-Sustain team is uniquely qualified to provide the services included within this proposal for the following reasons:

- ✓ DMS has experience providing similar services statewide for the CPUC on another project that is no longer in operation;
- ✓ DMS is well connected to other regional energy program implementers;
- ✓ DMS is a Pre-Qualified Provider for Energy Programs Support for other California CCAs[2];
- ✓ DMS has experience working on rate-payer programs and with PG&E; and,
- ✓ DMS has relationships with local and national lenders.

For this proposal, the bulk of the work will be completed by Nathalie Nestor and Mark O'Brien, a sub-consultant. Nathalie and Mark have worked together for three years on a variety of similar energy financing initiatives including the Statewide Finance ME&O Program, GoGreen Financing, Energy Upgrade CA and the California Hub for Energy Efficiency Financing. Nathalie's and Mark's qualifications are discussed in more detail in the previous section called *The Players* and in resumes included in the Appendix of this proposal.

Staffing

DMS does not anticipate that new staff will be needed to complete this project. However, as needed, DMS also has working relationships with outside vendors who provide copy editing, more complex front-end and back-end web development and custom database design.

Similar Work

DMS has worked on many programs, both statewide and regionally that provide experiences relating to the work proposed herein. Two of those that most directly correlate are:

GoGreen Financing (2015-2017), Subcontractor

DMS created an impartial state-backed website, GoGreen Financing, that allowed property owners to search a large database of energy project financing options, compare them and learn more about the different financing types. The site hosted several unique tools, including a Financing Finder, that used intelligent learning software to help property owners determine which type of financing was ideal for their circumstances. The site listed 300+ green financing products and boasted nearly 75,000 unique visitors in its first year.

References who can vouch for the effectiveness of the Financing Finder include:

- BayREN and Santa Clara county– Natalie DeLeon (408) 993-4763
- San Jose – Tina Gonterman (408) 975-2522
- Chula Vista – Cory Downs (619)476-2442

Statewide Energy Finance ME&O Program (2015-current), Subcontractor

[2] Chosen as part of a team with Vanir Construction Management, EES Consulting and Best Best and Krieger as a PQP for San Jose Clean Energy. Applied as a PQP for Clean Energy Alliance as part of a team with ICF and Vanir.

DMS provided targeted support for the Statewide Finance ME&O campaign as directed by the CPUC. Tasks included working with a team to develop a three-year statewide marketing plan, establishing brand strategy and designing and implementing the marketing campaign which promoted state-backed energy financing products to strategic partners including contractors, trade organizations, community groups, lenders and governments. To date, the residential financing pilot has six participating lenders and over 264 approved contractors providing over $3.4 million in loans.

For additional examples of experience, including Energy Upgrade CA, Home Upgrade Incentive Program, LA County PACE Program, BayREN Financing, and grassroots outreach efforts, please visit www.Design-Manage-Sustain.com.

EVALUATION

Access to financing removes the first-cost barrier to implementing an energy project, thus increasing project volume and comprehensiveness. This proposal leverages private lenders to provide financing through an unbiased, web-based tool. It is a resource that supports and provides additionality to other programs that the region offers. The Financing Finder can and will influence measurable GHG reductions, energy savings and energy production, though it cannot directly impact it.

The CPUC has completed numerous process and impact evaluations of finance-related programs over the past 10 years. This proposal has been refined with the results and recommendations of these evaluations in mind, in particular those completed on the original CPUC-backed Financing Finder created for the former GoGreen Financing. One feature that has been added in response is the “Apply Now” button, which gets this program as close as possible to determining success by tracking the “hand-off” from the Financing Finder to the private lender.

DMS would welcome a program evaluation and expects that it would rely heavily on the previous evaluation undertaken by the CPUC. With this in mind, success for PCE’s Financing Finder is determined by verifying that the objectives defined at the beginning of the proposal are measurable and that goals are reasonable based on performance of the previous Financing Finder.

METRICS AND ASSUMPTIONS

In 2013, the CPUC directed the utilities and other program implementers to consider energy project financing programs a “resource program” until that time that the CPUC created a uniquely designed component to effectively calculate a financing program’s contribution as a non-resource program. Both in 2015 and currently, the CPUC considered the original statewide Financing Finder to be an ME&O activity and, thus, a resource program. The metrics outlined below are similar to those collected and accepted by the CPUC for the previous program.

Objective	Metrics/ KPIs	Goals
Develop database	# of products in the database	15 products in each market sector
Increase project volume and additionality	# of clicks on “Apply Online”	>1.5% of total unique web visits
	Survey listed lenders	Lenders report an increase
Provide community benefits	# of unique web visits # of repeat web visits	+5-10% growth per month
Additionality to existing programs	# of partnering programs	+10 partner programs
	KPIs reported by partner programs	TBD

Appendix

- Budget Spreadsheet
- Nathalie Nestor Resume
- Mark O’Brien Resume

APPENDIX: BUDGET SPREADSHEET (OPTION A)

Budget Option A:
PSE's IT department/ vendor codes the Financing Finder, web page(s) and API, which transfers updates from the database to the Financing Finder. DMS drives creative direction, user experience and management of the final product.

Expense Categories

EXPENSE	DESCRIPTION**	YEAR 1	% of Budget
Expense #1	Labor: Research and database creation	$18,750	25%
Expense #2	Labor: (2) Semi-annual database updates	$9,750	13%
Expense #3	Labor: Create Financing Finder and web tools	$12,750	17%
Expense #4	Labor: Create outreach materials and training	$18,750	25%
Expense #5	Labor: Training and coordinating with existing programs	$9,000	12%
Expense #6	Expense: Travel and printed collateral	$6,000	8%
TOTAL PROPOSAL EXPENSES		**$75,000**	**100%**

Labor Expense Breakdown

	STAFF	POSITION	LOADED RATE ($)	HOURS	TOTAL COST ($)
Expense #1	Nathalie Nestor	Design-Manage-Sustain	125	150	18,750
Expense #2	Nathalie Nestor	Design-Manage-Sustain	125	78	9,750
Expense #3	Nathalie Nestor	Design-Manage-Sustain	125	102	12,750
Expense #4	Nathalie Nestor	Design-Manage-Sustain	125	75	18,750
	Mark O'Brien	Marketing/Branding Consultant/ Copy Edit	75	125	
Expense #5	Nathalie Nestor	Design-Manage-Sustain	125	72	9,000
TOTAL LABOR EXPENSES				**602**	**$69,000**

APPENDIX: BUDGET SPREADSHEET (OPTION B)

Budget Option B:
DMS provides a web developer to create a microsite that hosts the Financing Finder and financing web pages including an API for the database.

Expense Categories

EXPENSE	DESCRIPTION**	YEAR 1	% of Budget
Expense #1	Labor: Research and database creation	$18,750	25%
Expense #2	Labor: (2) Semi-annual database updates	$9,750	13%
Expense #3	Labor: Create Financing Finder and web tools	$25,000	33.3%
Expense #4	Labor: Create outreach materials and training	$9,250	12.3%
Expense #5	Labor: Training and coordinating with existing programs	$9,250	12.3%
Expense #6	Expense: Travel and printed collateral	$3,000	4%
TOTAL PROPOSAL EXPENSES		**$75,000**	**100%**

Labor Expense Breakdown

	STAFF	POSITION	LOADED RATE ($)	HOURS	TOTAL COST ($)
Expense #1	Nathalie Nestor	Design-Manage-Sustain	125	150	18,750
Expense #2	Nathalie Nestor	Design-Manage-Sustain	125	78	9,750
Expense #3	Nathalie Nestor	Design-Manage-Sustain	125	40	25,000
	TBD	Web IT Consultant	20,000	1	
Expense #4	Nathalie Nestor	Design-Manage-Sustain	125	37	9,250
	Mark O'Brien	Marketing/Branding Consultant/ Copy Edit	75	65	
Expense #5	Nathalie Nestor	Design-Manage-Sustain	125	74	9,250
TOTAL LABOR EXPENSES				**442+**	**$72,000**

Resume

FIRM
Design-Manage-Sustain, LLC

EDUCATION
Master of Architecture, University of Washington, WA

Postgraduate work, Stanford University, CA

PROFESSIONAL LICENSES
Licensed Architect, Washington and Arizona

CERTIFICATIONS
Certified Project Management Professional (PMP)

Leadership in Energy and Environmental Design (LEED) Accredited Professional

AFFILIATIONS
US Green Building Council

American Institute of Architects (AIA)

Project Management Institute

Nathalie Nestor, AIA, PMP, LEED AP

Energy Financing Consultant

Summary of Qualifications

Nathalie Nestor has nearly 20 years of experience in energy, sustainability, and program management for some of the largest local and state governments in the United States, as well as private companies. She has a proven ability to develop, design, and implement innovative techniques to reach target groups and support business goals.

Known for her ability to work with a diverse group of stakeholders to reach consensus and implement solutions, Nathalie is well-known throughout the industry. She is an avid speaker and subject matter expert in energy project financing, local governments and community based organizations. She has earned a reputation for leading complex projects, building consensus and being tenacious about getting results from clients. This is done through a systematic approach to leadership, strategy, innovation and client development. Her successful track record demonstrates her unique ability to analyze numerous disparate amounts of information and design a solution that is elegant, efficient and good for the environment, while still accomplishing organizational goals.

Nathalie's credentials include a Master of Architecture from the University of Washington, architectural licenses in multiple states, Project Management Professional certification, and LEED Accredited Professional certification. She has been involved in the US Green Building Counsel since 2001 and was the founder and co-chair for the Los Angeles chapter's South Bay branch.

Project Experience

Client: CPUC
Program: Statewide Energy Finance Marketing, Education and Outreach Program
Location: CA (statewide)
Year: 2015-current
Provided targeted support for the Statewide Finance Marketing, Education and Outreach campaign as directed by the CPUC. Tasks included working with a team to develop a 3-year statewide marketing plan, establishing brand strategy, and designing and implementing the marketing campaign which promoted the state-backed energy financing products to strategic partners including contractors, trade organizations, community groups, lenders, and governments. To date, the residential financing pilot acquired 7 participating lenders and over 225 approved contractors providing over $3.5 million in loans.

Sub-consultant to Center for Sustainable Energy.

Client: CPUC
Program: GoGreen Financing
Location: CA (statewide)
Year: 2015-current

Created an impartial state-backed database and website that allowed property owners to search energy project financing options, compare them and learn more about the different financing types. The site hosted several unique tools that used intelligent learning software to help property owners determine which type of financing was ideal for their circumstances. The site listed 300+ green financing products and boasted over 80,000 unique visitors in its first year.

Sub-consultant to Center for Sustainable Energy.

Client: Los Angeles County
Program: Residential PACE Program
Location: Los Angeles, CA
Year: 2009 - 2015

Ms. Nestor has been involved in LA County's PACE Program since 2009, managing the program from the legal side - coordinating the assessment district, creating the legal documents, and identifying all program design requirements. In 2014, Ms. Nestor was again hired to work with County staff to issue an RFP for an administrator for the Residential PACE Program. Two administrators were chosen, and Ms. Nestor's firm, Design-Manage-Sustain, launched the program with them in the summer of 2015.

Consultant to Los Angeles County

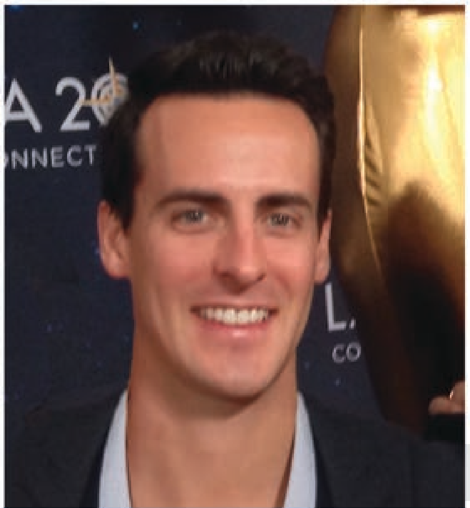
Client: Los Angeles County
Program: Commercial PACE Program
Location: Los Angeles, CA
Year: 2009 - 2014

Since July 2009, *Design-Manage-Sustain*, has been involved in the creation of LA County's Commercial PACE Financing Program. Early on, Ms. Nestor was involved in managing the program from the legal side - coordinating the assessment district, creating the legal documents, and all program design requirements. In 2012, Ms. Nestor was hired to manage the day-to-day implementation of the program. During the course of Ms. Nestor's management, the Program realized a 740% increase in applications representing more than $76 million in potential PACE financings.

Consultant to The Energy Coalition

Client: Los Angeles County
Program: Energy Champions Pilot Program
Location: Los Angeles, CA
Year: 2011-2012

The Energy Champions pilot program was created to test the effectiveness of communities to "champion" the cause of reducing energy waste by raising awareness of the cost-saving benefits of home energy efficiency and the incentives available to homeowners to complete them. Energy Champions hosted nearly 300 events and resulted in 169 energy upgrades within 18 months.



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EDUCATION

B.B.A. Marketing
University of Massachusetts, Amherst
GPA: 3.8
Summa Cum Laude

SKILLS

Strategy
Creativity
Communication
Vision
Leadership
Teamplayer

SOFTWARE

WEB DESIGN
WORDPRESS
PHOTOSHOP
MS OFFICE
HTML
CSS

LET'S MAKE
GOOD IDEAS
FAMOUS.

MARK O'BRIEN

DIGITAL MARKETING & WEB DESIGN

Gravitating toward that which is emerging, cutting edge and gainfully "disruptive", you could say that I'm a catalyst for change and a champion of fresh ideas. Ideas are contagious and have the potential to revolutionize minds, transform habits and carve new pathways into worn-out trails of human thought and culture. In short, I believe "marketing" is about the power of communicating ideas. Let's make GOOD ideas famous!

EXPERIENCE

Founder
2016 - 2018

MOVED BY MARK

As an independent marketing consultant, I currently help small and medium-sized businesses build and optimize their on and offline communications. I oversee a variety of marketing and advertising-related initiatives including brand and product positioning, customer development, lead generation, internal communications, and more.

Key deliverables include:

- Website development
- Brand guidelines
- Marketing collateral
- Powerpoint presentations
- SEM/SEO
- Investor pitch decks
- Webinars
- Social Media
- Email marketing
- And much more!

Brand & Media Specialist
2015 - 2016

CENTER FOR SUSTAINABLE ENERGY (CSE)

- Developed and executed integrated marketing strategies to support energy efficiency financing pilot program efforts
- Produced a variety of collateral materials in collaboration with in-house designers/agencies/partners
- Oversaw public-facing communications to ensure brand integrity and consistently monitored online brand reputation
- Drafted and reviewed website copy, blog posts, collateral materials, social media content, etc.

Marketing Associate
2011 - 2015

CENTER FOR SUSTAINABLE ENERGY (CSE)

- Led marketing efforts for distributed generation programs and connected marketing goals to CSE's broader strategic vision
- Collaborated with program managers, designers, marketing staff, research analysts, external agencies and regulators to develop integrated multimedia marketing strategies including:

- Digital ad campaigns (display, social, search)
- Television/ radio/ print
- Newsletters
- Collateral development
- Direct mail

Media & Communications Specialist
2011

U.S. GREEN CHAMBER OF COMMERCE

- Executed social media and email marketing strategies to increase member engagement
- Authored/co-authored press releases, event reviews, blog posts and miscellaneous website content
- Assisted in drafting grant and sponsorship proposals for non-profit funding

Design-Manage-Sustain
Bridging the Gap: With Energy Project Financing
8/3/18
Community Pilots

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**The program will not create revenue. It is a community service.**		**$0**	#DIV/0!	Requested
Income #2			**$0**	#DIV/0!	
Income #3			**$0**	#DIV/0!	
Income #4			**$0**	#DIV/0!	
Income #5			**$0**	#DIV/0!	
Income #6			**$0**	#DIV/0!	
Income #7			**$0**	#DIV/0!	
Income #8			**$0**	#DIV/0!	
Income #9			**$0**	#DIV/0!	
Income #10			**$0**	#DIV/0!	
	Total	**$0**	**$0**		

REVENUE SUMMARY		
Total Requested	**$0**	#DIV/0!
Total Pledged	**$0**	#DIV/0!
Total Received	**$0**	#DIV/0!
Total Estimated	**$0**	#DIV/0!
TOTAL PROPOSAL REVENUE	**$0**	#DIV/0!

Budget Option B:
DMS provides a web developer to create a microsite that hosts the Financing Finder and financing web pages including an API for the database.

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Labor: Research and database creation	$18,750	**$18,750**	25.00%	
Expense #2	Labor: (2) Semi-annual database updates	$9,750	**$9,750**	13.00%	
Expense #3	Labor: Create Financing Finder and web tools (Option B per proposal)	$25,000	**$25,000**	33.33%	
Expense #4	Labor: Create outreach materials and training	$9,250	**$9,250**	12.33%	
Expense #5	Labor: Training and coordinatng with existing programs	$9,250	**$9,250**	12.33%	
Expense #6	Expense: Travel and printed collateral	$3,000	**$3,000**	4.00%	
TOTAL PROPOSAL EXPENSES		**$75,000**	**$75,000**	**100%**	

Net Income - Expenses	**(75,000)**	**(75,000)**	

LABOR EXPENSE BREAKDOWN

	Staff	Position	Loaded Rate ($)	Hours	Total Cost ($)
Expense #1	Nathalie Nestor	Design-Manage-Sustain	125	150	18750
Expense #2	Nathalie Nestor	Design-Manage-Sustain	125	78	9750
Expense #3	Nathalie Nestor	Design-Manage-Sustain	125	40	25000
	TBD	Web Consultant	20000	1	
Expense #4	Nathalie Nestor	Design-Manage-Sustain	125	37	
	Mark O'brien	Marketing/Branding Consultant	75	62	9250
Expense #5	Nathalie Nestor	Design-Manage-Sustain	125	74	9250
Total Labor Expenses				**442**	**$ 72,000**

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Appendix

- Budget Spreadsheet
- Nathalie Nestor Resume
- Mark O'Brien Resume

APPENDIX: BUDGET SPREADSHEET (OPTION A)

Budget Option A:
PSE's IT department/ vendor codes the Financing Finder, web page(s) and API, which transfers updates from the database to the Financing Finder. DMS drives creative direction, user experience and management of the final product.

Expense Categories

EXPENSE	DESCRIPTION**	YEAR 1	% of Budget
Expense #1	Labor: Research and database creation	$18,750	25%
Expense #2	Labor: (2) Semi-annual database updates	$9,750	13%
Expense #3	Labor: Create Financing Finder and web tools	$12,750	17%
Expense #4	Labor: Create outreach materials and training	$18,750	25%
Expense #5	Labor: Training and coordinating with existing programs	$9,000	12%
Expense #6	Expense: Travel and printed collateral	$6,000	8%
TOTAL PROPOSAL EXPENSES		**$75,000**	**100%**

Labor Expense Breakdown

	STAFF	POSITION	LOADED RATE ($)	HOURS	TOTAL COST ($)
Expense #1	Nathalie Nestor	Design-Manage-Sustain	125	150	18,750
Expense #2	Nathalie Nestor	Design-Manage-Sustain	125	78	9,750
Expense #3	Nathalie Nestor	Design-Manage-Sustain	125	102	12,750
Expense #4	Nathalie Nestor	Design-Manage-Sustain	125	75	18,750
	Mark O'Brien	Marketing/Branding Consultant/ Copy Edit	75	125	
Expense #5	Nathalie Nestor	Design-Manage-Sustain	125	72	9,000
TOTAL LABOR EXPENSES				**602**	**$69,000**

APPENDIX: BUDGET SPREADSHEET (OPTION B)

Budget Option B:
DMS provides a web developer to create a microsite that hosts the Financing Finder and financing web pages including an API for the database.

Expense Categories

EXPENSE	DESCRIPTION**	YEAR 1	% of Budget
Expense #1	Labor: Research and database creation	$18,750	25%
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Expense #4	Labor: Create outreach materials and training	$9,250	12.3%
Expense #5	Labor: Training and coordinating with existing programs	$9,250	12.3%
Expense #6	Expense: Travel and printed collateral	$3,000	4%
TOTAL PROPOSAL EXPENSES		**$75,000**	**100%**

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	TBD	Web IT Consultant	20,000	1	
Expense #4	Nathalie Nestor	Design-Manage-Sustain	125	37	9,250
	Mark O'Brien	Marketing/Branding Consultant/ Copy Edit	75	65	
Expense #5	Nathalie Nestor	Design-Manage-Sustain	125	74	9,250
TOTAL LABOR EXPENSES				**442+**	**$72,000**

Nathalie Nestor, AIA, PMP, LEED AP

Energy Financing Consultant

FIRM
Design-Manage-Sustain, LLC

EDUCATION
Master of Architecture, University of Washington, WA

Postgraduate work, Stanford University, CA

PROFESSIONAL LICENSES
Licensed Architect, Washington and Arizona

CERTIFICATIONS
Certified Project Management Professional (PMP)

Leadership in Energy and Environmental Design (LEED) Accredited Professional

AFFILIATIONS
US Green Building Council

American Institute of Architects (AIA)

Project Management Institute

Summary of Qualifications

Nathalie Nestor has nearly 20 years of experience in energy, sustainability, and program management for some of the largest local and state governments in the United States, as well as private companies. She has a proven ability to develop, design, and implement innovative techniques to reach target groups and support business goals.

Known for her ability to work with a diverse group of stakeholders to reach consensus and implement solutions, Nathalie is well-known throughout the industry. She is an avid speaker and subject matter expert in energy project financing, local governments and community based organizations. She has earned a reputation for leading complex projects, building consensus and being tenacious about getting results from clients. This is done through a systematic approach to leadership, strategy, innovation and client development. Her successful track record demonstrates her unique ability to analyze numerous disparate amounts of information and design a solution that is elegant, efficient and good for the environment, while still accomplishing organizational goals.

Nathalie's credentials include a Master of Architecture from the University of Washington, architectural licenses in multiple states, Project Management Professional certification, and LEED Accredited Professional certification. She has been involved in the US Green Building Counsel since 2001 and was the founder and co-chair for the Los Angeles chapter's South Bay branch.

Project Experience

Client: CPUC
Program: Statewide Energy Finance Marketing, Education and Outreach Program
Location: CA (statewide)
Year: 2015-current
Provided targeted support for the Statewide Finance Marketing, Education and Outreach campaign as directed by the CPUC. Tasks included working with a team to develop a 3-year statewide marketing plan, establishing brand strategy, and designing and implementing the marketing campaign which promoted the state-backed energy financing products to strategic partners including contractors, trade organizations, community groups, lenders, and governments. To date, the residential financing pilot acquired 7 participating lenders and over 225 approved contractors providing over $3.5 million in loans.

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www.movedbymark.com

movedbymark@gmail.com

EDUCATION

B.B.A. Marketing
University of Massachusetts, Amherst
GPA: 3.8
Summa Cum Laude

SKILLS

Strategy
Creativity
Communication
Vision
Leadership
Teamplayer

SOFTWARE

WEB DESIGN
WORDPRESS
PHOTOSHOP
MS OFFICE
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CSS

LET'S MAKE
GOOD IDEAS
FAMOUS.

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Brand & Media Specialist

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2011

U.S. GREEN CHAMBER OF COMMERCE

- Executed social media and email marketing strategies to increase member engagement
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- Assisted in drafting grant and sponsorship proposals for non-profit funding

ELECTRIC VEHICLE 101

Submitted by

the Electric Auto Association

and

350 Bay Area Transportation Campaign

Contact:
Marc Geller
Vice Chair of the Board of Directors
Electric Auto Association
415-336-5678
marc@dybbuk.com

Project Description

Electric Vehicle 101 will present a series of classes to educate the EV curious about the feasibility of becoming electric vehicle owners in an open environment with no sales pressure. Experienced and passionate presenters will cover all the topics involved in choosing the right EV and having a successful ownership experience. Topics to be covered include the models of available vehicles including all-electric and plug-in hybrid vehicles, their respective ranges, prices, available rebates and incentives, the options available to charge vehicles, what's needed to set up personal charging infrastructure and the complications of multi-unit dwellings, along with public charging, as well as the individual, environmental and social benefits of ownership. All of this will be discussed in the context of communicating that switching from a gas or diesel to an electric car is likely the most significant action an individual or business can take to reduce their own GHG footprint. There will be ample time for questions and answers as direct exchanges help people to personalize the information and promote EV adoption.

People who are in the market for a car, and may be considering electric vehicles, often have no objective source of information. Dealerships are notoriously uninformed, and often likely to steer prospective customers toward their more profitable gas vehicles. Misconceptions abound - about price, availability, and charging to name just a few of the issues. To accelerate adoption of electric vehicles quickly enough to achieve our GHG and air pollution reduction goals, we must reach out to people where they are and answer the questions they have about their particular circumstance.

We will directly address the common misconceptions about EVs, which were cited in the CARB study (California's Advanced Clean Cars Midterm Review, 2017) and that are often barriers to adoption: that they are all too expensive, that their range is too short for normal usage, and that there is not enough charging infrastructure. Our knowledge of the existing and upcoming market and conditions, and our own experience as EV drivers will help to provide authentic and practical information to our audiences.

There are, of course, real barriers to EV ownership, whether financial or because of lack of a place to plug in at multi-unit dwellings, for example, which need to be addressed as well. The relative benefits of purchasing versus leasing new vehicles will be discussed. The increasingly attractive opportunities to purchase used vehicles will receive special attention. The newly available incentives that include used vehicles, available to people under a particular income threshold, along with the range of incentives now available to low and moderate income customers, including the new Beneficial State Foundation program just recently launched, will all be covered.

In discussing EVs, we will set them in the larger context that even greater impact in reducing GHG's come from using 100% renewable energy. Our vision for the near future, which we surely share with PCE, is to "electrify everything", with clean, renewable electricity to heat and cool our homes and businesses; to make hot water; as well as to power our transportation, whether personal cars, busses, trains or taxis. This is a clear, easy-to-communicate message to the public, who may place importance on reducing their carbon footprint, but may not know what steps to take. While there has been much legislation and innovation which makes it possible for people to adopt carbon-free energy, the public knowledge and perception of what is available seems to be lagging. It seems important to do the work of repeated public outreach with a clear message and attainable strategy to help quicken individual adoption of strategies to reduce one's carbon footprint. The classes will offer PCE an opportunity to share its messaging materials with us to present, and if desired have a staff member make a short presentation as part of the class.

We propose to give 8-12 classes without charge to attendees over the course of 18 months throughout San Mateo County, in convenient locations such as public libraries and community centers. Locations will include all areas served by PCE, with attention to differing populations in the county, with special attention to low income areas identified in the Community Vulnerability Index and in consultation with PCE. We intend to make special effort to create opportunities for communities that have not received appropriate attention in earlier EV promotion efforts.

Because additional consultation after the class may be useful to some attendees, we will explore the possibility of utilizing the call/help phone service currently under development by Plug In America and the Electric Auto Association. (We have included a line item in our budget should this become available to utilize during the project.) Our past experience has shown that people often need still more direct encouragement and personalized attention to aid in going electric, and this PIA/EAA project in development may offer such a post-class opportunity.

Outcomes

Accelerating GHG reduction and renewables

As transportation currently contributes over 40% of GHG's in the PCE's service territory, the need to speed adoption of EVs is critical. According to the US Department of Energy Alternative Fuels Data Center, the average electric vehicle in California releases 1,965 pounds of CO2 equivalent annually. The average gas car in California releases 11,435 pounds. Stated another way, an EV releases less than 20% of the GHG of a gas car. The importance of accelerating the adoption of electric transportation is undeniable. Of course the cleaner the source of the electricity, the lower the GHG emissions. If PCE's sources are cleaner than the California average, the switch to an EV is of even greater benefit than that just stated.

So far, EV adoption has been too slow, far below the rate needed to stave off the worst effects of climate change, and unlikely to meet the state's target of 5 million EVs on the road by 2030. While the adoption rate in the PCE area and adjoining areas is among the highest in the state, that adoption is not evenly distributed among the population's various demographic and income groups The quick change over to EVs is hampered by public perceptions, the inaction or undermining by the automakers and oil interests, and the unequally distributed public charging infrastructure. One strategy, proposed in this document, is to reach people in a focused, friendly atmosphere, sharing our own experience as EV drivers and encouraging neighborly discussion that can help people make purchasing decisions that contribute to efforts to reduce GHG emissions.

As to quantifying the GHG reduction benefits of classes such as these, we have at this point only anecdotal evidence. In classes taught as part of Stanford University's Health Improvement Program by Marc Geller along with three colleagues since 2015, the program director, based on correspondence with attendees, estimates that of the approximately 550 attendees, 10-20% acquired EVs within 6 months of taking the class. In fact, a more rigorous survey of attendees is underway now, and we will share the results with PCE as soon as available (within weeks of this application's submission.)

The State of California has not pursued nor funded efforts such as proposed here through any of its funding mechanisms.

Community Benefit

Information about the availability, affordability and low cost of ownership must be brought to vulnerable and low income communities if we are to see a broad adoption of EVs. There now are a number of programs that provide greater financial support for low income people to buy EVs, yet evidence is that the information is not yet reaching the intended communities. The benefits of EV adoption are already well-known: the reduced cost of ownership both because electricity is cheaper than gasoline and the fact that electric vehicles cost less to maintain. The health benefits to all communities of EVs are well understood, but are even more critical to communities that are the victims of the environmental injustice of being located in areas of greater air pollution.

This program seeks to serve the San Mateo community, and anyone who is interested can come to the talks. It is difficult to know audience size, but based upon experience we intend to serve 25 to 75 people per session. Total numbers should be in the range of 250 to 1,000 people served over 18 months. Our experience is that numbers will build over time. Our target audience is expected to be a mix of individuals and business customers of PCE, as well as people who work within the PCE area, including local government employees.

We have included in our proposal our intention to hire and train a person from within PCE's service territory, preferably a Spanish speaker, to help with outreach and to eventually become co-presenters at the classes. This would mean training them to learn about PCE, renewable energy, the landscape of electric vehicles, charging and rebates, and the fundamentals of community outreach.

Supports PCE's load serving needs

Ensuring a large number of electric vehicles capable of charging when useful to the utility will likely be the least expensive mechanism for dealing with over-generation due to intermittent renewable sources of power. The more EVs there are in San Mateo County, the more energy storage they can provide.

As the availability of excess daytime renewable energy increases, vehicles connected to the grid during these peak times will become increasingly valuable. Therefore, outreach efforts to people who work during peak hours in San Mateo County and park their cars here will become most helpful to the grid. Workplace charging infrastructure is only beneficial to the extent it is utilized. Outreach to employees of enterprises with or contemplating granting access to power for cars will receive special attention.

Additional Benefits

These classes should help PCE introduce itself to the communities within its service territory.

Local companies such as Electric Motor Werks are developing systems that will be critical to integrating EVs and the grid efficiently. Pilot programs with such companies should be explored to take advantage of the increasing numbers of EVs connected to the grid.

Additional EVs will result in greater demand for electricity, increasing billable kWh.

Scalability

Once the program is up and running, it should become less expensive to keep producing additional classes. Some initial costs, such as curriculum development, need not be repeatedly incurred.

PCE Implementation Requirements

As stated above, this proposal provides a valuable opportunity to PCE to introduce itself to its new customers. We presume PCE will want to take advantage of the opportunity to have PCE staff introduce themselves, present PCE programs, incentives, etc during the classes. This could aid PCE's own early introduction and general outreach efforts.

Should PCE develop its own EV incentive programs (as Sonoma Clean Power and MCE are doing,) these classes would be a ready and available vehicle for promotion.

We will request that PCE help to publicize these classes, in order to augment our independent efforts. Proposers will provide content, flyers, digital copy, etc. Our efforts will amplify PCE's own outreach and education efforts.

Qualifications

Teacher/speakers will include:

Marc Geller, Vice Chairman of the Board of Directors of the Electric Auto Association; co-founder and Vice President of Plug In America; co-founder, Golden Gate Electric Vehicle Association.

Marc's only vehicles have been electric cars since August 2001. He has assisted in developing policies and legislation for Plug In America. He organized the first National Plug-in Day event. He has co-authored "Plug In America's Recommendation for Electric Vehicle Infrastructure" for the Newhall Ranch development project. Since October 2015 Marc has been co-teaching semi-annual classes "Is an Electric Vehicle Right for You" for Stanford University's Health Improvement Program, (Jane Rothstein, Manager, Environmental Behavior Change Program.)

Elena Engel, Co-Chair of 350 Bay Area Transportation Campaign. Elena has been active in promoting electric vehicles and in starting the "Electrify Everything" coalition. She has served as City Captain for the San Francisco NDEW Ride and Drive, and has partnered with the San Francisco Dept of the Environment to give EV 101 presentations.

Ron Freund, Past Chair, Member of the Board of Directors, Electric Auto Association.

Speakers such as rebate experts from the CVRP, Beneficial Foundation, Spanish speaking presenters, health educators and others with relevant expertise in this field will be called upon as conditions require.

Evaluation

Qualitatively, success is measured by exposing the population to unbiased, noncommercial information about the value and accessibility of electric vehicles.

Quantitatively, success is measured by the number of folks directly moved to switch from a gas to plug-in electric vehicle within the year following the class.

We will regularly survey participants to determine the numbers that have purchased/leased a plug-in vehicle after having taken the class.

Metrics and Assumptions

Owning and operating a gasoline car has become second nature to most people. Contemplating switching to an plug-in electric vehicle is daunting to most and fraught with frightening possibilities for disastrous outcomes. Cost, range anxiety, and charging are only the three most prominent concerns that need to be assuaged for people to even begin to contemplate making the switch. Norway has proven that extremely generous financial incentives along with a host of non-financial incentives can over time result in a near 50% plug-in vehicle share of the market. However, that is not the world we live in, even in California with its relatively generous offerings. Most people still don't realize the full range of plug-in vehicles already available, the incentives available, nor the ease of charging and the differing opportunities available to charge cars. Car dealers themselves often perpetuate misconceptions as sales staff remain unfamiliar with the relatively small number of offerings from their own manufacturer.

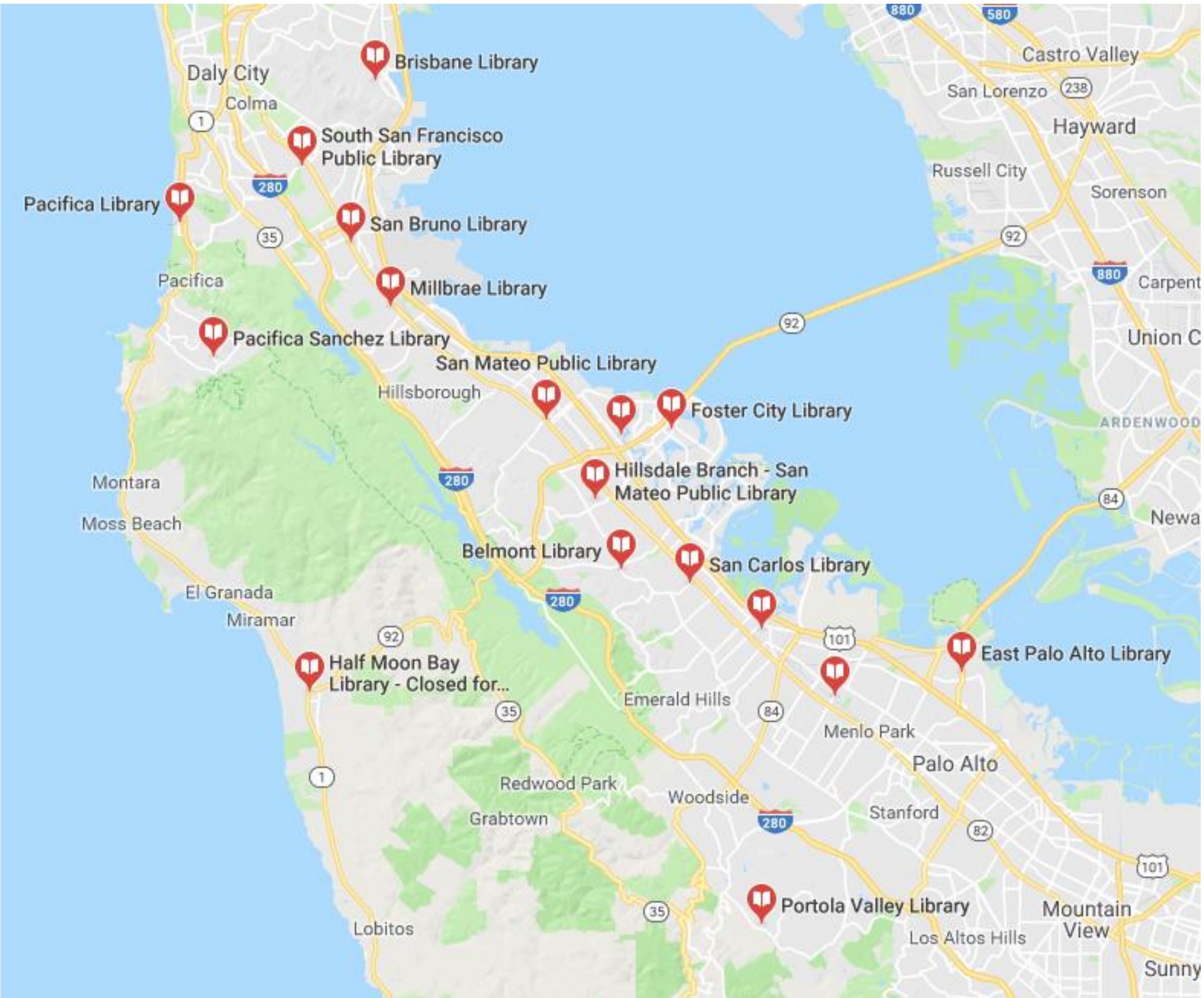
Only a small percentage of the car driving public is aware that EVs are an option, let alone an option that might serve them better and more inexpensively than a gas car. To spur adoption in an environment where huge incentives are not available which make an EV less expensive than a gas car, we must intervene to make information available when people are contemplating a car purchase. That is the intention of our EV 101 proposal.

The classes I have co-taught since October 2015 have resulted in 10-20% of the attendees switching to a plug-in vehicles within one year of taking the class. (Data regarding the numbers of class attendees who got a plug-in car will be available shortly and shared with PCE as an addendum to this application.)

As cited previously, according to the US Department of Energy Alternative Fuels Data Center the average electric vehicle in California releases 1965 pounds of CO2 equivalent annually. The average gas car in California releases 11,435 pounds. Stated another way, an EV releases less than 20% of the GHG of a gas car. Of course the cleaner the source of the electricity, the lower the GHG emissions. If PCE's sources are cleaner than the California average, it be assumed that a switch to an EV is of even greater benefit than that just stated.

To arrive at a Total 10 year GHG Benefit for the Submission Form, we conservatively estimated 50 people switched to EVs, resulting in a saving of 4,750,000 lbs of CO2 over 10 years. Using the google converter, we get 2154 metric tons. The savings is higher if more people convert, and lower depending on the number who get a plug-in hybrid, which result in a 50% rather than 80% GHG savings.

Public Libraries San Mateo County



Electric Auto Association
EV101
7/30/18
Community Pilots

		YEAR 1	TOTAL		STATUS*
REVENUE SOU SOURCE					
Income #1	**Requested from PCE**		**$68,250**	100%	Requested
Income #2			**$0**	0%	
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$68,250**		

REVENUE SUMMARY			
Total Requested		**$68,250**	100%
Total Pledged		**$0**	0%
Total Received		**$0**	0%
Total Estimated		**$0**	0%
TOTAL PROPOSAL REVENUE		**$68,250**	100%

If the expense request is classified as capital*, what is i**

EXPENSE	DESCRIPTION' YEAR 1		TOTAL	
Expense #1	Administration and plannin		**$28,800**	42%
Expense #2	PR and outreach 100 hours (		**$7,500**	11%
Expense #3	Curriculum Development fo		**$5,000**	7%
Expense #4	Payment for 2-3 speakers @$		**$7,200**	11%
Expense #5	Materials-- flyers, informatio		**$500**	1%
Expense #6	Post-class survey developme		**$2,500**	4%
Expense #7	Accounting services		**$1,500**	2%
Expense #8	Transportation costs for adm		**$250**	0%
Expense #9	Paid training and supervisio		**$10,000**	15%
Expense #10	Post-class access to PIA/EAA		**$5,000**	7%
TOTAL PROPOSAL EXPENSES		**$0**	**$68,250**	**100%**

Net Income - Expenses - -

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which

** For staff labor, specify the position, loaded rate and hours in the description.
*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over tim

PROPOSAL RESPONSE FOR

City of San Mateo Decarbonization Framework-Phase 1

Demonstrating an integrated approach to progressive policy development and program planning for Peninsula Clean Energy and its member cities

2018 Community Pilot Program

August 3, 2018

PRESENTED TO

Peninsula Clean Energy
2075 Woodside Rd
Redwood City, CA 94061

PRESENTED BY

Michael McGaraghan
Director
Energy Solutions
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ABOUT ENERGY SOLUTIONS

Founded in 1995, Energy Solutions is an employee-owned clean energy consulting firm. Our mission is to create large-scale environmental impacts by providing market-based, cost-effective energy, carbon, and water management solutions. We seek to develop reliable, high-value partnerships with our clients through a strong commitment to innovation, collaboration, and industry-leading quality.

TABLE OF CONTENTS

DESCRIPTION OF PROJECT

The City of San Mateo Decarbonization Framework-Phase 1 project seeks to demonstrate a scalable framework for PCE to: engage cities in collaborative planning, support local policy development, and introduce programs that support city efforts. This Phase 1 project will seek to: (1) increase Electric Vehicle (EV) readiness in San Mateo by facilitating adoption of an EV reach code and (2) develop a roadmap of high-impact policy initiatives and program opportunities that can be undertaken by PCE and its member communities. The engagement process, tools and templates used for the project can be leveraged to support similar initiatives throughout PCE territory. At the end of the project, Energy Solutions will facilitate a workshop for all PCE's member cities to review the project and learn about and discuss opportunities to undertake similar initiatives in their territory.

ABOUT SAN MATEO

The City of San Mateo is located approximately 20 miles south of San Francisco and encompasses approximately 13.5 square miles. The City shares borders with Belmont, Burlingame, Foster City, and Hillsborough, in addition to the unincorporated Highlands-Baywood Park area of San Mateo County. With a population of over 103,000, San Mateo is the second largest city in San Mateo County.

San Mateo is a mixed residential and commercial community, with a multimodal transportation network. The largest land use in the City is residential, comprised of single-family and multi-family housing options. Commercial and industrial uses constitute the second largest land use category. As an urbanized city, redevelopment and small-scale infill are the predominate forms of new development. The City is a charter city operating under a Council/Manager form of government. The five-member City Council serves as the legislative body, represents the entire community, and is empowered by the City Charter to formulate citywide policy. The City Manager, appointed by the Council, serves as the chief executive officer and is responsible for the day-to-day administration of City affairs. The Sustainability and Infrastructure Commission and Planning Commission will provide guidance in the update of the Climate Action Plan (CAP).

The City of San Mateo is committed to environmental stewardship and sustainability. In 2007, the City adopted the Sustainability Initiatives Plan, which was prepared by the ad hoc Sustainability Advisory Committee (since disbanded) to provide the City with an overall framework for reducing greenhouse gas (GHG) emissions and addressing a variety of sustainability initiatives in order to exceed the State's 2020 GHG emissions reduction target. The City's current CAP, adopted in 2015, was prepared with guidance from the Sustainability Commission. The Sustainability Commission served as an advisory body for the development of the CAP and has provided input on the implementation of CAP measures. The CAP provides two main pieces of technical information: 1) a GHG emissions inventory, and 2) calculation of the credit for measures and actions. This approach allows the City to measure progress toward the General Plan target of a 15 percent reduction in GHG emissions by 2020.

In 2019, the City of San Mateo is undertaking an update to its Climate Action Plan that will recommend new GHG emission reduction targets through 2030 that align with SB 32, and through 2050, to align with Executive Order B-30-15. The update will serve as the City's roadmap for achieving the newly established reduction goals. PCE's funding of this project — City of San Mateo Decarbonization Framework-Phase 1 — is a perfect complement to the City's already-planned CAP update, as it will demonstrate an optimal means for PCE to engage its member cities to advance mutual goals.

SCOPE OF WORK

Working closely with the City of San Mateo and PCE, Energy Solutions proposes an integrated policy and program development approach, to implement three key activities:

1. **Support EV-ready Building Code Adoption:** Energy Solutions will conduct technical analysis and develop an EV-ready building code cost-effectiveness report. Energy Solutions' staff will then develop model code language for City of San Mateo and support the City staff through the adoption process.
2. **Create an Integrated Policy and Program Roadmap:** In parallel with creating a model EV-ready building code, Energy Solutions will work with City staff and PCE to develop an Integrated Policy and Program Roadmap detailing a phased plan of policy initiatives the City can undertake and program models that PCE can offer to enhance the impact of local policies that are adopted.
3. **Engage Local Governments throughout the Region:** At the mid-way point of the project, Energy Solutions will distribute a project overview to PCE's member cities and facilitate a webinar to provide more detailed information about the project goals, process, and milestones. At the end of the project, Energy Solutions will facilitate a workshop for all PCE's member cities to review the project and discuss opportunities to undertake similar initiatives in their territory.

Task 1: Project Administration

The goal of this task is to manage the project to schedule and budget, while ensuring the team provides robust analysis and exceptional work.

Task 1.1: Kick-off Meeting

The goal of this task is to establish lines of communication and procedures for implementing this project. During the meeting, parties will discuss administrative and technical aspects of the project agreement, including expectations for accomplishing tasks described in the Scope of Work, ensure mutual understanding of the deliverables and due dates, and review the monthly progress report and technical product format. The draft meeting agenda will be provided to PCE five business days prior to the meeting seeking input and a final agenda will be circulated to all meeting participants 24 hours prior to the meeting. Notes from the kickoff meeting will be sent to meeting participants two business days following the kickoff meeting.

Task 1.2: Mid-term and Final Project Reports

The Mid-term Project Report will summarize activities performed during the reporting period, identify activities planned for the next reporting period, and identify issues that may affect performance and expenditures.

The Final Project Report will summarize the project methods, discuss the measurable impacts resulting from the implemented changes, and provide the Integrated Policy and Program Roadmap that will be developed in Task 3.1. Energy Solutions will provide recommended next steps for monitoring and training, as well as enforcement, to further PCE and PCE member objectives. The Final Report is envisioned to be a professionally produced document that is approximately ten pages with multiple graphics showcasing the process, outcomes, and roadmap items to other cities served by PCE.

Following delivery of the Mid-term and Final Project reports, Energy Solutions will schedule an in-person meeting with PCE and applicable local governments to review and discuss the report contents and other relevant topics. Energy Solutions will also issue a post-project satisfaction survey to PCE to obtain feedback on our performance.

Task 2: Advancing Electric Vehicle Infrastructure Codes

The goal of this task is to provide a model code adoption package based on CALGreen PEV Readiness voluntary code and local enhancements as described below. Updated codes will:

- Provide a model EVSE-readiness (electric vehicle supply equipment) code that can be adopted by the City of San Mateo and other PCE member municipalities;
- Significantly increases (e.g., double) the number of PEV ready parking spaces;
- Reduce PEV electrical infrastructure costs up to an order of magnitude due to proper planning, pre-installed conduit, and properly sized electrical systems; and
- Increase PEV adoption and achieve climate and local air pollution benefits.

Energy Solutions will develop a presentation and fact sheet which introduces the concepts and benefits of EV reach code adoption and addresses the conditions and cost-effectiveness of adopting a reach code. For instance, as shown in Table 1, the multi-family statewide CALGreen codes require that 3 percent of parking spaces in new construction are PEV Ready, far below current EV adoption rates and state goals of 1.5 million vehicles in 2015 requiring a ramp to 15 percent of all vehicle sales by 2025. In addition, the current mandatory codes exempt multi-family housing with between three and 17 units.

Table 1: Comparison of CALGreen Mandatory and Voluntary EV Readiness Standards

	Nonresidential			Multi-family	
	Mandatory	Voluntary			
		Tier 1	Tier 2	Current Mandatory	Current Voluntary
Minimum threshold	10 parking spaces	10 parking spaces	One parking space	17 units	17 units
Percent of new parking spaces that must be EV Ready	~6%[1]	~8%	~10%	3%	5%

The existing City of San Mateo EV reach code demonstrates the City of San Mateo's willingness to take a leadership role on EV reach codes, and the existing code can be significantly upgraded by following the example of other progressive cities such as Oakland and San Francisco. These codes require that 20 percent of all new parking spaces are PEV Ready and 100 percent of spaces have some minimum elements of PEV-Readiness.

Task 2.1: EV Infrastructure Codes Cost-Effectiveness Report

Energy Solutions will analyze local conditions and develop a cost-effectiveness report that tailors our existing cost-effectiveness research to address the conditions in the City of San Mateo, including local labor and material costs. The research will focus on multifamily housing due to the persistent challenge of providing PEV infrastructure for this sector and the expected high concentration of disadvantaged community members in multifamily housing. The research will also address workplace charging, which is an important complementary strategy.

The report will document the benefits and costs of implementing tailored local codes compared to re-adopting the existing City of San Mateo code during the next code cycle. The report will

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[1] The number of parking spaces that must be EV-ready is determined based on steps that increase based on total parking spaces. The percentages in Table 4 are approximate.

also identify options to provide “plug-and-play” electrical infrastructure to support near-term PEV charging needs while also providing capacity to facilitate future PEV adoption ramp-up. In addition to the report, the team will create a presentation for local policy makers, including sustainability and building code staff.

Task 2.2: Develop Proposed Code Language and Adoption Memorandum
The team will develop model code language based on the cost-effectiveness modeling analysis and feedback from the City of San Mateo. This material will be accompanied by a memorandum describing the language, expected impacts, and how and why the code update will support EV adoption, including the increased number of EV-ready parking spaces and options to harmonize with state accessibility requirements. This material is expected to be complete by June 30, 2019.

Task 2.3: Provide Technical Support for Code Adoption
Throughout the code adoption process, the team will provide as-needed technical support, including preparation of staff memorandums for decision makers, answering questions during local agency public participation processes, suggesting any revisions needed to address public participation and input, preparing documents needed for the local adoption process, and assisting with drafting a letter to file with the Building Standards Commission. This process will continue until codes are adopted, unless a longer timeline is needed to address local concerns (we anticipate that this process would be completed by June 1, 2020, at the latest).

Task 3: Policy and Program Road-mapping

The goals of this task are to (1) identify local policy initiatives that can accelerate progress towards City of San Mateo’s Climate Action Plan goals, (2) identify programs that PCE can offer to support different progressive city policies, (3) determine the level of interest and political will among other cities in PCE territory to pursue additional policy initiatives.

Task 3.1: Develop Integrated Policy and Program Roadmap
Energy Solutions will develop a glossary of local policy initiatives that have been implemented elsewhere in California and across the country. Examples of policies include but are not limited to: codes and ordinances to promote zero-net energy (ZNE) buildings, electrification (buildings and transportation), load control, density, infill development, and building benchmarking and disclosure. Energy Solutions will also review City of San Mateo’s CAP, housing element, mid-to-long-term development plans, and other relevant documents with the goal to link CAP goals to policy opportunities for the City and program opportunities for PCE. Once research and analysis are complete, Energy Solutions will facilitate a collaborative design session with the City and PCE to identify synergistic program-policy opportunities and determine how to phase efforts for maximum impact.

As an example, the City may decide to adopt an ordinance that promotes all-electric design in multi-family construction projects by requiring more aggressive codes for mixed-fuel buildings, or allowing for higher density development, reduced setbacks, or other attractive measures. In parallel, PCE may decide to offer incentives for heat pump water heaters, induction stoves, and other measures that would replace gas appliances. The result is a more attractive customer value proposition, enabled through coordinated policy and program measures that PCE and the City intentionally undertook. Other similar examples include efforts to increase transit-oriented development, refrigerant management and/or retirement, and community-scale solar.

The results of the effort will be included in the Final Report, which will be an approximately ten-page, graphic-heavy memorandum that identifies and prioritizes policy and program opportunities that City of San Mateo and PCE can undertake in unison to maximize carbon reductions and community benefits, while laying a technical foundation that supports PCE's load serving needs. Each item on the Roadmap will have a brief description of its key elements and the value it provides, and the glossary of local policy initiatives will be included as an attachment to the Roadmap.

Task 3.2: Engage Local Governments
At the culmination of the project, Energy Solutions will invite PCE's local governments to a workshop. The workshop will be held in a central location on the Peninsula. Agenda topics will include, but not be limited to:

- Overview of the process and outcomes from the City of San Mateo EV code adoption initiative and the Integrated Policy and Program Roadmap
- Review of the 2019 Title 24 building code and the opportunities that remain for local policy development
- Review of local policy initiatives being undertaken elsewhere in California and around the country
- Discussion of high-impact policy opportunities for the Peninsula region
- Issuing a survey to help PCE understand where political will exists to champion and/or support progressive policy development

The survey results will be summarized and provided as an addendum to the Final Project Report. Actual survey responses will also be provided to PCE.

TIMELINE AND MILESTONES

As shown below in Figure 1, the technical project tasks will take place in parallel over the course of 12 months. Table 2 lists and briefly describes the key milestones and their due dates. In parallel with these efforts, the City of San Mateo anticipates launching their Climate Action Plan update starting in November of 2018 and expects the process to last approximately 12 months.

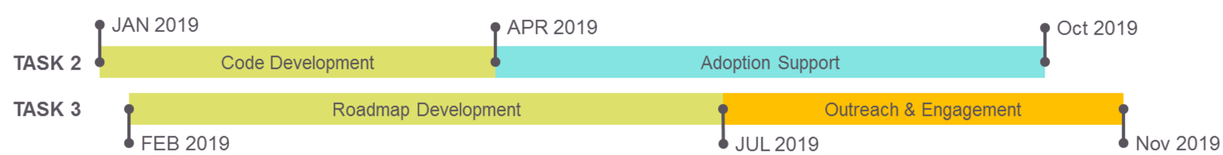

Figure 1: Project Timeline

Table 2: Milestone Dates

Milestone	Due Date	Description
Kickoff Meeting	1/10/2019	In-person meeting at PCE headquarters
Mid-term Report	6/30/2019	Three-page memorandum
Final Report	10/11/2019	Ten-page memorandum and Policy-Program Roadmap
Code Cost-effectiveness Report	4/5/2019	Ten-page summary.
City of San Mateo Code Proposal	6/28/2019	Detailed code language and memo
City of San Mateo Code Adopted	10/2/2019	City Council adopts EV reach code
Workshop	10/30/2019	Half-day in-person workshop

OUTCOMES

Accelerates GHG reductions and renewables: California's ZEV Action Plan defines a statewide goal of 1.5 million zero emission vehicles (mainly PEVs) by 2025. We estimate that by 2025, 4,800 metric tons of CO_2(e) emissions and 480,000 gallons of petroleum will be avoided annually from PEV-Ready spaces. Over a ten-year period, this amounts to approximately 47,000 metric tons of avoided GHGs. These calculations do not include benefits likely to occur due to spaces with some elements of PEV-readiness or the potential benefits of vehicle-grid integration (VGI). As a proxy, implementation of the City of Oakland building codes in the City of San Mateo would result in an estimated 1500 additional PEV-Ready charging spots and an additional 2500 parking spaces with some level of infrastructure by 2025, with further increases in the future. The project will also lead to significant reductions of carbon monoxide and other air pollutants, such as those leading to harmful levels of ozone and fine particulates. References for the assumptions used to prepare initial project benefit estimates are listed below under "metrics and assumptions."[2]

Delivers Community Benefits to Vulnerable Communities: The City of San Mateo has the highest Community Vulnerability Index (CVI) of all the cities in PCE territory. Moreover, considering one of the key barriers to EV ownership — lack of access to convenient vehicle charging — adopting more aggressive local codes is one of the most cost-effective ways to ensure low to moderate income (LMI) residents also benefit from accessible EV charging. EVs have lower lifetime operating costs and greater local public health benefits as compared to equivalent internal combustion engine (ICE) vehicles;[3] thus, increasing EV readiness provides lifetime economic benefits to those who need it most. In addition, we expect that 48 kg of local air pollutants will be avoided by each battery electric vehicle (reductions for plug-in hybrids can vary based on duty cycles and were not included in the analysis). Assuming that about half of PEVs will be battery electric vehicle (BEVs), the benefits from BEVs will include about 33,000 kg of avoided criteria pollutant benefits in 2025.

Supports PCE's Load Serving Needs: Increased adoption of grid-tied EVs will increase PCE's ability to shift load, including consuming load in over generation scenarios. Toward this end, Energy Solutions will seek to include vehicle-grid integration (VGI) enabling technical specifications into the codes that are developed. Beyond EVs, the Policy and Program Roadmap will align City climate action plan goals to PCE's load serving needs by defining actions that PCE and the City can undertake in unison to increase adoption of battery storage, building electrification, and flexible building loads through ordinances, codes, procurement specifications, community programs, and other initiatives.

Additional Benefits: As demonstrated by the dozen cities that Energy Solutions has assisted through the reach code development process, local policy development, and policy development generally, is a highly cost-effective and scalable means of accelerating progress toward energy, water, and carbon reduction goals. For example, the California investor-owned utilities (IOUs) spend less than five percent of their energy efficiency program budget on

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[2] Facilities that fall within the scope of Chapter 11B may not install any non-accessible EV charging stations unless the required number of accessible EV charging stations are also installed. Local codes will now ensure that facilities are designed to enable Chapter 11B compliance, which is not the case with current state level codes.

[3] For instance, see the "Cost-Effectiveness of Electric Vehicle" by M.J. Bradley http://mjbradley.com/sites/default/files/MA_PEV_CB_Analysis_FINAL_17nov16.pdf. This 2016 report was prepared for the state of Massachusetts, which has adopted the California Zero Emission Vehicle mandate.

building and appliance standards but achieve more than 60 percent of the portfolio savings from this modest investment. In addition to being scalable, the proactive engagement with cities proposed in this project will identify innovative program and policy levers that support PCE's mission and the City's climate action plan goals, clearly positioning PCE and the City of San Mateo as leaders in the region and the state.

PCE IMPLEMENTATION REQUIREMENTS

There are few distinct roles that Energy Solutions would like PCE to serve on the project. First, we seek PCE's participation in the development of the Integrated Policy and Program Roadmap. We estimate that this would equate to approximately 10 hours during the ideation and development stage, and approximately five hours to review and refine the deliverable. Secondly, we would like PCE to review and comment on the agenda and presentation materials for the workshop. We estimate this being approximately six-to-ten hours of staff time. Lastly, we seek PCE's support and assistance in convening local governments for the end-of-project workshop, including suggesting potential event spaces and deploying an email campaign to the cities to publicize the event. We estimate that the convening function should be less than five hours of staff time.

Energy Solutions is happy to include PCE at whatever level of engagement is desired. Our team will minimize burdens by providing content for email campaigns, clear agendas and primer materials for participatory meetings, and ensure that draft materials requiring review are well-developed and ready for a review from PCE.

QUALIFICATIONS

STAFF ROLES AND EXPERIENCE

Our staffing plan includes four key roles: Project Manager, EV Code Lead, Road-mapping Lead, and Research Associate. Additionally, Energy Solutions' Production Team will also provide support for deliverables, including copy editing, graphics development, and document design. The Project Manager will oversee the project's scope, schedule and budget and the Research Associate will undertake discrete research, content development, and other project support functions as needed. The EV Code Lead and Road-mapping Lead will be senior staff members that have highly relevant experience to the work they will be leading for this project.

Ed Pike, PE is a Senior Engineer at Energy Solutions and will serve as EV Code Lead. Ed has led the entirety of Energy Solutions clean transportation policy work and is widely recognized as an expert on EV codes. Ed brings more than 25 years of experience providing technical services in the energy and environmental fields. He has led Energy Solutions' efforts relating to the CALGreen Mandatory and Voluntary Code (Part 11 of Title 24, California Code of Regulations, also known as "CALGreen"), including developing the infrastructure cost model that is used to assess the cost-effectiveness for EV-ready infrastructure standards, the language for the codes, as well as the coordination with Building Standards Commission and the Department of Housing and Community Development. Ed has also led technical analysis and program design for EVSE and low-rolling-resistance tire incentive programs, provided subject matter expertise in support of utility integration to enable EV smart charging and automated demand response, and supported several local agencies through the analysis, design, and adoption process for EV-ready building codes. Prior to joining Energy Solutions, Mr. Pike spent five years at the International Council on Clean Transportation (ICCT) as the Electric Drive Program Manager, served as the Co-chair of California Plug-in Electric Vehicle

Collaborative Market Development Workgroup and spent 15 years at the United States Environmental Protection Agency helping local governments establish and implement Clean Air Act programs.

Nate Dewart is a Senior Project Manager at Energy Solutions and will serve as Road-mapping Lead. Nate has led multiple local policy efforts for the City of Richmond and City of Lancaster in the areas of ZNE buildings, all-electric buildings, integrated building and land use ordinances, and building benchmarking and disclosure. For local programs, Nate led the ZNE strategy and program design for a Social Impact Bond program that purchases vacant and blighted single family properties, designs and renovates them to be all-electric ZNE, and sells them to low-income residents and members of a first-time homebuyers' program. In January 2019, Nate will be leading Energy Solutions' work on a project titled Policy, Planning and Program Frameworks for Zero Carbon Communities. Nate also leads the Energy Solutions' Title 20 Appliance Standards Team in support of the California IOUs codes and standards program. This role includes overseeing appliance standards proposal submissions to the California Energy Commission, coordinating and managing industry engagement, technical support, and economic analysis. Nate has also served as Lead Report Author of recommendations to expand appliance standards into New York State. He has also been both the technical lead and contributor to several proposed measures for California appliance standards and building codes.

PROJECT EXPERIENCE

EV Infrastructure Cost Model and CALGreen EV Readiness Code Development: Energy Solutions developed the cost model used to assess the cost-effectiveness for the first mandatory EV-ready infrastructure standards for the CALGreen Building Code (Part 11 of Title 24, California Code of Regulations) in 2014. The infrastructure model is based on detailed labor and expense costs for more than 50 different EV infrastructure installation tasks and is customizable to local building types, labor and material costs. The model output is a comparison between the cost of EV-ready parking spaces and retrofitting EV infrastructure electric circuits after construction, showing roughly an order of magnitude cost-savings from EV readiness due to avoided costs such as breaking hardscape and retrofitting electrical panels. It has been reviewed by California code agencies (including the Building Standards Commission and Dept. of Housing and Community Development), California IOUs, EPRI, and leading EVSE manufacturers and Electric Vehicle Service Providers (EVSPs). Energy Solutions used this model to develop and recommend CALGreen EV Readiness standards to the Building Standards Commission and the Dept. of Housing and Community Development.

Local Agency EV Readiness Planning and Implementation: Energy Solutions has advised several local agencies on opportunities to adopt the Voluntary Code for multi-unit dwelling (MUDs) and has presented these lessons learned regarding cost-effectiveness and specific code options to local government officials and other stakeholders. In 2015 Energy Solutions helped the Cities of Oakland and Fremont, and City and County of San Francisco obtain funding from the California Energy Commission (CEC) for EV readiness planning and implementation. The scope included providing technical expertise to support local adoption of the CALGreen Voluntary Code, developing processes, collateral and training to facilitate permit streamlining, and administering training to city permitting and inspections staff as well as building industry stakeholders. All of the assets from this project can be made available to participating cities in the PCE territory. Since completing this project, Energy Solutions has developed an EV code for the City of Richmond, CA, a model code for the County of Monterey and its local jurisdictions, and a comprehensive survey of EV reach codes across the country.

Richmond Advanced Energy Community: Through an Advanced Energy Communities (AEC) grant provided by the CEC, Energy Solutions led the development of an integrated policy, planning, and program framework to transform the City of Richmond, California into a Zero Net Energy (ZNE) community. The framework integrates forward-looking strategies in energy, land use, transportation, and municipal financing to reach the City of Richmond's Climate Action Plan goals. Energy Solutions was responsible for designing a comprehensive plan for achieving ZNE in new and existing buildings, pursuing both mandatory and voluntary demand side management strategies to lay the foundation for the City's long-term approach. Energy Solutions helped the City of Richmond craft a ZNE ordinance for new single family homes, a requirement for mixed-fuel multi-family buildings to have a design rating at least 15 percent better than the mandatory Title 24 Building Energy Efficiency Standards, and a requirement for all multi-family buildings to offset site energy use by 80 percent with on-site renewable generation. At the same time, the City has been implementing a first-of-its-kind Social Impact Bond to facilitate the acquisition, rehabilitation, and sale of foreclosed and/or abandoned properties in the City to low-income families at fair market value, giving the first opportunity to members of the first-time homebuyer program graduates. As part of this project, Energy Solutions designed two online tools to facilitate market adoption of ZNE building measures: a ZNE Decision Tool and a Benchmarking Compliance Platform. In 2019, Energy Solutions is contracted by the California Air Resources Board (CARB) to lead a project building on the Energy Commission funded work titled Policy, Planning and Program Frameworks for Zero Carbon Communities.

ZNE Decision Tool **–** To help aid in compliance with this ordinance, and to additionally incentivize zero net energy (ZNE) performance in low-rise multi-family new construction, Energy Solutions designed a ZNE Early Adopter Program that uses a ZNE Decision Tool to enable builders and developers to optimize cost-effective measure combinations to achieve ZNE building performance. The Tool is designed on annual energy simulations from the California Building Energy Code Compliance (CBECC-Res) software. Partnering with a building developer, architect and contractors, Energy Solutions developed building energy models, technology specifications, and life cycle cost analysis applicable to four distinct prototype homes in the Richmond Housing Renovation Program. The team demonstrated that these buildings could not only achieve Zero Net Energy, but also that rebuilding homes without natural gas is more cost-effective (and better for the environment). Because of this effort, a developer reused the all-electric design strategy at numerous projects throughout California's Bay Area, showing that the Richmond project successes are creating spillover effects that are sustained in the market.

Benchmarking Compliance Platform **–** Energy Solutions has developed a proposal for the City of Richmond for the adoption of a benchmarking and assessment policy that would allow the City and utility partners to systematically assess the energy consumption and opportunity of its building stock. The Richmond City Council plans to adopt this policy in Q4 of 2018. Energy Solutions laid the foundation for implementation of this policy by specifying a software platform that will enable the City to maximize building owner compliance through a suite of data validations, portfolio analysis and insight capabilities, and a pipeline of whole-building retrofit opportunities, thereby unlocking the largest portion of the City's emissions inventory (existing buildings). The software system addressed the City's concerns over compliance costs and is being designed so that other local governments can configure and deploy the system as well.

Lancaster ZNE Ordinance and Battery Storage Guidelines: Energy Solutions modeled the cost-effectiveness for the City of Lancaster's residential ZNE ordinance, and supported development of the application to the CEC. Energy Solutions also developed residential battery energy storage sizing guidelines for 3 use cases (off-grid buildings, emergency resilience, demand response/load shifting).

Title 24 Building Energy Efficiency Standards: Since 2008, Energy Solutions has served as both a Technical Lead and Prime Consultant Team Manager of five consulting firms supporting California utilities in the California Building Energy Efficiency Standards (Title 24) proceedings. Energy Solutions supported the adoption of 35 code change proposals, during the 2013 and 2016 code cycles. The adopted measures addressed energy efficiency across a variety of building systems in residential and nonresidential buildings and industrial processes.

EVALUATION

The success of this project will be measured by the successful adoption of an EVSE reach code that aligns with the outcomes the City and PCE have set for EV adoption and carbon reduction. Additionally, success will also be measured by the expressed interest from other cities in undertaking similar local policy initiatives, as well as the commitments the City of San Mateo and PCE make to implementing the elements of the Roadmap. Data to inform the evaluation of the Roadmap effort will be collected via surveys of workshop participants and interviews with PCE and the City of San Mateo.

METRICS AND ASSUMPTIONS

Given the variety of possibilities that could be included in the Roadmap (Task 3), Energy Solutions is only reporting benefits from adoption of the EV reach code. The benefits are based on comparing the populations served by this PCE project, to the benefits provided for the recent Energy Solutions project with Fremont, Oakland, and San Francisco. Additional details for these calculations are located in the Appendix of the California Energy Commission Alternative and Renewable Fuel and Vehicle Technology Program Final Project Report. We would calculate estimated benefits specifically for the PCE service territory served by this project, and update all of these estimates and assumptions to include the increased carbon savings that would occur due to cleaner electricity being delivered to residents and businesses in PCE’s service territory, compared to PG&E’s electricity mix.

While future PEV adoption rates are uncertain, the project team expects that the vast majority of infrastructure resulting from this project will be utilized, given the state’s ambitious PEV adoption goals, the high and growing levels of PEV adoption in the Bay Area, and continued advancements in PEV technologies and battery ranges by vehicle manufacturers.

Insert YOUR ORGANIZATION'S NAME
Insert PROPOSAL TITLE
Insert Date
Community Pilots

REVENUE SOURCE	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	Requested from PCE	$75,000	**$75,000**	4%	Requested
Income #2	CARB Research Project: Policy, Planning and Program Frameworks for Zero Net Carbon Communities	$240,000	**$240,000**	14%	Pledged
Income #3	Energy Commission Research Project: Richmond Advanced Energy Community Phase 1	$400,000	**$400,000**	23%	Received
Income #4	City of Lancaster Local Policy Technical Support Project: Solar PV and Battery Storage Ordinance	$35,000	**$35,000**	2%	Received
Income #5	PG&E REACH Code Technical Support: Scope TBD	$150,000	**$150,000**	9%	Estimated
Income #6	Energy Commission and PG&E Funded EV Readiness REACH Code Development: Oakland, San Francisco, Fre	$200,000	**$200,000**	11%	Received
Income #7	PG&E Funded Modeling Project: EVSE Infrastructure Cost Model for Code Feasibility Analysis	$150,000	**$150,000**	9%	Received
Income #8	Energy Commission Deployment Project: Richmond Advanced Energy Community Phase 2	$500,000	**$500,000**	29%	Estimated
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$1,750,000**	**$1,750,000**		

REVENUE SUMMARY		
Total Requested	**$75,000**	4%
Total Pledged	**$240,000**	14%
Total Received	**$785,000**	45%
Total Estimated	**$650,000**	37%
TOTAL PROPOSAL REVENUE	**$1,750,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Project Manager (Project Manager; $159/hr; 64 hours)	$10,017	**$10,017**	13%	
Expense #2	Carbon Neutral Strategy Subject Matter Expert (Sr. Project Manager; $206/hr; 100 hours)	$20,600	**$20,600**	28%	
Expense #3	Electric Vehicle Subject Matter Expert (Sr. Engineer; $217/hr; 50 hours)	$13,020	**$13,020**	17%	
Expense #4	Research Associate (Associate; $141/hr; 150 hours)	$21,150	**$21,150**	28%	
Expense #5	GHG Strategy Analyst (Project Manager II; $176/hr; 20 hours)	$1,225	**$1,225**	2%	
Expense #6	Advisor (Director; $245/hr; 5 hours)	$3,520	**$3,520**	5%	
Expense #7	Creative Director (Marketing Manager; $159/hr; 15 hours)	$2,385	**$2,385**	3%	
Expense #8	Graphic Designer (Graphic Designer I; $141/hr; 20 hours)	$2,820	**$2,820**	4%	
Expense #9	Ground Travel ($0.50/mile; 300 miles)	$150	**$150**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$74,887**	**$74,887**	**100%**	

Net Income - Expenses	**1,675,113**	**1,675,113**	

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

OFFICE OF THE CITY MANAGER

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July 30, 2018

Community Pilots Program Manager
Peninsula Clean Energy
2075 Woodside Rd
Redwood City, CA 94061

RE: Commitment to support and participate in City of San Mateo Decarbonization Framework-Phase 1 Project

Dear Peninsula Clean Energy (PCE):

The City of San Mateo is pleased to provide this commitment letter for Energy Solutions proposal to implement the City of San Mateo Decarbonization Framework-Phase 1 Project.

With a population of over 103,000, San Mateo is the second largest city in San Mateo County. Of all the cities in PCE territory, San Mateo has the highest Community Vulnerability Index (CVI) score at 69.2. The City of San Mateo is committed to environmental stewardship and sustainability. In 2015, the City adopted its first Climate Action Plan (CAP), a framework for reducing greenhouse gas (GHG) emissions and addressing a variety of sustainability initiatives. Among other initiatives, the City adopted an Electric Vehicle (EV) reach code during the last code cycle, and the City plans to do so again in the upcoming code cycle.

In 2019, the City of San Mateo is undertaking an update to its CAP that will recommend new GHG emission reduction targets through 2030 that align with SB 32 and through 2050 to align with Executive Order B-30-15. The update will serve as the City's roadmap for achieving the newly established reduction goals. PCE's funding of the proposed City of San Mateo Decarbonization Framework-Phase 1 Project is a perfect complement to the City's already-planned CAP update as it will demonstrate an optimal means for PCE to engage its member cities to advance mutual goals.

In developing the proposed project design with the Energy Solutions team, the City has been impressed with their experiences in policy development, program design, EVs, building efficiency, as well as their strategic vision for how cities and community choice energy providers can collaborate to advance mutually beneficial goals pertaining to decarbonization of buildings and transportation. As such, we are excited for the opportunity to work with Energy Solutions, and PCE, on this project.

Please contact Andrea Chow at 650-522-7007 or achow@cityofsanmateo.org if you have any questions or if there is any other way that we can be of assistance.

Sincerely,

Larry A. Patterson
City Manager

EVmatch Community Charging Network

EVmatch, Inc.

Submission Date:

August 3rd, 2018

Contact Details:

Heather Hochrein
Chief Executive Officer
EVmatch, Inc.
530-260-3619
heather@evmatch.com

Project Description

Background

Transportation electrification is a critical component of our clean energy future and electric vehicle (EV) technology is paving the way in this transition. EVs have zero tailpipe emissions, lower life-cycle emissions compared to gasoline vehicles, and the potential to serve as distributed energy resources. EVs can significantly reduce San Mateo County's greenhouse gas emissions footprint, 57% of which came from vehicle emissions in 2013 (San Mateo County Open Data Portal). However, limited and unreliable EV charging prevents widespread adoption of these cleaner vehicles. Inadequate public charging infrastructure limits the range of current EV owners and causes stress, commonly referred to as "range-anxiety". Most public EV charging stations are not reservable and are limited in number. This is especially problematic for EV drivers without home charging access, such as renters, multi-unit dwellers, and commuters with a daily roundtrip commute that exceeds their vehicle's battery range.

EVmatch, Inc. (EVmatch) directly addresses this infrastructure challenge through an innovative peer-to-peer network for EV charging. The EVmatch network harnesses the power of sharing to immediately create more reliable charging options. EVmatch has developed web and mobile applications (iOS and Android) that allow EV drivers (Drivers) to easily find and reserve charging stations anywhere they go by enabling increased access to underutilized private charging stations. EVmatch launched its service in April 2017 in Southern California and has over 500 registered users. The company recently expanded to Boulder, Colorado as a winner of the Boulder Energy Challenge.

EVmatch reduces the stress in locating an available charger and can grow the public charging network in San Mateo County by over 10x simply by making private charging stations available to the public. By using EV charging infrastructure more efficiently, EVmatch will reduce "range anxiety" in PCE territory and eliminate the number one barrier to consumer adoption of EVs – lack of reliable charging.

Project Objectives

EVmatch will leverage its existing web and mobile software applications to rapidly build a community EV charging network in San Mateo County, leading to increased EV charging reliability and a corresponding increase in electric vehicle miles traveled (VMT). EVmatch's applications allow any EV driver to find, reserve, and pay for use of a private station in a few quick clicks, eliminating the stress and hassle in finding a place to charge. The application includes charger mapping, reservations, payment processing, and a pricing algorithm that accurately estimates the cost of residential charging transactions. The algorithm accounts for the varying cost of electricity across time and electricity service territories, and ensures accurate payouts to residential charging hosts (Hosts).

EVmatch will expand its service to San Mateo County through this project, recruiting a minimum of 50 charging hosts and 150 Drivers to participate in its sharing network over the course of twelve months. The community pilot will leverage investments in private charging resources to immediately address the need for greater EV charging reliability in San Mateo County. EVmatch will target three different host segments: 1) single-family residential charging station owners; 2) multi-family residential charging station owners; and 3) small and medium-sized businesses. EVmatch will offer discounted smart charging hardware to all Hosts in order to incentivize participation and enable enhanced networking features. These features include access control and real-time monitoring of EVmatch charging stations. **EVmatch is requesting $75,000 from Peninsula Clean Energy for implementation of its service in San Mateo County throughout 2019.** By utilizing the sharing economy, EVmatch will provide reservable charging access at a lower cost relative to current public charging networks and induce the purchase of EVs by those lacking home charging access.

Technology and Product Characteristics

Given its existing software platform, EVmatch is uniquely positioned to build its peer-to-peer charging network in PCE territory on an accelerated timeline. The EVmatch software application is a comprehensive sharing platform that provides all the features necessary to quickly find, reserve, and pay for use of a private charger. Drivers and Hosts access the EVmatch network through the company's web application (www.evmatch.com) and mobile applications (iOS and Android). The software is highly scalable, requiring no substantial additional features to expand to new service territories. EVmatch will update its pricing algorithm to include PCE electricity rates prior to launching the service in PCE territory. Current application features include:

- **Map interface:** Drivers in need of charging open the EVmatch application and search the map for a charging station that meets their needs. They can search by address, city, or zip code through an adapted Google Maps interface. Users can also filter listings by connector type, charging speed, availability, price, and instant reservation options.

- **Charger matching:** Each Host's listing includes important details to easily find a compatible charger. These details include the availability, power output, and plug-type for a station. Drivers can also view the price of any charging transaction and can compare prices across different times and with different Hosts.

- **Smart pricing:** EVmatch maintains a proprietary pricing algorithm that accurately estimates the cost of each charging transaction based on the power specifications of the EV and the charging station, the time of the reservation, and the electricity service provider. The calculator enables residential charging Hosts to confidently share home charger access knowing that they will be compensated for charging transactions appropriately.

- **Reservations:** Every EVmatch station is reservable in advance. Drivers submit a reservation request to Hosts, who review the request before accepting or denying it. Drivers and Hosts receive notifications about the status of pending and upcoming charging reservations. EVmatch is in the process of adding an instant booking feature to its application. This feature will be mandatory for all commercial listings and optional for residential chargers.

- **Payment processing:** EVmatch prompts Drivers to purchase charging credit in increments of $10 or $40. The credit is then automatically applied to a Driver's charging requests. If a Driver's credit balance is less than the cost of a proposed charging request, the Driver is prompted to purchase more credit before being able to complete the charging request. EVmatch is PCI compliant, leveraging a PCI Service Provider Level 1 to handle all customer payment information.

- **Credit storage & transfers:** Purchased charging credit is stored in a customer's virtual wallet within the application and deducted with each transaction. A Host's earned credit can either be converted into charging credit or disbursed to her bank account.

- **Customer Support:** EVmatch provides customer support Monday-Friday, 9am-5pm via in-app messaging, email support, and a direct phone number.

Hardware/Software Integration: EVmatch is developing a hardware/software integration through a partnership with eMotorWerks, an electric vehicle supply equipment (EVSE) manufacturing company based in San Carlos, CA. This integration will also allow EVmatch to expand its network to commercial charging hosts, including multi-unit residential properties and small and medium-sized businesses. By coupling the EVmatch software with eMotorWerks' JuiceNet API, EVmatch can track real-time use, electricity consumption, and regulate electricity flow for Hosts with JuiceNet- enabled hardware. EVmatch will facilitate this integration by providing Hosts with a $200 discount on a JuiceNet- enabled charging station from eMotorWerks, ClipperCreek, or AeroVironment (MSRP ranging from $599-$899).

These charging stations will connect to the EVmatch application via WiFi and communicate via eMotorWerks' open EVSE network, the JuiceNet. EVmatch will not provide installation services, but will offer a list of recommended local electrical contractors for installation. This hardware/software integration is currently underway, will be beta-tested in late 2018 in Boulder Colorado, and launched broadly through this pilot project in San Mateo County. This hardware/software integration will provide additional value to the company's current service offering, broaden its Host base by expanding to commercial properties, and enable future service offerings through enhanced data collection and aggregation.

Marketing and Outreach Plan

EVmatch will hire a Community Manager based in San Mateo County to implement a local sales and outreach campaign. The Community Manager will recruit residents, businesses, and property managers through a targeted marketing campaign, which will include direct mail, digital advertising, email marketing, and in-person sales and outreach. EVmatch will first target residential charging station owners as Hosts and then expand to commercial property owners beginning in the second quarter of 2019. For initial customer acquisition, EVmatch will leverage partnerships with community organizations, corporate partners, car dealerships, and will attend EV events and tradeshows. The company will leverage existing outreach and referral partnerships with complementary organizations and companies, including: Plug-In America, Electric Auto Association, Sierra Club, Pick My Solar, and Rising Sun Energy Center.

The Community Manager will also be responsible for managing the EVmatch paid advertising campaigns targeting new customers in PCE territory. The paid marketing campaigns will include a direct mail campaign to 3,000 San Mateo County residents and businesses, specifically targeting EV drivers and potential Hosts. It will also include digital advertising campaigns via Facebook, Twitter, Instagram, Google search, Cleantechnica, and other relevant publishers. The digital advertising campaign will geo-target and advertise EVmatch to individuals that currently frequent public charging stations. EVmatch will attend local community events, conduct door-to-door canvassing, and utilize email marketing. EVmatch will also implement a referral marketing program to recruit new customers to the network via current customer referrals.

Pilot Timeline

Table 1. EVmatch Community Charging Network Pilot Timeline (2019)	
Date	**Activity**
Jan.	Application upgrades and Community Manager hiring
Feb.	Marketing campaign planning and partnership development
Mar.	Launch service in PCE territory
Mar.-Dec.	Targeted marketing and customer acquisition
Jun.	Network target- 25 Hosts and 50 Drivers
Dec.	Network target- 50 Hosts and 100 Drivers

Outcomes

Accelerates GHG Reductions

EVmatch reduces greenhouse gas emissions (GHG) by increasing the number of electric vehicles miles traveled (VMT) relative to internal combustion engine VMT. EVmatch's innovative approach is a deep emissions reduction strategy that will both immediately reduce San Mateo County's passenger vehicle emissions and facilitate further emissions reductions as PCE shifts to 100% renewable electricity generation.

EVmatch estimates a reduction of 55 metric tons of CO_2e from this project assuming the following: EVmatch recruits 100 active users in San Mateo County, all electric miles powered by EVmatch displace internal combustion engine vehicle miles, and electricity from EVmatch charging stations are on average powered 85% from GHG-free sources and 15% from natural gas. Assumptions regarding number of charges per week, miles enabled per charge, and emissions reductions per mile are provided in Appendix A and as a separate attachment. This calculation assumes a small portion of drivers will use EVmatch to charge regularly (3x/week), while most customers will use EVmatch less frequently (2x/month) because they currently have another regular charging option. The company aims to increase its number of Primary Customers over time by inducing the purchase of an EV by those who currently lack dedicated charging access. In order to account for the ramp-up time required to recruit customers each quarter, EVmatch assumes charging with its full customer target number for only a portion of each quarter, as specified in Appendix A.

CO_2e reductions per electric VMT were quantified based on average results from a review of multiple peer-reviewed passenger vehicle life-cycle assessment studies (Appendix B). Per mile traveled, an EV will provide an emissions reduction of 343 grams CO_2e compared to a gasoline vehicle if powered by electricity from renewables and 206 grams CO_2e if powered by electricity from natural gas. It is important to note that this emissions reduction estimate includes total lifecycle emissions, taking into account the increased emissions for EV manufacturing relative to internal combustion engine vehicles.

Table 2. CO_2e reductions from EVmatch pilot project in San Mateo County assuming 85% of electricity comes from GHG-free sources							
Year	Quarter	EVmatch Drivers	Primary Customers	Secondary Customers	Battery Charges	Electric miles enabled	Total CO_2e reduced (kg)
2019	Q2	50	30%	80%	500	25,000	8,061
2019	Q3	75	40%	70%	900	45,000	14,510
2019	Q4	100	40%	70%	2,000	100,000	32,245
Total					**3,400**	**170,000**	**54,800**

This calculation only includes the emissions reductions from electric miles provided directly during this project. It does not account for any subsequent emissions reductions due to the induced purchase of EVs with expected lifetimes beyond the project timeline. Furthermore, as PCE continues to transition its generation portfolio to meet its goal of 100% renewable electricity by 2025, the emissions reductions the service creates will increase.

Full implementation: Assuming the service continues over the next decade at this pilot scale, EVmatch will reduce 550 metric tons of CO_2e. However, EVmatch is a highly scalable solution that can provide much greater impact at full implementation. At full scale, EVmatch anticipates serving over 150,000 customers (assuming a 20% market penetration) in San Mateo County. At this scale, EVmatch would reduce 195,000 metrics tons of CO_2e through its charging services annually.

Delivers Community Benefits

Through its reservable peer-to-peer charging network, EVmatch increases public access to reliable and convenient EV charging. Limited access to charging is currently a major barrier to widespread EV adoption, especially among renters and apartments dwellers. According to the 2010 US Census and American Community Survey, 42% of San Mateo County residents live in multi-unit dwellings and 41% are renters. Yet, according to EV consumer survey data collected through the Clean Vehicle Rebate Project (CVRP), only 5% of EV drivers in San Mateo County live in apartments and only 12% are renters. This mismatch highlights the need for creative charging solutions that specifically serve renters and apartment dwellers.

EVmatch's community-based charging network is that solution. The EVmatch service allows EV drivers to find and reserve charging stations anywhere they go by enabling increased access to underutilized private charging stations. EVmatch will reduces the stress in locating an available charger in San Mateo County and immediately grow the public charging network by making private charging stations available to the public. As of May 2015, 662 residents in San Mateo County who had purchased an EV lived in a single-family home (according to CVRP). By bringing a small subset (8%) of these home chargers into public use throughout this pilot project, EVmatch will dramatically increase charging accessibility throughout the community.

EVmatch will serve both residential and small business customers in this pilot, enabling them to list their Level 2 chargers on the EVmatch application and earn money by sharing access as Hosts. EVmatch will also serve battery electric vehicle (BEV) and plug-in hybrid electric vehicle (PHEV) drivers with increased access to chargers at these semi-public locations. The EVmatch platform services all EV types with Level 1 and Level 2 charging on a reservation basis. EVmatch is the only charging service that offers reservations for 100% of its chargers. This added reliability is a critical component to relieving “range anxiety”, which currently causes EV drivers stress and limits adoption.

EVmatch aims to have a minimum of 10% of Hosts in San Mateo County located within the top ten most vulnerable census tracts as identified by the Community Vulnerability Index. EVmatch will specifically target small businesses, non-profit organizations, and places of worship within these communities to become Hosts. EVmatch will offer increased incentives to Hosts in these census tracts, covering both charging hardware and installation costs (up to $3,000 per project). These Hosts must guarantee public access to chargers at a minimum of 50% of the time.

In addition to these community benefits, EVmatch will provide economic benefits to local community members by allowing Hosts to earn money from their private charging stations, increasing their return on investment and reducing their investment payback period. By utilizing a peer-to-peer model, EVmatch will keep more fuel dollars in the local community and allow residents to easily monetize their assets.

The EVmatch service supports the acceleration of EV adoption in San Mateo County at a much lower cost relative to traditional public charging projects. Purchasing and installing a new, public, networked Level 2 charging station comparable in features to that of EVmatch stations can cost $6-15K+ depending on the type of station and the associated permitting, installation, and labor costs. This pilot project will recruit 50 charging hosts at a total project cost of $75K. Assuming these stations are available to the public 50% of the time, this project will provide 25 public charging equivalents at a cost of $3K/station. This is a 50% to 80% reduction in costs per public charging station and a total savings of $75K to $300K compared to traditional Level 2 public charging station projects.

Supports PCE’s Load Serving Needs

EVmatch can help PCE manage future over-generation issues by increasing electricity consumption from EV charging during the middle of the day. EVmatch increases daytime charging options by providing access to charging stations near workplaces and other public locations that would not otherwise be usable by the public.

EVmatch specifically targets renters and apartments dwellers. Since most of these customers lack nighttime charging options at home, they are highly dependent on daytime charging options. By bridging this gap with its convenient, app-based service, full implementation of EVmatch in San Mateo County will induce new vehicle purchases from this customer segment.

In addition to growing public EV charging resources, the EVmatch service also incentivizes off-peak charging when coupled with time-of-use (TOU) electricity rates. EVmatch is the first of its kind and the only crowdsourced charging platform to provide tailored pricing based on cost of service. EVmatch currently has all PG&E residential electricity rates built into its database and will add in PCE-specific rates prior to launching this pilot. EVmatch updates its residential rate database annually to ensure accuracy.

Lastly, EVmatch’s software application will aggregate valuable data from PCE customers with EVs and can serve as an efficient communication platform to support future PCE-specific EV programs and load serving objectives. As a trusted service provider for EV drivers, EVmatch can utilize behavioral nudging techniques to influence charging and purchasing behavior. Targeted messaging through the EVmatch app, social media channels, and email campaigns can be used to communicate the benefits of EV ownership, smart EV charging, enrolling in TOU rate structures, PCE's ECO100 energy product, and/or other mutually agreed upon messages that benefit San Mateo County and the environment.

Additional Benefits

EVmatch provides an innovative approach to public charging and is the first of its kind. EVmatch provides a cost-effective, market-centric model for developing EV charging infrastructure. The EVmatch business model is also highly scalable, offering opportunities for major expansion with the rapidly growing EV market. The EVmatch service is centered around its web and mobile applications, which require only minor modifications to expand to new geographic areas and customer segments. EVmatch maintains no hardware assets but rather connects privately owned assets through its sharing platform. Hardware installations discussed in this proposal will be owned and operated by Hosts and not by EVmatch. This business model reduces startup costs and allows the company to quickly expand into new territories. The scalability of the EVmatch business model provides a strong competitive advantage for its service over all other public charging providers. While the process of siting, permitting, and installing a public charging station today can take months to years, EVmatch creates more public charging instantly, saving time, money, and resources.

This project will serve as a prominent starting point for the EVmatch service in San Francisco Bay Area, with major potential for expansion across the region and beyond. While the EVmatch platform is currently available to PG&E customers, no marketing or advertising resources have been dedicated to any of the nine Bay Area counties. EVmatch is currently implementing a similar pilot project in Boulder, Colorado as a winner of the 2017 Boulder Energy Challenge. In just four months, EVmatch has recruited 20 Hosts in Boulder and made these private chargers publicly available. Through its current Boulder pilot, EVmatch will complete its hardware/software integration and begin testing its commercial sales process.

PCE Implementation Requirements

EVmatch will implement this project independently and with minimal required PCE staff time. EVmatch will manage all components of the project including engineering, marketing and customer acquisition, customer service, and public relations.

If feasible, EVmatch would like to implement a co-marketing agreement with PCE to enhance visibility for both parties and drive demand for their respective services. EVmatch would deliver targeted messages about PCE offerings and initiatives through its application, social media channels, blog, and email campaigns. PCE would simultaneously promote EVmatch's service through its website, email newsletter, social media, bill inserts, blogs, and/or local events and workshops.

Qualifications

EVmatch, Inc. is a Delaware C corporation founded in 2016 and headquartered in Santa Barbara, California. EVmatch is led by co-founder and Chief Executive Officer (CEO), Heather Hochrein. She brings technical and business development expertise from years of working in the energy efficiency and electric utility sectors. She holds a Master of Environmental Science & Management from the University of California, Santa Barbara, and a Bachelor of Science from the University of California, Berkeley. Prior to EVmatch, Heather spent five years in leadership roles at Rising Sun Energy Center, a leading green workforce training organization, where she managed a $1.5 million annual budget and 25 staff members. Heather is supported by co-founder and member of the Board of Directors, Shannon Walker, who brings expertise in corporate sustainability, environmental management, and transportation planning. The team also includes three full stack JavaScript software developers and one marketing and customer research specialist.

Five advisors provide guidance and industry connections to EVmatch. This advisory board brings technical and business development expertise from the clean energy, automotive, and utility sectors. Matthew Burks is the Chief Strategy Officer at E Source, a company that provides independent research, advisory, and information services to electric utilities. David Felix serves as VP at MMA Energy Capital and previously was Senior Program Manager of Tesla's Supercharger team. Claire Dooley manages product analytics at Greenlots, a developer of software solutions for EV charging hardware. Jennifer Roberts leads Commercial Operations at Lola, an on-demand personal travel service, and previously served as VP of Global Business Operations at Kayak. Gary Fox is an electrical engineer who works as the Global Hardware Product Manager at Bosch Automotive.

Heather Hochrein was recently selected as a 2018 Echoing Green Climate Fellow. This prestigious two-year fellowship honors innovative leaders with bold new ideas for a more equitable and sustainable world, and will provide EVmatch with $93K in funding. In October 2017, EVmatch won the Boulder Energy Challenge and received a $50K grant to expand its service to Boulder, Colorado. In May 2017, EVmatch completed the MergeLane startup accelerator program for female-led companies based in Boulder, Colorado.

Additionally, EVmatch received numerous accolades as a student project including: Winner of MSNBC's Growing Hope Challenge; 2nd Place and People's Choice Award at the University of California Carbon Slam; 3rd Place at the University of California, Santa Barbara's New Venture Competition; Finalist at the University of California, Berkeley's Cleantech University Prize.

EVmatch will hire a locally-aware part-time Community Manager to manage this project in San Mateo County. The Community Manager will manage a local marketing and community outreach campaign, provide customer service to residents, and serve as the company's spokesperson at local events. The Community Manager will also conduct commercial sales and assist with installation referrals. EVmatch's CEO will dedicate a portion of her time to the day-to-day management of the PCE pilot project. The CEO will also supervise the Community Manager, the engineering team, and the overall direction and success of the project. She will also report to PCE staff on items including budget status and progress on project milestones.

Evaluation

This project will allow EVmatch to demonstrate the viability of its peer-to-peer charging network in San Mateo County with both residential and commercial Hosts. EVmatch will evaluate the effectiveness of this strategy at increasing EV charging availability and increasing the number of electric VMT in San Mateo County. The pilot will be evaluated at the middle and end of the project based on the target outcomes outlined in Table 3.

Table 3. EVmatch Pilot Outcome Goals

Benefit Category	Outcome
Increased EV charging	50 registered EVmatch charging hosts
Increased EV charging	100 registered EVmatch EV drivers
Increased EV charging	3,400 EV charges provided through EVmatch
Reduced GHGs	170,000 electric miles enabled
Reduced GHGs	55 metric tons CO_2e reduced
Vulnerable Communities	5 registered EVmatch charging hosts in vulnerable communities

Metrics and Assumptions

EVmatch estimated CO_2e emissions reductions for this pilot based on the projected number of electric VMT enabled by its service in San Mateo County over 12 months. All model input assumptions are outlined in Appendix A.

CO_2e reductions per electric VMT were quantified based on average results from a review of multiple peer-reviewed passenger vehicle life-cycle assessment studies. The specific life-cycle assessment studies are listing in Appendix B.

Appendix A

Appendix A. CO_2e Reduction Model Inputs		
Metric	**Value**	**Unit**
EV charges per week- Primary Customer	3	battery charges
EV charges per week- Secondary Customer	0.5	battery charges
Average range provided per EVmatch charge	50	miles
CO_2e reduced per BEV VMT relative to ICEV VMT (electricity source- natural gas)	0.206	kg
CO2e reduced per BEV VMT relative to ICEV VMT (electricity source- renewables)	0.343	kg
Q2 weeks of charging with quarterly customer target	8	weeks
Q3 weeks of charging with quarterly customer target	8	weeks
Q4 weeks of charging with quarterly customer target	13	weeks

Appendix B

Life-cycle Assessment Sources Used in Quantification of Emissions Reductions

Background Information: All studies were conducted in the U.S. The baseline considered for our analysis included a BEV, similar to a Nissan Leaf with a range of 80 miles (129 km), a PHEV, similar to a Chevrolet Volt with a battery range of 40 miles (64 km), and a conventional gasoline powered sedan, similar to a Toyota Camry.

Dunn, J. B., Gaines, L., Kelly, J. C., James, C., & Gallagher, K. G. (2015). The significance of Li-ion batteries in electric vehicle life-cycle energy and emissions and recycling's role in its reduction. *Energy & Environmental Science*, *8*(1), 158-168.

Samaras, C., & Meisterling, K. (2008). Life-cycle assessment of greenhouse gas emissions from plug-in hybrid vehicles: implications for policy. Environmental science & technology, 42(9), 3170-3176.

Tamayao, M. A. M., Michalek, J. J., Hendrickson, C., & Azevedo, I. M. (2015). Regional variability and uncertainty of electric vehicle life-cycle CO2 emissions across the United States. Environmental Science & Technology, 49(14), 8844-8855.

U.S. Department of Energy, Hydrogen and Fuel Cells Program. (2014*). Cradle to Grave Lifecycle Analysis of Vehicle and Fuel Pathways, DOE Hydrogen and Fuel Cells Program Record*. Retrieved from: http://www.hydrogen.energy.gov/pdfs/14006_cradle_to_grave_analysis.pdf

EVmatch, Inc.
EVmatch Community Charging Network
8/3/18
Community Pilots

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	Peninsula Clean Energy	$75,000	**$75,000**	68%	Requested
Income #2	Private Investment (Angel Investor)	$25,000	**$25,000**	23%	Pledged
Income #3	Echoing Green Fellowship	$10,000	**$10,000**	9%	Received
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$110,000**	**$110,000**		

REVENUE SUMMARY		
Total Requested	**$75,000**	68%
Total Pledged	**$25,000**	23%
Total Received	**$10,000**	9%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$110,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	San Mateo County Community Manager, $30 per hour, 1040 hours	$31,200	**$31,200**	31%	
Expense #2	CEO, $50 per hour, 200 hours	$10,000	**$10,000**	10%	
Expense #3	Software Developer, $125 per hour, 100 hours	$12,500	**$12,500**	13%	
Expense #4	JuiceNet-enabled EV charger incentives, $200 per charger, 45 chargers	$9,000	**$9,000**	9%	
Expense #5	Vulnerable communities EV charger and installation incentives, $3,000 per project, 5 projects	$15,000	**$15,000**	15%	
Expense #6	Digital advertising	$12,000	**$12,000**	12%	
Expense #7	Marketing materials	$1,000	**$1,000**	1%	
Expense #8	Event fees	$1,000	**$1,000**	1%	
Expense #9	Direct mail campaign, $1 per piece, 3,000 pieces	$3,000	**$3,000**	3%	
Expense #10	Office space	$5,000	**$5,000**	5%	
TOTAL PROPOSAL EXPENSES		**$99,700**	**$99,700**	**100%**	

Net Income - Expenses	**10,300**	**10,300**

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Table 2. CO_2e reductions from EVmatch pilot project in San Mateo County assuming 85% of electricity comes from GHG-free sources							
Year	Quarter	EVmatch Drivers	Primary Customers	Secondary Customers	Battery Charges	Electric miles enabled	Total CO_2e reduced (kg)
2019	Q2	50	30%	80%	500	25,000	8,061
2019	Q3	75	40%	70%	900	45,000	14,510
2019	Q4	100	40%	70%	2,000	100,000	32,245
Total					**3,400**	**170,000**	**54,800**

Appendix A. CO_2e Reduction Model Inputs		
Metric	**Value**	**Unit**
EV charges per week- Primary Customer	3	battery charges
EV charges per week- Secondary Customer	0.5	battery charges
Average range provided per EVmatch charge	50	miles
CO_2e reduced per BEV VMT relative to ICEV VMT (electricity source- natural gas)	0.206	kg
CO2e reduced per BEV VMT relative to ICEV VMT (electricity source- renewables)	0.343	kg
Q2 weeks of charging with quarterly customer target	8	weeks
Q3 weeks of charging with quarterly customer target	8	weeks
Q4 weeks of charging with quarterly customer target	13	weeks

Devil's Canyon Brewery-

Providing solar for a community space

Brandon Bradford
Energy Design and Sales Manager
InterMountain ELECTRIC COMPANY
947 Washington Street | San Carlos, CA 94070
Office (650) 591-7118 | Cell (650-222-7244)
Fax (650) 591-7123 | Brandon@im-electric.com
Visit our website @ www.im-electric.com

Project Description

Intermountain Electric in partnership with Devil's Canyon Brewery proposes a two Solar Carports ina collaborative effort towards meeting Peninsula Clean Energy's objectives for San Mateo County.

InterMountain Electric Company, is one of the freshest and steadily growing design-build companies in the San Francisco Bay Area. Intermountain is a local, Union, Electrical contractor that has made commercial renewable a huge focus in the companies direction.

Devi's Canyon Brewery in San Carlos is known for it's community building. As a local, family owned craft brewery, they've invested heavily in also being environmentally friendly. The brewery operates full time as a production facility and event center. Over 8,000 visitors come to the brewery each month, for event that feature live music, food trucks, craft beer and root beer.

Devil's Canyon has been a prime example and a case study for the County of San Mateo, See here

http://www.smcenergywatch.com/devilscanyonbrewery

With solar, we'd like to take the next steps:

- Offset Devil's Canyon's electrical load with solar
- Provide a shaded community space to expand their community events through
- Provide community visibility and support for PCE's goals to achieve 100% GHG-free power by 2021 and 100% renewable energy by 2025
- Provide press release and engagement with local media about PCE grant
- Develop and implement successful pilot that can be used as a commercial example for the businesses in the County of San Mateo

Partner roles and expectations:

- Intermountain is going to design, build, and maintain the solar with the oversite and approval of the owners at Devil's Canyon

Outcomes

a) **Accelerates GHG reductions and renewables**
Offset Devil's Canyon's electrical load . Detailed information can be found below

Delivers community benefits

Solar Powered Learning will provide several community benefits in alignment with the strategic goals outlined in PCE's Integrated Resource Plan. Specifically:

- Workforce benefit : Intermountain Electric will use local IBEW 617 labor for the design, build, and maintenance of the project.
- Customers within PCE's geography: Offset of electrical load, providing of excess energy back into the grid

b) Supports PCE's load serving needs

[It does not, but can be designed to add

c) Additional benefits

PCE's strategic goals include developing "a diverse power portfolio that is greenhouse gas free" and to "stimulate development of new renewable energy projects and clean-tech innovation in SMC."

By setting the example that local businesses can "Figure out" solar, Intermountain Electric can provide the case study and format of how these projects can be feasible and profitable for the mid-size commercial space.

.

PCE Implementation Requirements

At this time, we do not foresee any additional staff burden for PCE employees beyond establishing the contract to provide power to the grid and coordinating with InterMountain Electric and/or PG&E. PCE will be welcome to perform site visits at any time.

Qualifications

- Intermountain Electric Company has 14+ years as a Design-Build electrical contractor in the PG&E region, and extensive experience with commercial solar

Evaluation

Success will be evaluated through the following measures:

- The offset of Devil's Canyon electrical load as much as possible in the space provided

Metrics and Assumptions

Budget

The largest portion of the budget will go to the materials and installation of the solar carport arrays. A portion of the budget will go into the rehabilitation of the parking lot, and bringing the area up to city code in regards to visibility, landscaping, and paving.

Solar for Devil's Canyon.

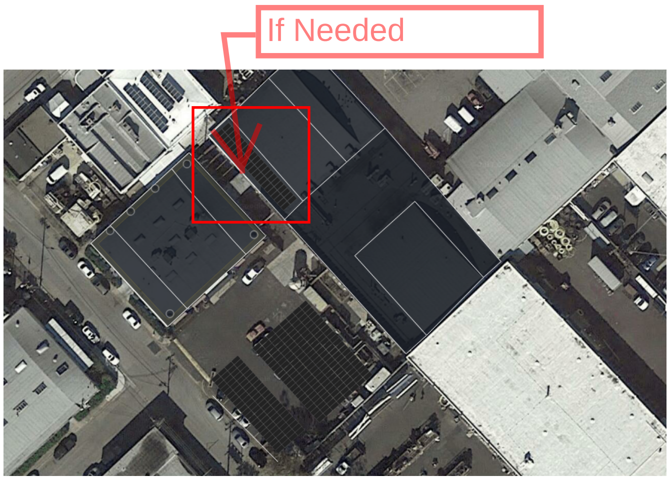
Intermountain Electric Company, one of the freshest and steadily growing design build companies in the San Francisco Bay Area. We are enjoying a period of rapid, healthy growth which positions us to meet and exceed your design build and customer service expectations for both commercial and industrial projects. We have extensive experience in all phases of the design build process.

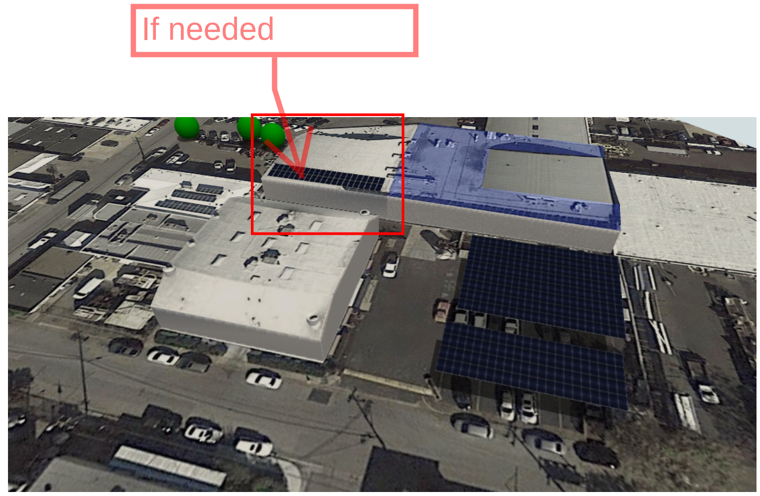
We've provided a layout that covers the entire entertainment area and extra parking in the back for Devil's Canyon- with an optional "if needed" roof option if increases in usage are expected. Savings are still based on the orignal sizing.

1. <u>90% Energy Coverage- Roof if needed.</u>

Initial cost to Devil's Canyon?

$0





What Does a PPA of this size do for your business?

It gives back an average of

$1,739

from your electric bill each month over the lifetime of the project

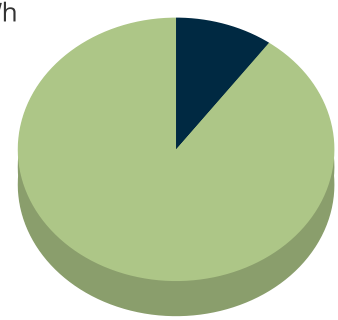
It saves

$521,674

over the lifetime of the system

Energy Consumption Mix

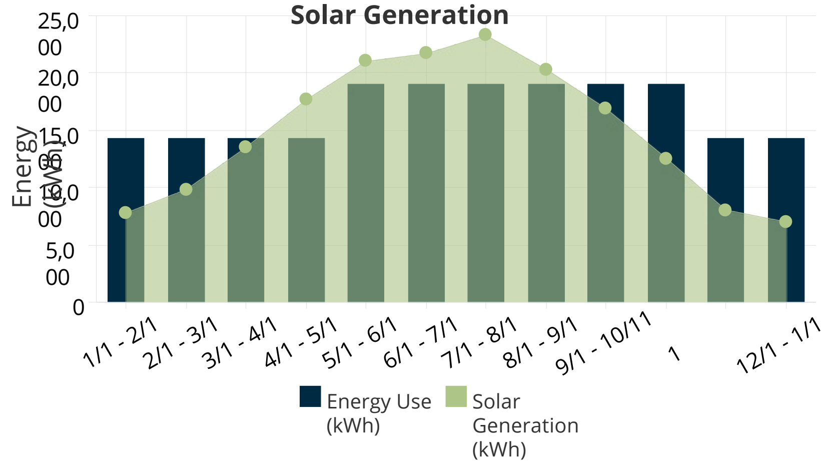
Annual Energy Use: 199,554 kWh



(90%)Utility 19,959 kWh

(10.00%) Solar PV 179,595 kWh (90.00%)

Monthly Energy Use vs Solar Generation



Billing Schedule

Below is an estimated billing schedule using the standard PG&E increases for the past 10 years and tying our escalation to constantly be 1% less than that. Our escalation for this contract is locked at a max of 3% a year, no matter if PG&E increases their pricing.

**Discounted energy drops after year one to pay for the paving of the parking lot.

PG&E 4% increase per year. PPA rate 3%/yr Panel efficieny degredation at .25% per year

year	PGE weighted	PGE Bill- No Solar	PPA rate	Total New Bill- With Solar	Customer savings per year	Customer running sum of
1	0.2300	$45,897.42	0.2000	$40,509.57	$5,387.85	$5,387.85
2	0.2392	$47,733.32	0.1800	$37,127.87	$10,605.44	$15,993.29
3	0.2488	$49,642.65	0.1854	$38,318.91	$11,323.74	$27,317.04
4	0.2587	$51,628.36	0.1910	$39,550.63	$12,077.73	$39,394.77
5	0.2691	$53,693.49	0.1967	$40,824.51	$12,868.98	$52,263.75
6	0.2798	$55,841.23	0.2026	$42,142.10	$13,699.13	$65,962.88
7	0.2910	$58,074.88	0.2087	$43,504.98	$14,569.90	$80,532.78
8	0.3027	$60,397.87	0.2149	$44,914.81	$15,483.06	$96,015.84
9	0.3148	$62,813.79	0.2214	$46,373.31	$16,440.48	$112,456.33
10	0.3274	$65,326.34	0.2280	$47,882.26	$17,444.08	$129,900.41
11	0.3405	$67,939.39	0.2349	$49,443.52	$18,495.88	$148,396.28
12	0.3541	$70,656.97	0.2419	$51,059.01	$19,597.96	$167,994.25
13	0.3682	$73,483.25	0.2492	$52,730.73	$20,752.52	$188,746.77
14	0.3830	$76,422.58	0.2566	$54,460.76	$21,961.82	$210,708.58
15	0.3983	$79,479.48	0.2643	$56,251.26	$23,228.23	$233,936.81
16	0.4142	$82,658.66	0.2723	$58,104.46	$24,554.20	$258,491.01
17	0.4308	$85,965.01	0.2804	$60,022.70	$25,942.31	$284,433.32
18	0.4480	$89,403.61	0.2888	$62,008.39	$27,395.21	$311,828.54
19	0.4659	$92,979.75	0.2975	$64,064.06	$28,915.70	$340,744.23
20	0.4846	$96,698.94	0.3064	$66,192.30	$30,506.64	$371,250.88
21	0.5040	$100,566.90	0.3156	$68,395.83	$32,171.07	$403,421.94
22	0.5241	$104,589.58	0.3251	$70,677.48	$33,912.09	$437,334.04
23	0.5451	$108,773.16	0.3349	$73,040.17	$35,732.99	$473,067.02
24	0.5669	$113,124.08	0.3449	$75,486.95	$37,637.13	$510,704.16
25	0.5896	$117,649.05	0.3552	$78,020.98	$39,628.07	$550,332.23
26	0.6131	$122,355.01	0.3659	$80,645.55	$41,709.46	$592,041.69
27	0.6377	$127,249.21	0.3769	$83,364.08	$43,885.13	$635,926.82
28	0.6632	$132,339.18	0.3882	$86,180.12	$46,159.06	$682,085.88
29	0.6897	$137,632.75	0.3998	$89,097.36	$48,535.38	$730,621.26
30	0.7173	$143,138.06	0.4118	$92,119.65	$51,018.40	$781,639.66

Insert YOUR ORGANIZATION'S NAME	Intermountain Electric Company	
Insert PROPOSAL TITLE	Devil's Canyon Solar	
Insert Date		8/3/18
Community Pilots		

REVENUE SOURCES	**SOURCE**	**YEAR 1**	**TOTAL**		**STATUS***
Income #1	**Intermountain Financing**	$350,000	**$350,000**	100%	Pledged
Income #2			**$0**	0%	
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$350,000**	**$350,000**		

REVENUE SUMMARY		
Total Requested	**$0**	0%
Total Pledged	**$350,000**	100%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$350,000**	100%

EXPENSE	**DESCRIPTION****	**YEAR 1**	**TOTAL**		**If the expense request is classified as capital***, what is its anticipated length of service**
Expense #1	Materials	$289,827	**$289,827**	83%	
Expense #2	Labor	$20,173	**$20,173**	6%	
Expense #3			**$0**	0%	
Expense #4	Design	$5,000	**$5,000**	1%	
Expense #5	Repavement	$30,000	**$30,000**	9%	
Expense #6	Landscaping	$5,000	**$5,000**	1%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$350,000**	**$350,000**	**100%**	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Cover Page

Project Name:
Versailles Smart Grid Project

Project Site:
Versailles
10 Crystal Springs Rd
San Mateo, CA 94402

Applicant Organization:
Intertie, Incorporated

Key Partners:
Ash Street Green Partners LLC • 10 Crystal Springs Rd., San Mateo, CA 94402
eMotorWerks • 846 Bransten Rd, San Carlos, CA 94070
Lexa Corporation • 136 Stanley St, Redwood City, CA 94062
(all participants are Bay Area based companies)

Point of Contact:
Richard Mrlik
Founder and President
Intertie, Incorporated
(415) 567-0446
rmrlik@intertie.com

Description of Project

Abstract
Versailles is an independent senior living community consisting of 61 condominium residences located next to the downtown shopping district of San Mateo. Its residents are interested in clean energy and recently asked Ash Street Green Partners, the manager of the services at Versailles, to provide electric vehicle charging and enable the community to both reduce their GHG emissions and promote clean energy. Ash Street Green Partners is working with Intertie Incorporated, a clean tech startup in the Bay Area, to build an innovative pilot project that meets the emerging EV needs of the Versailles community while advancing the grid of the future for Peninsula Clean Energy (PCE). The Versailles pilot project will deploy Intertie's modular, smart-grid technology, the EV ChargePod, that draws power from available grid capacity and local solar resources, efficiently stores electricity; then optimally routes power to fast-charge electric vehicles and supply the host or grid. The innovative system provides fast-charging to electric vehicles without stressing the grid, integrates local solar PV, provides backup power to the senior living community, supplies demand response, peak shaving and other a grid services while improving local grid reliability.

Objectives
The main objective of this project is to deliver clean energy benefits to the local community by reducing greenhouse gas emissions through increased electric vehicle usage and maximizing the penetration of local solar PV. The Project's objectives are as follows:

1) Demonstrate how the modular, scalable EV ChargePod solution can reliable meet Versailles' requirements and provide a flexible blueprint for other senior living communities and multi-family dwellings to adopt.
2) Accelerate the adoption of electric vehicle transportation in the Versailles community by supplying convenient, super-fast charging capable of supplying over 20 residents daily without impacting the grid or needing any PG&E upgrades.
3) Utilize intelligent battery storage and software to match supply and load and enable the maximum penetration of solar PV on the local distribution circuit.
4) Provide tangible and measurable clean energy benefits to San Mateo County. Intertie will measure and assess the EV ChargePod's performance in reducing GHGs.
5) Provide behind-the-meter energy services that lowers building electric costs and supplying grid services including demand response, RA capacity and frequency regulation.
6) Provide clean backup power to the site, therefore removing the need for GHG emitting gas powered backup generator.

Roles of Partners
Intertie: Responsible for the development and execution of the project, including the design, installation and operation of the EV ChargePod.

Ash Street Green Partners: Responsible for interacting face to face with the Versailles community participants to make sure their clean energy goals are met through this project.

eMotorWerks: Supplies DC fast charging and Level 2 charging stations and charging platform.

Lexa Corporation: Provides design, engineering and software services necessary supporting development, installation and integration of EV ChargePod at the Versailles Project.

Sequence of Activities to Execute the Project

Task 1: Perform a full evaluation of the site including measuring the site energy load, identify and characterize all solar resources on the local distribution circuit and assess distribution circuits. (M1)

- **Subtask 1.1**: Assess PG&E's service, building electrical capacity and the site's electric load over the last twelve months. (M1)
- **Subtask 1.2:** Analyze the solar resources on distribution circuit supplying project using PG&E PV program mapping tool. (M1)

Task 2: Complete signed engineering drawings and obtain all required permitting (M1-M4).

- **Subtask 2.1**: Complete final electrical drawings for the Project, signed and stamped by professional electrical engineer. (M1-M2)
- **Subtask 2.2:** Meet with the City of San Mateo and obtain the required permitting for both the Level 2 Charging Station, battery storage and the EV ChargePod. (M2-M4)
- **Subtask 2.3** Complete and submit PG&E interconnection application per Electric Rule 21, Fast Track process. (M2-M4)

Task 3: Install eMotorwerks Level 2 Charging Station in Parking Garage to meet immediate EV Charging needs. (M5)

Task 4: Assemble and Install EV ChargePod at Site, (M6-M8)

- **Subtask 4.1:** Transport prefabricated, modular EV ChargePod components and install battery pack, charger station, disconnects, isolation transformer., and ancillary equipment in Parking Garage. (M6-M7)
- **Subtask 4.2:** Interconnect EV ChargePod in Parking Garage to building electric distribution system. (M8)
- **Subtask 4.3:** Install metering, local telemetry and communications hardware and connect EV ChargePod charging and solar peer-to-peer platform to the cloud. (M8)

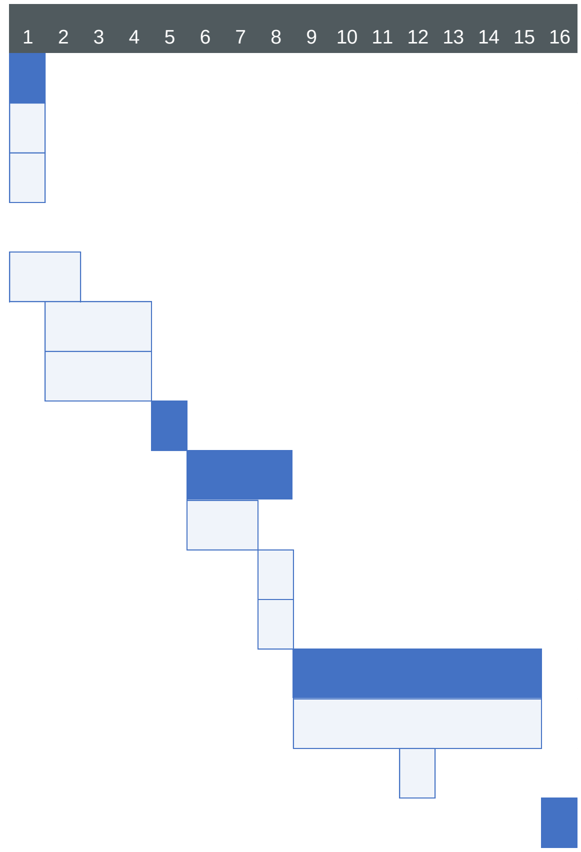
Task 5: Operate and monitor the Project's performance. (M9-15)

- **Subtask 5.1:** Track performance of site and record data. Collaborate with PCE staff to meet their data needs and is a useful platform for their ongoing use (M9-M15)
- **Subtask 5.2:** Provide platform software with user-friendly dashboard to PCE for real time data acquisition. (M12)

Task 6: Complete White Paper on Versailles Project for PCE and the public. (M16)

Gantt Chart on Sequence of Events

Task #	Task	Months
1	Perform Full Evaluation of Site	1
1.1	Analyze site load	1
1.2	Analyze solar resources on distribution circuit	1
2	Complete engineering drawings and required permitting	4
2.1	Complete engineering drawings	2
2.2	Complete permitting with City of San Mateo	3
2.3	Complete and submit PG&E interconnection application	3
3	Install eMotorWerks Level 2 Charger at Site	1
4	Assemble and Install EV ChargePod at Site	3
4.1	Prefabricate and assembly EV ChargePod	2
4.2	Interconnect EV ChargePod (parking lot to electric room)	1
4.3	Install meter to EV ChargePod and connect to cloud	1
5	Operate and Monitor the Project’s Performance	7
5.1	Track performance of site and record data	7
5.2	Provide dashboard software to PCE	1
6	Permit, Assemble and Install EV ChargePod at Site	1



Outcomes

The San Mateo Versailles Project will deliver PCE's desired outcomes.

Outcome #1: Accelerate GHG Reductions and Renewables

Decarbonizing the economy requires new technologies that enable high levels of renewable generation and electric transportation to fully satisfy energy needs in the manner consumers are accustomed to. The EV ChargePod™ simultaneously accelerates GHG reductions by promoting EV use and increasing PV penetration.

- *Promotes EV Use*: At the Versailles site, the EV ChargePod™ installation will enable 20 to 30 electric vehicles to charge daily, cost-effectively and at their most convenient locations. Unlike conventional charging which cause high power surges that cause high demand charges and often require both onsite and utility electric upgrades, impede their deployment and causing high demand charges and often requiring utility upgrades, the EV ChargePod™ supplies super-fast charging without impacting the grid, thus expediting and broadening charging access., A network of EV ChargePods™ such as the Project will solve range anxiety spur the adoption of electric vehicles for residents and visitors.

- *Increases Solar PV Penetration*: The innovative EV ChargePod™ combines intelligent storage with a solar peer-to-peer platform to integrate onsite and local solar photovoltaics (PV). More specifically, the EV ChargePod™ has 200kWh battery capacity and uses a 60kW bidirectional converter to manage solar resources within the PCE area. For example, in the morning when the sun rises and local solar supplies exceed load, the bidirectional converter will draw power from the grid and store in the system's battery. At dusk, when the sun sets. power will be delivered to the grid. Here the EV ChargePod™ balances supply & loads while also delivering a host of behind-the-meter energy services that lowers building electric costs and supplying grid services including demand response, RA capacity and frequency regulation.

On a larger scale, the Versailles Project could have a far-reaching impact on accelerating GHG reductions and renewables than its site performance alone. Following the publication of a white paper, the EV ChargePod could be replicated in many locations that lack grid capacity. This has a massive social impact as it allows rural communities to be part of the electric revolution.

On the next page is a quantitative calculation of estimated GHG reductions from the site for a single EV ChargePod™ installation. The calculation combines the annual impact of both EV and PV estimates for emissions reduction at the site.

Annual EV Emissions Reduction Calculation

Metric	Count	Units	Source
# EVs / Day at Site	20.0	EVs/Day	Intertie Assumption
Average Full Battery Capacity per EV	55.6	kWh	EVAdoption.com
Average Charge (Capacity)	25.0	kWh/charge	Intertie Assumption
Average EV Fuel Efficiency	0.3	kWh/VMT	Plug-In America
EV Miles / Charge	83.3	miles/charge	
Total Charging (Capacity) / Day	500.0	kWh total / day	
Total EV VMT / Day	1,666.7	miles total / day	
Gas-powered LDA CO2 Emission Rate	289.4	g CO2/VMT	PCE Estimate
Gross CO2 Emissions Avoided	194.0	tons CO2/Yr	
less Emissions in PG&E Supplied Electricity	41.7	tons CO2/Yr	
Net CO2 Emissions Avoided from EVs	**152.3**	**tons CO2/Yr**	
Emissions in Electricity Supplied to EVs			
PG&E Emissions Factor	457.0	lbs CO2 / MWH	PG&E Annual Report
Total kWh for Charging	182.5	MWHs/Yr	
GHGs in PG&E Supplied Electricity	41.7	tons CO2/Yr	

Annual PV Emissions Reduction Calculation

Metric	Count	Units	Source
Solar Capacity Integrated	60.0	kW	Size of power converter
Annual Solar Energy per kW	1,700.0	kWh/kW-yr	Average Bay Area
Annual Solar Energy, kWh	102,000.0	kWh/Yr	
PG&E Emissions Factor	457.0	lbs CO2 / MWH	PG&E Annual Report
Net CO2 Emissions Avoided from PV	**23.3**	**tons CO2/Yr**	

Intertie estimates that the project’s annual GHG emission reduction would be 175.7 tons CO2.

Outcome #2: Deliver Community Benefits
The Versailles Project delivers numerous benefits to the community of San Mateo County.

- Provides an electric transportation option for senior citizens.
- Reduces operating cost of a senior living community by managing behind-the-meter load.
- Provides clean backup power option in the event utility power goes down. This is particularly important for senior citizens.
- Allows others to realize more value from their solar investments. By tying into the local distribution grid, the site can maximize PV output and manage PV oversupply during periods of overgeneration. The number of potential PCE customers will depend on the number of residential, small business, large commercial customers on the local distribution grid with PV systems.
- Support local businesses. All partners on this project are Bay Area businesses. Two key participants, *eMotorWerks and Lexa Corporation*, are headquartered in San Mateo County.

Outcome #3: Supports PCE's Load Serving Needs
California's biggest grid challenge is solving the renewable influx, which is causing new grid operating conditions to emerge including: oversupply; short, steep ramps to meet electricity demand; and decreased frequency response. The forecast of future scenarios of Net Load curves, referred to as "the Duck Curve," reflect this phenomenon. As more solar and wind energy is added to the grid, the Net Load sags in the middle of the day when solar generation is highest (the duck's belly), causing over-generation because inflexible resources such as nuclear and geothermal cannot be curtailed. PCE's Net Load in the early evening rises rapidly as solar generation falls when the sun goes down (the head), requiring a very steep ramp-up of generation. To reliably operate in these conditions, the PCE will require flexible resources capable of performing offsetting functions to control upward or downward ramps, starts and stops, etc. The EV ChargePod™ has these operating capabilities which the PCE will increasingly need in order to maintain reliability as the grid becomes greener.

The EV ChargePod can integrate renewables by using its bidirectional converter to act as both a controllable supply or a controllable load. During periods of overgeneration, the system's controller can send excess solar to the battery for storage. During periods of peak demand, the controller can send the storage electricity back to the building or the grid. The system's software has various use cases for these different scenarios and the controller is designed for electricity to flow to the area of greatest value. Once the Project is operational, the team will monitor the performance of the controller and make minor modifications to the use cases in the controller to maximize efficiency.

Outcome #4: Additional Benefits
The EV ChargePod™ is an innovative and scalable solution that solves fundamental grid problems caused by increased penetration of solar PV and electric transportation. Suitable for most commercial locations, its standardized design, plug and play installation, small footprint, inherent safety, and straightforward behind-the-meter connection, facilitates rapid expansion. The standard EV ChargePod™ illustrated in the adjacent figure locates the battery system underground with the aboveground power station. This its novel, patented form factor, enables super-fast charging from any sidewalk location, allowing cities to provide convenient, grid-friendly superfast charging to accelerate the mass adoption of EVs. The EV ChargePod™ also combines multiple power service capabilities with large capacity, intelligent storage makes to also support load serving needs by consuming or storing electricity during times of excess supply and supplying electricity when demand is high.

The Versailles Project locates the battery storage aboveground but offers the same low-cost, grid-friendly EV fast-charging and provides a blueprint for increased solar and EV penetration. Intertie believes, that the EV ChargePod by mirroring gas-station convenience and allowing drivers to charge when they want to and not when the grid has capacity, will accelerate the adoption of EVs. Moreover, its modular, standardized interconnection and installation will enable the Company to quickly deploy a network of EV ChargePods to advance the realization of a regions climate change goals.

Rather than solving the duck curve and or grid problems with utility-scale storage, the Versailles Project provides distributed storage, which maximizes its economic value and builds a network of resilient microgrids, the foundation of the grid of the future.

<u>PCE's Implementation Requirements</u>
Intertie has designed the Project to benefit the San Mateo County community. While Intertie will assume all activities and work required to install and commission the Project, the Company will closely collaborate with PCE staff to ensure the project achieves PCE's objectives and is consistent with PCE's resources. For example, for the EV ChargePod to support PCE's load serving needs, Intertie would collaborate with PCE staff to ensure its platform facilitates PCE's ability to successfully execute its Integrated Resources Plan (IRP).

Intertie's dashboard for PCE will give PCE remote access to the project and provide immediate feedback to gauge the Project's performance and the ability to make operational changes that enhances PCE's ability to achieve its IRP objectives.

Qualifications

Intertie was founded following electric industry deregulation and focused on improving grid resiliency following the Western US Energy crisis of 2000 by providing power marketing services, deploying distributed generation and facilitating the formation of small public electric utilities. In the last ten years, the Company broadened its grid experience by designing and planning electric distribution grid expansions, interconnecting generators & loads to the grid and developing, building and operating distributed solar PV projects.

Intertie completed a similarly innovative project for City of Industry's MetroLink, integrating 2 MW solar carport and EV charging facility. Leveraging SCAQMD's 20% project cost share, the Company developed and operated the MetroLink project which provided 60 mass transit customers at the commuter rail station with electric transportation at a lower life-cycle cost versus gasoline and stimulated the deployment of zero emissions transport in the region. It was California's largest solar carport and EV charging project at the time and was awarded the sustainability project of the year in southern California in 2014.

Experiencing firsthand how the grid was the main obstacle to zero emissions transport and solar PV penetration, Intertie repurposed its mission to develop the EV ChargePod™. Since its strategic shift, the Company has received significant financial support from the Department of Energy, the California Energy Commission and the Bay Area Air Quality Management District.

Partners

- Ash Street Green Partners, LLC is led by principals with decades of experience in real estate investment and development in the San Francisco Bay Area. Their team recognizes the value of clean energy and are actively greenifying their buildings
- eMotorWerks designs and manufactures EV charging systems and supplies one of the most advanced and intelligent Level 2 EVSE chargers on the market. The Company was acquired by Enel through its EnerNOC subsidiary.
- Lexa Corporation is a consulting engineering firm that accelerates its client's ability to grow successfully in the areas of renewables and distributed generation. Its services include design, ideation and product realization.

Readiness of the Technology and Key Risks

The EV ChargePod™ integrates commercially available and tested components including the eMotowerks charging subsystem and battery system. Intertie has completed comprehensive testing of various components and has completed and is testing its commercial system in its product realization lab. Intertie and Lexa Corporation have worked closely to build the controller system, successfully testing various use cases with the EV ChargePod's hardware components. The controller will be updated for Versailles use cases. eMotorWerks has a line of EV chargers and has been working closely with Intertie to fit their components into the EV ChargePod system. Intertie is working closely with LG Chem to integrate its robust battery technology in Intertie's packaging.

The completed prototype has allowed the Company to identify and incorporate lessons learned into its 2nd generation system. The main risk to achieving Versailles Project objectives is lowering the life-cycle-cost battery system such that storage can be profitable deployed to eliminate demand charges associated with DC fast charging and the site, for energy arbitrage as needed to store excess solar and other power services. Batteries have limited life-cycles and replacement costs must be accounted for.

Evaluation

Intertie's evaluation process has several features. The Company will closely monitor the progress detailed in the tasks outlined on Pages 3 and 4. If there are any delays in the plan, Intertie will act decisively to address the problem and keep the project on track. To quantify the benefits derived from the project, Intertie has outlined the annual projected GHG emissions reduction from the Versailles Project on Page 5. As indicated in the earlier table, the site's combines EV charging and solar integration to reduce GHG emissions by 107.6 tons per year which Intertie will closely monitor and analyze operating data to accurately determine actual GHG reductions. Intertie has provided similar metrics to AQMD for a similar EV charging and solar project using similar assumptions for this projection.

Metrics and Assumptions

The key metric for measuring the project's impact is the number of tons of GHG reduced per year. The Intertie team has made conservative assumptions, which it details below.

By providing convenient, cost-effective charging (similar to its experience at MetroLink), Intertie believes its program will incentivize 1/3 of the residents to convert to EV. The 20 cars per day estimate assumes less than a third of the residents will purchase EVs and there will also be visitors who take advantage of the convenient fast-charging. The number of electric vehicles will fluctuate significantly based on the number of visitors to the site. Other recent projects have shown a significant increase in the number of electric vehicles to visit a site once the site has established electric vehicle infrastructure. The majority of these other projects have installed of Level 1 or Level 2 charging stations, which provide much slower charging and reduce the number of available cars to charge per day compared to DC fast charging stations. After considering market research based on other projects and conservative EV adoption assumptions at the site, Intertie predicts the site will charge 20 cars/day between its DC fast charging station and Level 2 charging station.

The amount of kWh per charge used in the calculation is a conservative estimate based on current market research on electric vehicle battery capacity. According to a January 2018 market analysis conducted by EVAdoption.com, the average battery pack capacity for an electric vehicle is 56 kWh. From prior experience, Intertie assumes most electric vehicle drivers have varying degrees of range anxiety, thus prefer to have closer to a full charge than a low charge. Therefore, it is highly unlikely that the average vehicle will charge more than 40kWh. Tesla is an outlier, since their vehicles have larger battery packs, but Intertie has chosen to use a more conservative charging assumption. Intertie anticipates most drivers will try to maintain a state of charge between 20% to 85% of battery pack capacity.

Apart from the annual solar energy per kW (1,700.0 kWh/kW-yr) number taken from the California Energy Commission's estimates for the Bay Area, the rest of the assumptions used in the GHG calculations are either taken directly from PCE or PCE listed sources. Intertie believes that there is tremendous upside to the total CO2 emissions reduction number if it can efficiently store the excess local solar and use it to power electric vehicles. This would reduce the GHG emitted to charge the vehicles at the site.

Scalability

Intertie's basic business model is to partner with site hosts to install EV ChargePods at locations owned by site hosts secured by 20-year contracts. Intertie will obtain project financing for each site, while earning an initial developers fee and monthly operating fee. Once the project finance period ends, the project will flip to a profit share between the site host and Intertie. Intertie's business model is to develop, finance, operate and co-own (with site hosts) a network of EV ChargePod projects. Once established, this network will provide a massive environmental benefit to the state.

Annual GHG Impact at Scale

# of Sites	1	10	25	50	100	1000
GHG Reduction (Tons CO2)	176	1,757	4,391	8,783	17,565	175,652

Intertie Incorporated
Versailles Smart Grid Project
August 3, 2018
PCE 2018 Community Pilot Program

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**SGIP Rebate - 1 time**		**$10,000**	6%	Pledged
Income #2	**PCE Grant**		**$75,000**	45%	Requested
Income #3	**Intertie**		**$82,500**	49%	Pledged
Income #4				0%	Estimated
Income #5				0%	Estimated
Income #6				0%	Estimated
Income #7				0%	Estimated
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$167,500**		

REVENUE SUMMARY		
Total Requested	**$75,000**	45%
Total Pledged	**$92,500**	55%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$167,500**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated
Expense #1	Stationary Battery (200 kWh) with Battery Management System		**$70,000**	42%	10 yrs
Expense #2	Power Electronics including 60 kW Bi-directional Power Converter		**$30,000**	18%	10 yrs
Expense #3	DC Faster Charging Subsystem (80 to 150 kW)		**$25,000**	15%	10 yrs
Expense #4	Balance of Plant (meter, transformer, disconnects, etc.)		**$5,000**	3%	30 yrs
Expense #5	Installation and Commissioning		**$20,000**	12%	1 time
Expense #6	Commercial Cloud Plan - 1 yr		**$500**	0%	1 year
Expense #7	Engineering & Overhead		**$12,000**	7%	1 time
Expense #8	O&M Management		**$5,000**	3%	annual
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$0**	**$167,500**	**100%**	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Annual EV Emissions Reduction Calculation

Metric	Count	Units	Source
# EVs / Day at Site	20.0	EVs/Day	Intertie Assumption
Average Full Battery Capacity per EV	55.6	kWh	EVAdoption.com
Average Charge (Capacity)	25.0	kWh/charge	Intertie Assumption
Average EV Fuel Efficiency	0.3	kWh/VMT	Plug-In America
EV Miles / Charge	83.3	miles/charge	
Total Charging (Capacity) / Day	500.0	kWh total / day	
Total EV VMT / Day	1,666.7	miles total / day	
Gas-powered LDA CO2 Emission Rate	289.4	g CO2/VMT	PCE Estimate
Gross CO2 Emissions Avoided	194.0	tons CO2/Yr	
less Emissions in PG&E Supplied Electricity	41.7	tons CO2/Yr	
Net CO2 Emissions Avoided from EVs	**152.3**	**tons CO2/Yr**	
<u>Emissions in Electricity Supplied to EVs</u>			
PG&E Emissions Factor	457.0	lbs CO2 / MWH	PG&E Annual Report
Total kWh for Charging	182.5	MWHs/Yr	
GHGs in PG&E Supplied Electricity	41.7	tons CO2/Yr	

Annual PV Emissions Reduction Calculation

Metric	Count	Units	Source
Solar Capacity Integrated	60.0	kW	Size of power converter
Annual Solar Energy per kW	1,700.0	kWh/kW-yr	Average Bay Area
Annual Solar Energy, kWh	102,000.0	kWh/Yr	
PG&E Emissions Factor	457.0	lbs CO2 / MWH	PG&E Annual Report
Net CO2 Emissions Avoided from PV	**23.3**	**tons CO2/Yr**	

Total Net CO2 Emissions Avoided	**175.7**	**tons CO2/Yr**	

# of Sites	1	10	25	50	100	1000
GHG Reduction (Tons CO2)	176	1,757	4,391	8,783	17,565	175,652

Metric	Count	Units	Comment	Reference	
San Francisco Case Study			Based on 2017 San Francisco County Transportation Authority Report	https://www.sfcta.org/sites/default/files/content/Planning/TNCs/TNCs_Today_112917.pdf	
SF total daily vehicle miles traveled (VMT)	9,287,878	VMT/day	This includes all types of vehicles, including passanger cars, trucks, buses, etc.	CA Air Resources Board EMFAC2017 Web Database, see sheet 2 for data downloaded	https://www.arb.ca.gov/emfac/2017/
VMT for light-duty automobiles (LDA)	5,639,603	VMT/day	CARB defines LDA as passanger cars. I narrowed it down to LDA because all ride-hailing cars are passanger cars	CA Air Resources Board EMFAC2017 Web Database, see sheet 2 for data downloaded	
VMT for ride-hail services within SF	569,700	VMT/day	This estimated VMT is only for intra-SF vehicle trips so does not account for regional trips	https://www.sfcta.org/sites/default/files/content/Planning/TNCs/TNCs_Today_112917.pdf	
Ride-hailing services VTM out of total passanger cars VMT	10%		SFMTA estimate		
San Mateo Project Impact					
San Mateo County total daily VMT	18,619,050	VMT/day		CA Air Resources Board EMFAC2017 Web Database, see sheet 3 for data downloaded	
VMT for LDA	10,036,614	VMT/day		CA Air Resources Board EMFAC2017 Web Database, see sheet 3 for data downloaded	
Estimated VMT for TNC drivers who live in SMC, based on SF percentage	1,003,737	VMT/day	According to CPUC report between 1% of TNC VMT were from EVs, so I adjusted this number to reflect only TNC VMT by gas-powered vehicles		
Gas-powered LDA CO2 Emission Rate	289.37	g CO2/VMT	While some of these might be from diesel cars, for simplicity I only used the gas-powered CO2 emission rate		
GHG (g) from SMC TNC gas-powered vehicles	290,456,213	g CO2/day			
	1,000,000	g/metric tons		hhttps://www.metric-conversions.org/weight/grams-to-metric-tons.htm	
GHG (Mt) from SMC TNC gas-powered vehicles	290	Mt CO2/day			
Annual GHG (Mt) from SMC TNC gas-powered vehicles	106,016.52	Mt CO2/year			
ECOplus CO2 Emission Factor	0.142	lbs of CO2/kWh	This was the emission factor for 2017 but will likely be the same for 2018 because we overprocurred last year and had about 85% GHG electricity, which is what we are supposed to be at this year. Also this assumes all charging stations are enrolled an ECOplus, future calculations should take into account ECO100 charging stations (such as City-owned ones)	New estimated numbers from Peninsula Clean Energy	
Average EV Fuel Efficiency	0.3	kWh/VMT	According to Plug-In America, an average EV needs about 30 kWh of electricity to power the vehicle for 100 miles.	https://pluginamerica.org/how-much-does-it-cost-charge-electric-car/	
Estimated EV charge CO2 emission rate	0.0426	lbs CO2/VMT			
Projected GHG (lbs) from charging TNC EVs per day	42,759	lbs CO2/day	9.00		
	2,205	lbs/metric tons		https://www.metric-conversions.org/weight/grams-to-metric-tons.htm	
Projected GHG (Mt) from TNC EVs per day	19.4	Mt CO2/day			
Projected GHG (Mt) from TNC EVs per year	7,079	Mt CO2/year			
GHG Avoided	**98,937**	**Mt CO2/year**			

Source: EVAdoption.com
20-Jan-18
http://evadoption.com/ev-statistics-of-the-week-range-price-and-battery-size-of-currently-available-in-the-us-bevs/

Make/Model	**Battery Pack Capacity (kWh)**
BMW I3	33
Fiat 500e	24
Ford Focus Electric	33
Chevrolet Bolt EV	60
Honda Clarity Electric	25.5
Hyundai Ioniq Electric	28
Kia Soul EV	30
Nissan LEAF	30
smart fortwo electric drive	17.6
Tesla Model 3	78
Tesla Model S 75D	75
Tesla Model S 100D	100
Tesla Model S P100D	100
Tesla Model X 75	75
Tesla Model X 100D	100
Tesla Model X P100D	100
VW e-Golf	35.8
Mean	56
Mean (excluding Tesla)	32

Solar4Cars

Applicant organization:

npc Solar

Point of contact:

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Solar4Cars

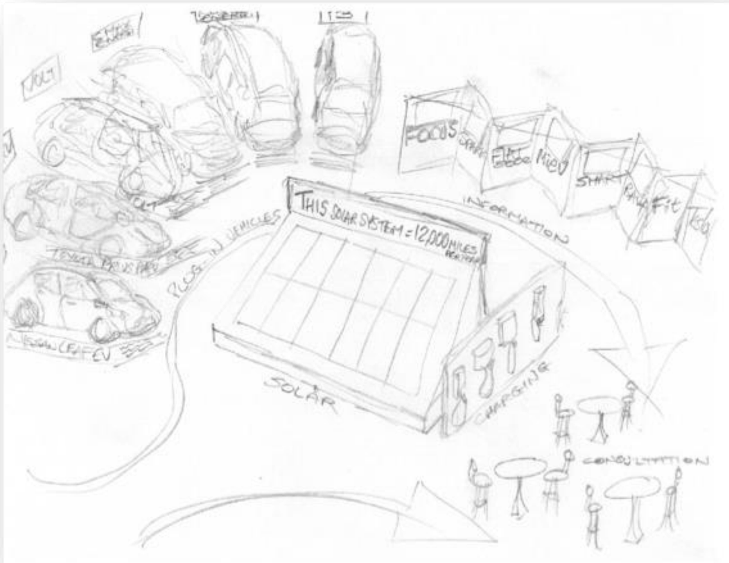
Description of the Project

There is an urgent need to reduce Greenhouse Gas emissions and transportation is a large source of these in the Peninsula Clean Energy service area.

Switching transportation from gasoline-powered vehicles to plug-in vehicles (whether pure electric or plug-in hybrid) enables the move to zero emissions, in conjunction with the transition to renewable energy generation on the electricity grid.

Solar (PV) systems are typically sold on their economic benefits versus buying electricity from the grid, however there is a much more compelling case for solar electricity when it is used to offset vehicle “fuel”. For example, a PV system may generate electricity for 10-50% less than the retail cost of grid electricity but when that same electricity is compared on a per-mile basis to the cost of gasoline there may be 80-90% savings.

The Solar4Cars center will be a for-profit brick-and-mortar educational facility where customers can learn about plug-in vehicles, preparing them for a purchase to be made elsewhere, whilst also selling PV systems, Electric Vehicle Supply Equipment (EVSE), and energy storage systems (ESS). Such a center would circumvent conventional car dealers’ conflict of interest, in that the bulk of their revenue comes from selling and servicing combustion engine vehicles, so they are not incentivized to sell electric vehicles.



Center staff will be impartial regarding vehicle choice and can recommend a plug-in vehicle tailored to customer needs, whilst providing a commercial transaction on the solar PV + EVSE + stationary storage side.

Once tested and established, such centers could be replicated countrywide. They are intended to be for-profit enterprises, educating consumers regarding vehicles but making money on selling the associated PV systems, EVSE and ESS.

The center will also provide:

- Knowledgeable and friendly staff constituting a center of expertise related to solar, plug-in vehicles, vehicle charging and energy storage
- Hands-on experience with the 4 or 5 top-selling plug-in vehicles
- Summary infographics relating to all other available plug-in vehicles
- A showcase of representative solar equipment, including modules and inverters
- A showcase of representative EVSE
- A showcase of representative ESS
- A meeting place for related local non-profit groups (Electric Auto Association, NorCal Solar, etc.)

Somewhat similar centers have just started operating in the United Kingdom:

> The EV Experience Center in Milton Keynes
> https://evexperiencecentre.co.uk/about-us/,

in Canada:

The Electric Vehicle Discovery Center in Toronto
https://www.plugndrive.ca/electric-vehicle-discovery-centre/

and most recently in Columbus, Ohio:

the Smart Columbus Experience Center
https://www.columbusunderground.com/smart-columbus-launching-experience-center-downtown-we1.

These are each slightly different to the current proposal, in that the UK center is funded by government and only covers plug-in vehicles, not solar. The Canadian location is funded jointly by government, business and organized labor and also only covers plug-in vehicles. The Columbus location is funded by government and philanthropic money, showcases plug-in vehicles provided by their manufacturers and covers broader transportation options, not just EVs, but also public transit, ride sharing and bike sharing.

It is important to emphasize that the Solar4Cars center is intended to be independent of vehicle manufacturers – the display vehicles will be purchased/leased independently, based on the current non-Tesla entries in the league table of best-selling plug-ins (see https://insideevs.com/monthly-plug-in-sales-scorecard/), so as not to be beholden in any way to the legacy car companies that are not uniquely offering plug-in vehicles.

Outcomes

Accelerates GHG reductions and renewables

Enabling residents of the Peninsula Clean Energy service area to make the switch from fossil-fuel powered vehicles to plug-in vehicles powered by solar electric (PV) systems will reduce GHG emissions by up to 14,277 lbs (6.49 metric tons) of CO2 per vehicle per year.

This number is based on the following statistics:

- 19.6 lbs of CO2 is emitted per gallon of gasoline burned (https://www.eia.gov/tools/faqs/faq.php?id=307&t=11)
- 13,476 miles on average are driven per driver per year in California (2015 numbers, according to U.S. Department of Transportation Federal Highway Administration [FHWA] - https://www.fhwa.dot.gov/policyinformation/statistics/abstracts/2015/california_2015.pdf)
- 18.5 miles per gallon fuel efficiency on average per vehicle for those same California drivers
  (2015 numbers: 336 billion miles travelled / 18.1 billion gallons – note typo in infographic referenced above, where “m” for millions should be “b” for billions)
- 728 gallons of gasoline are therefore consumed per driver per year (calculated based on the numbers above)

With the target of signing roughly one PV+EV customer per week for the first year of the project and then 50% growth in the second year, about 84 customers would be signed up during the 18-month initial phase of the project, and total CO2 emissions savings of up to 213.5 metric tons would result. By the end of the second complete year this would grow to 120 customers and almost 700 metric tons of cumulative savings and the aim would be to open a second center in that second year, contributing a further 48 customers and 155.3 more metric tons of emissions savings.

Projecting out to ten years with a 50% year-on-year growth rate of customers and based on doubling the number of new centers opened each year from year three onwards, would lead to total cumulative emissions savings of over 865,000 metric tons of CO2 (see attached file "GHG Emissions Reduction and Cost Effectiveness npcSolar_Calcs.xls"). Over 92,000 customers could be served during that period.

All the emissions savings from customers would be locked in for the life of their plug-in vehicles, on the assumption that this is shorter than the lifetime of their solar systems. However, it is typical that consumers who make the switch to electric drive don't switch back, so, even if they replace their vehicle in the future it would be hoped that they would still contribute emissions reductions for the remainder of the 25-30+ year lifetime of their solar system.

It is therefore important to stress the multiplier effect of the initial customers signed up as a result of the initial 18-month Solar4Cars program and the potential for huge GHG emissions savings if the program were scaled up during the warrantied lifetime of the solar systems involved, and beyond.

Given the typical PV system size in California of 6-7 kW, the project will lead to the installation of upwards of half a Megawatt of PV systems during the eighteen months of the first phase. If successfully scaled, as described above, a total of 556-649 MW of PV would be installed over ten years.

Delivers community benefits

With the switch to plug-in vehicles come dramatic financial savings and an improvement in air quality. There are also local economic benefits, as a result of fuel expenses being converted into local jobs at PV installation companies, Solar4Cars center jobs and new customer discretionary spending enabled by savings.

Although the program is initially targeted at residential customers, it is equally applicable to commercial and industrial customers with small fleets of fossil-fueled vehicles or simply to their employees. Given the projected 84 customers in the first 18 months, and 92,000 over 10 years, as described above, it seems reasonable to expect some of those to be from the small business and large commercial sectors.

Based on a gasoline price of $3.63 per gallon (https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_sca_w.htm) and the average usage of 728 gallons per year calculated above, a gasoline-powered vehicle is costing a California resident $2,643 per year at current prices.

In comparison, at the PVE electricity rate of 23.2 cents per kWh (

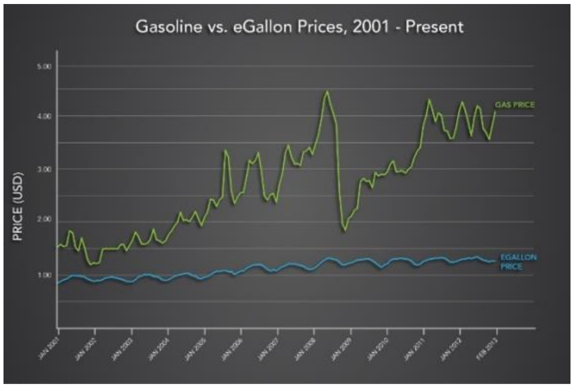
https://www.peninsulacleanenergy.com/residential/residential-rates/), and assuming electricity usage of approximately one kWh per 4 miles, the replacement plug-in vehicle will cost, at minimum, $782 per year for the same 13,476 miles.

This produces a saving of up to $1,861 per year for each customer.

It is anticipated that the initial Solar4Cars center would be located, and ideally staffed by local workers, in District 4 in Redwood City, a city that rates between 64.3-68.2 on the Community Vulnerability Index. So, based on average income for Redwood City of $46,318 (https://www.areavibes.com/redwood+city-ca/employment/), that's an increase in annual income of 4%.

In addition to that benefit, there will be potential employment benefits, as more workers are hired for local PV installation companies, and, in the future, more employees are needed for the expanding Solar4Cars center network.

Switching to electricity as vehicle fuel also introduces an important element of stability for consumers, as the price of electricity fluctuates much less than gasoline:



Source: https://www.energy.gov/articles/egallon-how-much-cheaper-it-drive-electricity

Installing a solar (PV) system is an even better solution. The price of the electricity is fixed, based on the installation cost of the PV system divided by the kWh produced over the lifetime of the system.

For example, a 6 kW PV system may cost around $12,000 after tax credits and it can produce approximately 219,000 kWh over its warrantied lifetime:

6kW * 4 derated sun-hours for Northern CA * 365 days per year * 25 years

giving a simple gross cost per kWh of about 5.5 cents (1,200,000 cents / 219,000 kWh).

Using this as the cost of electric "fuel" for the plug-in vehicle produces a cost of $185 for 13,476 miles. This results in a saving of $2,458 per year, equivalent to a 5.3% increase on the Redwood City average income.

Supports PCE's load serving needs

Customers will be able to take advantage of charge management for their plug-in vehicles. As part of being a Solar4Cars customer they will be educated that they may simply set a timer on their plug-in vehicle or on the associated EVSE unit to take advantage of lower Time-of-Use rates.

They may also potentially participate in a utility or PCE plug-in vehicle charge management scheme, where the utility or PCE has the potential to control the charging load in return for financial compensation for the customer.

Customers will also have the opportunity to be supplied with more sophisticated EVSE (eg: eMotorWerks' JuiceNet-based EVSE), that may, for example, coordinate charging with times when the grid is being supplied by the most renewable electricity or throttle back power in times when demand is high.

Customers may also choose to purchase an energy storage system (ESS) that will enable them to time-shift their loads and thereby respond to Time-of-Use schedules or other pricing signals that may be deployed.

Having PCE involved with the Solar4Cars program will provide the organization with a conduit to local owners of plug-in vehicles, solar systems and energy storage systems, so that the customers can be direct participants in the evolution of grid services, demand management programs, time-of-use rate schedules, vehicle-to-grid developments and other aspects of the renewable energy transition.

Additional benefits

Customers making the switch to plug-in vehicles and PV systems, potentially also with local energy storage, will be supporting the advancement of innovation and scaling of all these industries. They will also be contributing to community resilience if their energy and transportation needs can be met locally and not be reliant on international fossil-fuel supply chains with their associated price volatility. This is especially true if they choose to deploy energy storage and can ride out local grid outages.

Customers will also be advancing grid level innovation as part of the move to Time-of-Use pricing and expansion of demand response programs, especially with regard to the integration of plug-in vehicle charging and deployment of energy storage.

As described above, the Solar4Cars concept is original but clearly replicable and addresses a clear need for the vast majority of the market that will be buying non-Tesla vehicles, solar systems and energy storage products.

PCE Implementation Requirements

There will be no administrative burden on PCE, other than reviewing the required reports. Ideally, PCE will see the Solar4Cars center as a resource and center of expertise where they can refer their customers who are interested in pursuing the option of PV, plug-in vehicles and energy storage.

The project does not require any external policy changes but may in fact present a positive opportunity for collaboration between PCE and its customers and a way to build its capacity to guide future policy, as described in the sections above.

Qualifications

Dr Nicholas Carter, the initiator of the Solar4Cars project, is a world-renowned expert in PV, plug-in vehicles and energy storage.

He has been involved in all aspects of the solar industry for over 17 years, including installation, design of residential and commercial PV systems, developing and delivering training for the North American Board of Certified Energy Practitioners (NABCEP) exams and innovating in the solar industry (He holds US patent 8635773B2 for Systems and methods of installing photovoltaic modules).

Dr Carter has also been driving electric since 2001, first in a Th!nk City, then a Solectria Force and currently he shares a 2011 Nissan LEAF and a 2017 Tesla Model 3 with his wife at their PV-powered household in San Carlos, CA.

Dr Carter is about to complete 3 years with Tesla Energy products, where he was involved with developing and delivering training for the launch around the world of the original Powerwall residential energy storage device, its successor, Powerwall 2, and also setting up a complete training center and program for installation and service of the Powerpack commercial energy storage system.

As part of his LinkedIn network (linkedin.com/in/nicholas-carter-936b4313), Dr Carter has over 1,050 connections, most of whom are in the electric transportation, renewable energy or energy storage spaces and these will provide a rich resource for supporting and/or staffing the Solar4Cars center(s). He has also spoken extensively at numerous events on the synergy between PV and EV.

Evaluation

The program will be evaluated against the projected customer numbers and emissions targets laid out in the attached file “GHG Emissions Reduction and Cost Effectiveness npcSolar_Calcs.xls”.

Installed PV capacity will be assessed in parallel, on the basis of the expectation that customers will each install 6-7 kW of PV, as mentioned above.

Metrics and Assumptions

The metrics to be used and any associated assumptions have been laid out above and in the file “GHG Emissions Reduction and Cost Effectiveness npcSolar_Calcs.xls”. Broader, state-wide or national figures have been used where appropriate, on the basis that the centers could be rolled out beyond PCE’s territory, if the program proves successful.

Records will also be kept of the numbers of participants in all outreach efforts and educational activities, as a gauge for the project’s effectiveness in spreading knowledge related to PV, plug-in vehicles and energy storage systems

It is assumed that the Solar4Cars centers will, in the longer term be profitable ventures. They can be viewed in essence as educational centers that are also lead generation sources for the solar + energy storage industry.

It has been a long-standing problem for the US solar industry that their customer acquisition costs are high, especially in comparison to countries such as Germany, and even more so given the dramatic fall in hardware costs.

It is not unusual to see public companies quoting customer acquisition costs in the range of 50-60 cents per DC Watt or higher. This represents $3,000 to $4,200 on an average-sized PV system.

If the Solar4Cars center can serve to reduce this number whilst also capturing some of this value, by referring customers to local solar installers, then there is the potential to bring in around $250,000 of revenue over the duration of the project’s initial 18-month phase from this source alone.

In addition, there would be revenue from selling EVSE and energy storage systems, and potentially also consulting services.

The overall aim, therefore, would be to generate the GHG savings at no expense to PCE or any external party and in fact for the customers to save money, as a result of their choice of PV plus plug-in vehicle and, optionally, energy storage.

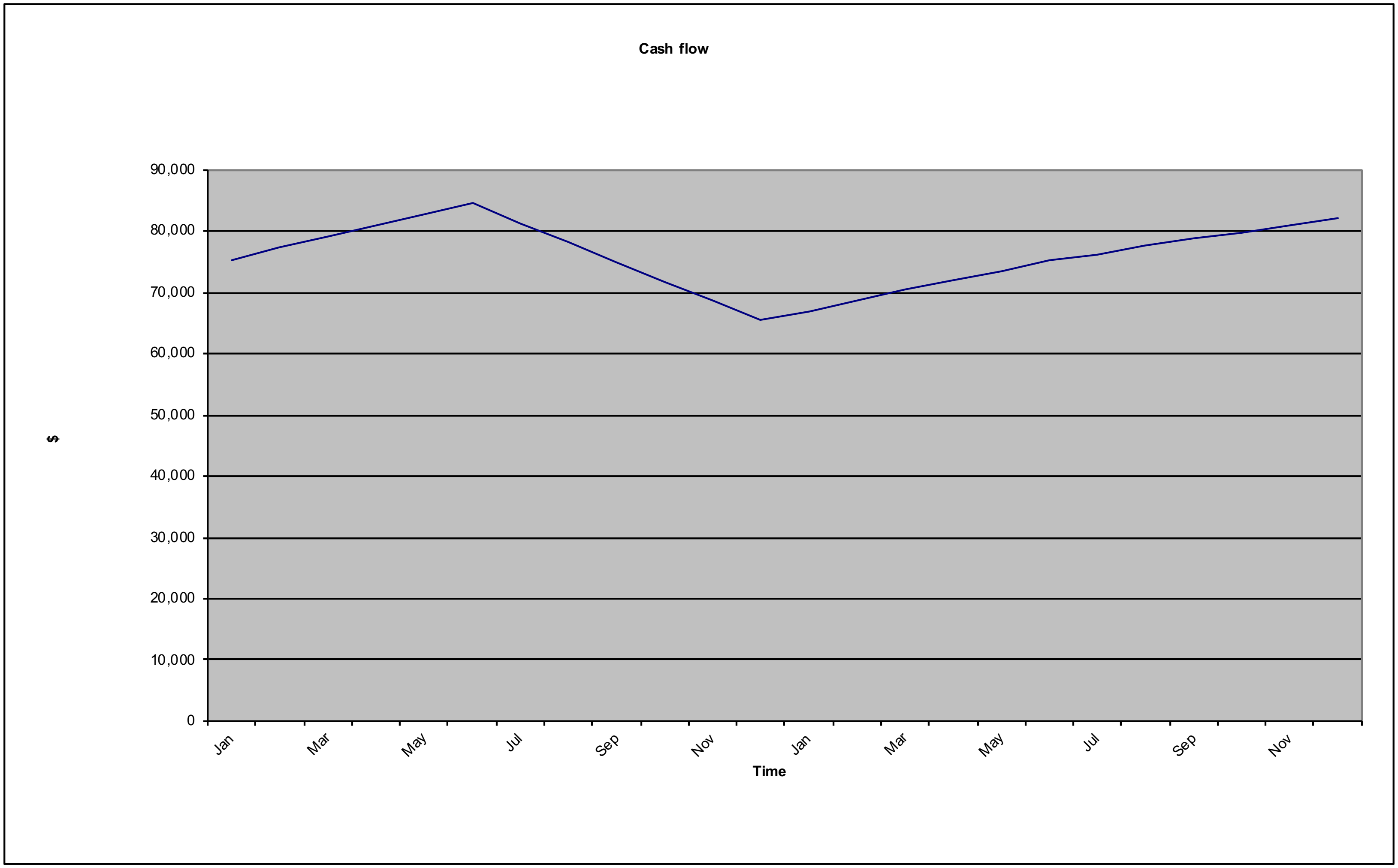
npc Solar
Solar4Cars
3rd August 2018
Community Pilots

Solar4Cars budget

		Year 1 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rent - Solar4Cars center [1]		2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Plug-in Cars[2] (4 x lease payments)		1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Site insurance		200	200	200	200	200	200	200	200	200	200	200	200
Signage and infographics		1,500	0	0	250	0	0	250	0	0	250	0	0
Misc. overhead		500	500	500	500	500	500	500	500	500	500	500	500
Supplies and Equipment		6,100	4,600	4,600	4,850	4,600	4,600	4,850	4,600	4,600	4,850	4,600	4,600
Sales advisor 1 (full-time, 40hrs/wk)		5,000	5,000	5,000	5,000	5,000	5,000	5,500	5,500	5,500	5,500	5,500	5,500
Sales advisor 2 (full-time, 40hrs/wk)								5,000	5,000	5,000	5,000	5,000	5,000
Direct labor costs		5,000	5,000	5,000	5,000	5,000	5,000	10,500	10,500	10,500	10,500	10,500	10,500
(Employee 1 salary)													63,000
(Employee 2 salary)													30,000
TOTAL EXPENSES		11,100	9,600	9,600	9,850	9,600	9,600	15,350	15,100	15,100	15,350	15,100	15,100
Customers per month		4	4	4	4	4	4	4	4	4	4	4	4
kW per month		26	26	26	26	26	26	26	26	26	26	26	26
PV referral fees ($)		10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400
EVSE		600	600	600	600	600	600	600	600	600	600	600	600
Energy storage		500	500	500	500	500	500	1,000	1,000	1,000	1,000	1,000	1,000
Non-PV net income		1,100	1,100	1,100	1,100	1,100	1,100	1,600	1,600	1,600	1,600	1,600	1,600
TOTAL INCOME		11,500	11,500	11,500	11,500	11,500	11,500	12,000	12,000	12,000	12,000	12,000	12,000
Net Revenue		400	1,900	1,900	1,650	1,900	1,900	-3,350	-3,100	-3,100	-3,350	-3,100	-3,100
	PCE funds												
Cash balance	75,000	75,400	77,300	79,200	80,850	82,750	84,650	81,300	78,200	75,100	71,750	68,650	65,550

	Year 2 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	*Notes*
Rent - Solar4Cars center [1]	2,520	2,520	2,520	2,520	2,520	2,520	2,520	2,520	2,520	2,520	2,520	2,520	+5% annually
Plug-in Cars[2] (4 x lease payments)	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	3 year leases
Site insurance	210	210	210	210	210	210	210	210	210	210	210	210	+5% annually
Signage and infographics	250	0	0	250	0	0	250	0	0	250	0	0	
Misc. overhead	550	550	550	550	550	550	550	550	550	550	550	550	+5% annually
Supplies and Equipment	5,030	4,780	4,780	5,030	4,780	4,780	5,030	4,780	4,780	5,030	4,780	4,780	
Sales advisor 1 (full-time, 40hrs/wk)	6,000	6,000	6,000	6,000	6,000	6,000	6,500	6,500	6,500	6,500	6,500	6,500	
Sales advisor 2 (full-time, 40hrs/wk)	5,500	5,500	5,500	5,500	5,500	5,500	6,000	6,000	6,000	6,000	6,000	6,000	
Direct labor costs	11,500	11,500	11,500	11,500	11,500	11,500	12,500	12,500	12,500	12,500	12,500	12,500	
(Employee 1 salary)												75,000	
(Employee 2 salary)												69,000	
TOTAL EXPENSES	16,530	16,280	16,280	16,530	16,280	16,280	17,530	17,280	17,280	17,530	17,280	17,280	
Customers per month	6	6	6	6	6	6	6	6	6	6	6	6	
kW per month	39	39	39	39	39	39	39	39	39	39	39	39	
PV referral fees ($)	15,600	15,600	15,600	15,600	15,600	15,600	15,600	15,600	15,600	15,600	15,600	15,600	
EVSE	900	900	900	900	900	900	900	900	900	900	900	900	
Energy storage	1,500	1,500	1,500	1,500	1,500	1,500	2,000	2,000	2,000	2,000	2,000	2,000	
Non-PV net income	2,400	2,400	2,400	2,400	2,400	2,400	2,900	2,900	2,900	2,900	2,900	2,900	
TOTAL INCOME	18,000	18,000	18,000	18,000	18,000	18,000	18,500	18,500	18,500	18,500	18,500	18,500	
Net Revenue	1,470	1,720	1,720	1,470	1,720	1,720	970	1,220	1,220	970	1,220	1,220	
Cash balance	67,020	68,740	70,460	71,930	73,650	75,370	76,340	77,560	78,780	79,750	80,970	82,190	

[1, 2] Initial sample PV, EVSE and ESS equipment, vehicle downpayments and vehicle insurance to be provided by npc Solar, not to exceed amount of matching PCE funds


Cash flow
$
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan
Mar
May
Jul
Sep
Nov
Jan
Mar
May
Jul
Sep
Nov
Time

GHG Emission reductions for Solar4Cars project

Assumptions

Gallons saved per vehicle per year	728	(see 1.1 in submission document for calculations)	
CO2 saved per vehicle per year	6.47	Mt CO_2	(see 1.1 in submission document for calculations)

Calculations

Total number of locations	Number of new locations	Customers in year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
1	1	Location 1	48	72	108	162	243	365	547	820	1,230	1,845	
2	1	Location 2	0	48	72	108	162	243	365	547	820	1,230	
4	2	Locations 3-4	0	0	96	144	216	324	486	729	1,094	1,640	
8	4	Locations 5-8	0	0	0	192	288	432	648	972	1,458	2,187	
16	8	Locations 9-16	0	0	0	0	384	576	864	1,296	1,944	2,916	
32	16	Locations 17-32	0	0	0	0	0	768	1,152	1,728	2,592	3,888	
64	32	Locations 33-64	0	0	0	0	0	0	1,536	2,304	3,456	5,184	
128	64	Locations 65-128	0	0	0	0	0	0	0	3,072	4,608	6,912	
256	128	Locations 129-256	0	0	0	0	0	0	0	0	6,144	9,216	
512	256	Locations 257-512	0	0	0	0	0	0	0	0	0	12,288	
													Total customers for 10 years
		Total customers	48	120	276	606	1,293	2,708	5,597	11,468	23,346	47,307	92,768
		CO_2 emissions											
			155.3	543.5	1,125.8	1,999.2	3,309.4	5,274.7	8,222.6	12,644.4	19,277.2	29,226.3	
			0	155.3	543.5	1,125.8	1,999.2	3,309.4	5,274.7	8,222.6	12,644.4	19,277.2	
			0	0	310.6	1,087.0	2,251.6	3,998.5	6,618.8	10,549.3	16,445.1	25,288.8	
			0	0	0	621.1	2,173.9	4,503.1	7,996.9	13,237.6	21,098.7	32,890.2	
			0	0	0	0	1,242.2	4,347.8	9,006.2	15,993.8	26,475.2	42,197.3	
			0	0	0	0	0	2,484.5	8,695.7	18,012.5	31,987.7	52,950.5	
			0	0	0	0	0	0	4,969.0	17,391.4	36,025.0	63,975.4	
			0	0	0	0	0	0	0	9,937.9	34,782.7	72,049.9	
			0	0	0	0	0	0	0	0	19,875.8	69,565.4	
			0	0	0	0	0	0	0	0	0	39,751.7	
													Total emissions for 10 years (Mt CO_2)
		Total emissions (Mt CO_2)	155.3	698.8	1,979.8	4,833.1	10,976.4	23,918.0	50,783.8	105,989.5	218,611.8	447,172.7	**865,119.2**

Open Energy Efficiency

2018 Community Pilot Program
Call for Proposals Response

prepared for

Peninsula Clean Energy

August 3, 2018

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Introduction to OpenEE

Open Energy Efficiency (OpenEE) offers Peninsula Clean Energy (PCE) a unique opportunity to manage its demand-side management portfolio, including energy efficiency and electrification efforts. OpenEE provides an advanced M&V platform to track and normalize metered consumption data from individual buildings so that portfolios of assets can be aggregated to provide a flexible, demand-side load balancing platform. The OpenEE platform enables near real-time performance analytics and supports performance-based procurements and programs.

The modern grid requires tracking of energy efficiency and electrification efforts on both a time and locational basis. This tracking ability is critical for organizations like PCE to survive in a wholesale market dominated by price volatility. Moreover, beyond load balancing and non-wires alternatives, time and locational energy accounting is a prerequisite for accurate carbon accounting. Without knowing the precise time and locational impacts of different efficiency and electrification efforts, there is no way to determine whether or not carbon reduction goals are actually being met.

Near real-time program feedback helps optimize business strategies and program designs to respond to grid and carbon-based price signals. OpenEE’s transparent calculations, based on CalTRACK standards, support both traditional regulated programs as well as performance-based initiatives.

OpenEE provides a secure, cloud-hosted enterprise SaaS platform that implements a scalable version of the OpenEEmeter. This platform enables the development of markets that value load shaping from energy efficiency and electrification of buildings. Utilities, program managers, implementers, and third-party aggregators can leverage our platform to put their data to work to deliver the business model, technology, and financial innovations necessary to scale demand-side energy resources.

Demand Flexibility as a Resource

Millions of grid-balancing assets are waiting to be deployed in the smart grid of the future. These assets include smart thermostats, high-tech water heaters and heat pumps, electric vehicle chargers, demand response, and battery storage, along with many other new technologies and business models waiting for a market. These actions and interventions lead to quantifiable resource curves that can increase or decrease load to different locations of the grid.

OpenEE provides the platform necessary to implement a distributed market for flexible demand resources inclusive of energy efficiency and electrification of buildings. Based on open-source AMI data-driven measurement of grid and carbon impact, by hour of the day and location on the grid, the OpenEE Platform allows load serving entities to procure metered performance as a grid and climate resource through competitive markets that drive innovation and enable the private investment required to achieve scale.

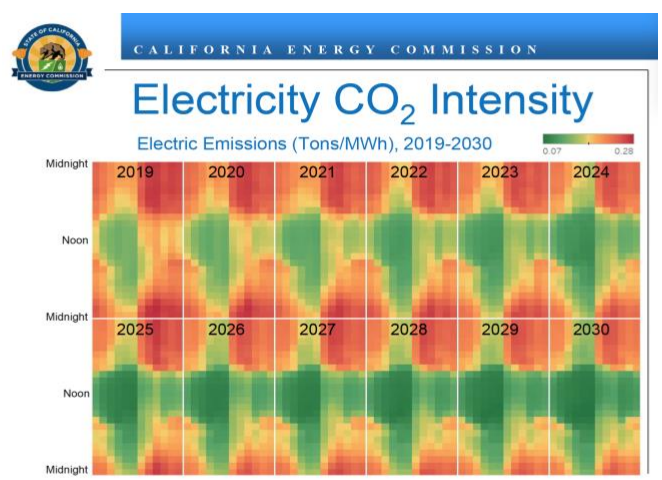
To date, most efficiency or electrification programs have utilized a centralized infrastructure to send signals to smart devices during periods of high demand or through measure-based efficiency programs based on guesswork savings. However, as the number of devices and programs multiply, and consumer fatigue sets in, other, more decentralized forms of grid balancing must be considered to achieve scale in both demand and capital. If we are to leverage the vast potential of demand-side resources, we must look beyond the current centralized framework and leverage the infrastructure, innovation, and capital of third parties, with their own unique approaches to engaging, financing, and managing the demand patterns of their customers.

A decentralized model based on performance and delivered by third parties offers several advantages:

- One size does not fit all when it comes to demand-side management. Instead, an approach that encourages innovation will allow more effective and less expensive demand-side technologies and business models to emerge.
- The use of meter-based resource curves, as opposed to modeled or deemed values, ensures that the impact of third party actions on the grid are accurately captured, and creates the confidence necessary to treat flexible demand as a procurable resource.
- Driving innovation through markets that pay third parties for results encourages competition that in turn drives consumer demand through innovative technologies and better options.
- Designing market models that align incentives rather than regulating the specifics of each business model and technology greatly reduces administrative costs.
- You pay only for the delivery of real of value to the grid while aligning risk within the market so that private capital can be deployed to scale demand-side energy management solutions.

Accelerating GHG Reductions and Balancing of Renewables

The first step in targeting greenhouse gas emissions is to account for them correctly. Historically, the effect of energy efficiency and electrification on carbon emissions has been calculated based on monthly average impact multiplied by average grid carbon intensity. However, this is not a very accurate measure of carbon -- it matters when and where one uses or saves energy, especially as the grid adds more renewable generation.



As we move to increasing levels of clean, but often intermittent, energy resources, the value of time and locational demand flexibility is critical to balance load to ensure carbon reductions. The OpenEE Platform can provide accurate accounting for both the load balancing value and true marginal carbon reductions by accounting for the time and locational impacts of both energy efficiency and electrification efforts.

Our proposal is not for a traditional program, but instead delivers a platform that can enable PCE to deliver distributed energy resources and demand flexibility, while ensuring cost effectiveness, load shape impacts, and carbon metrics and grid impacts that are transparent and robust.

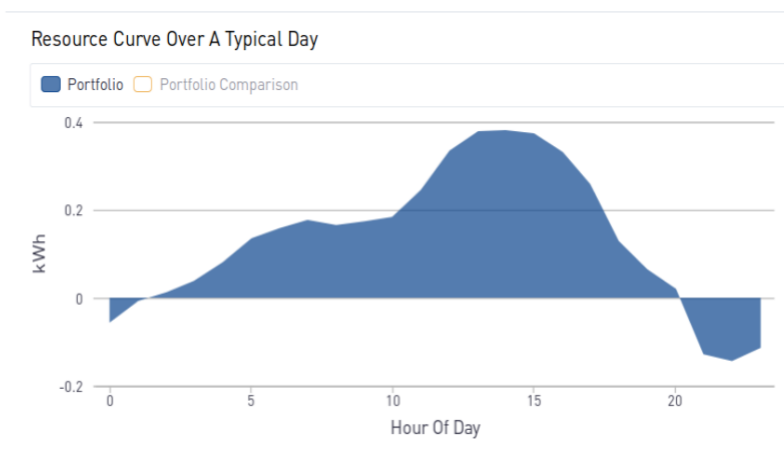
Because the price signal can be delivered based on both time and locational value, procurements leveraging this platform will be acquiring resources based on the carbon value of grid impact, which we believe sets it apart from current CPUC programs that only marginally incorporate these values and should ultimately become a part of the procurement rather than traditional program budgets.

Supporting Load Serving Needs

As PCE accelerates towards its clean energy goals, it will acquire a broad portfolio of storage, EVs, demand response, time and locational efficiency, and electrification to provide load balancing resources and grid services to meet resource adequacy (RA) requirements and to identify the most cost-effective means to serve load. OpenEE enables integration of energy efficiency and electrification into the distributed energy resource mix in the same way as other DERs; without having to learn to comply with a complicated set of rules and guidance for energy efficiency specific funding sources.

Depending on what set of measures are implemented and for which customers, it is possible for energy efficiency and electrification to have either positive or negative impacts on grid, carbon or cost-reduction goals. OpenEE can help PCE ensure that its efficiency and electrification efforts are coordinated to reduce consumption during the peak periods that drive resource adequacy costs for the CCA.

Resource Curve: Hourly Impact of Energy Efficiency and Electrification



The OpenEE platform delivers resource curves that measure the time-based impact of behind the meter DERs to the demand of a portfolio of buildings.

Using the methods established by [CalTRACK 2.0](), time-based changes to demand for individual buildings are rolled into portfolios to create stable counterfactuals of predicted usage that consider the effects of both weather and occupancy and can measure both energy efficiency and electrification, as well as any other behind the meter DERs.

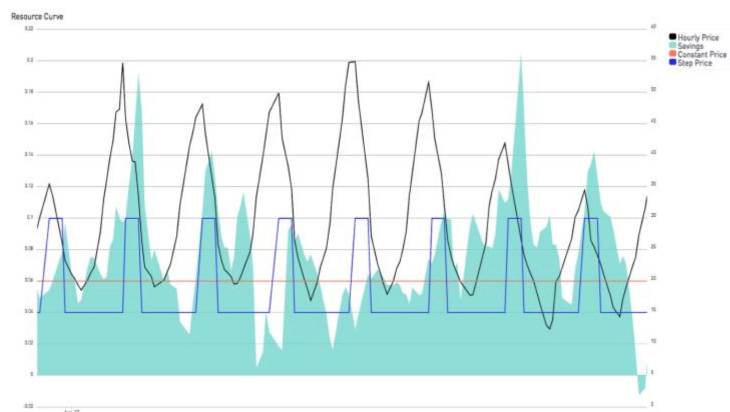
With CalTRACK and the OpenEE Platform, it is possible to calculate hourly impact on demand for every hour of the year.

The grid is impacted differently at different times of the day from one neighborhood to the next. A truly flexible demand-side market must be able to send price signals based on grid needs for demand changes that are tied to the particular time and locational impacts. By geofencing the portfolios and using metered consumption data to measure the actual impact of purported curtailments, portfolio resource curves can be measured and verified with similar precision as hardware devices such as batteries and solar panels. Hourly resource curves can also be calculated in near real-time and as frequently as consumption data is made available.

Sending a Price Signal

Rather than deploy programs that try to predict the most promising technology, PCE can instead send a price signal that will engage the market and deliver more reliable flexible demand impacts at a lower cost and risk than traditional efficiency or electrification programs. Much like in demand response, third party aggregators will deliver portfolios of buildings with savings concentrated in the most valuable hours.

As an example, PG&E's Residential Pay-for-Performance program sets its valuation to reward savings that happen during the late afternoon ramping period at 3x the value of baseload savings.

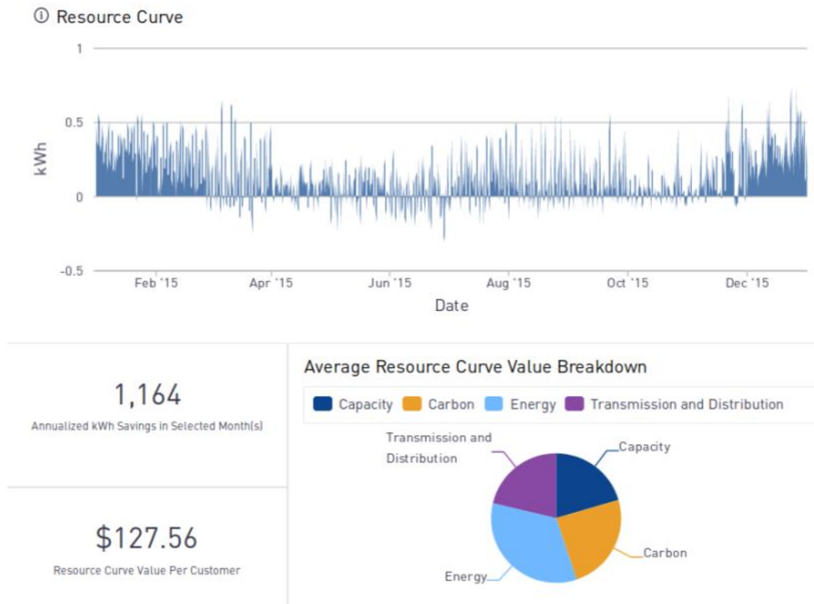


Resource Curve: Green area
Locational Marginal Cost: Black line
Tiered Valuation Model: Blue line

Engaging the Market

PCE will be able to procure demand flexibility from third parties through pricing and a specification for other valuable criteria (e.g., particular measures or hard to reach sectors). Third parties will respond with an appropriate price that balances their risk with procurement cost-effectiveness.

Evaluation of demand changes are conducted using the CalTRACK hourly NMEC methods, which are expressed in the open-source OpenEEmeter code, and typically calculated simultaneously by both the procurer (in this case PCA) and the aggregators. The open methods and source code enable both parties to track savings in real time as well as to forecast yields and target high value customers by analyzing the performance of their existing assets.



Paying-for-Performance

Once a performance period has commenced, daily, weekly, or monthly payments can be issued to aggregators for their performance. PCE simply applies the energy valuation pricing curve to the resource performance curve to calculate payments. The top figure shows how historical resource curves may be calculated for different types of assets, to inform forecasting and financial projections. The actual 8760 resource curve and its associated value can be calculated using a number of valuation/pricing approaches, and it can be broken down into different categories (e.g. T&D, Carbon etc.), as shown in the bottom figure. This conveys the value of the resource curve to specific components of the grid.

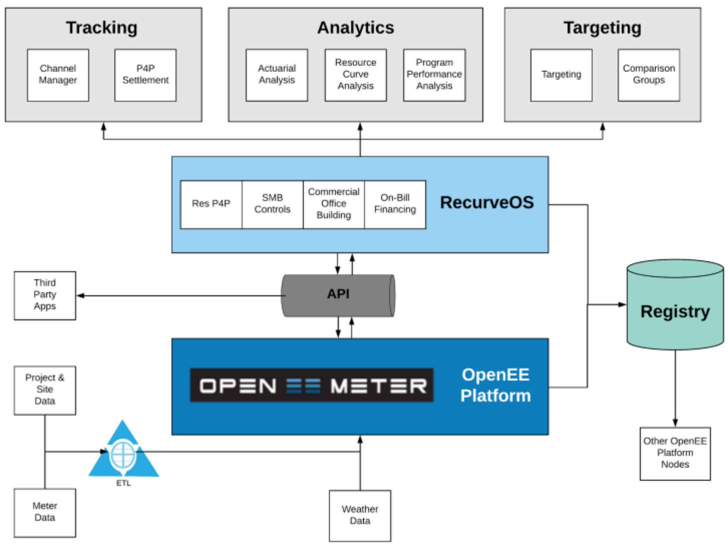
Use Case: Smart Water Heater Pilot by Center for Sustainable Energy

The Center for Sustainable Energy (CSE) is proposing a smart water heater electrification pilot. OpenEE could be expected to determine the time and locational impacts by tracking each system's performance. This data can be used to understand the value and viability of smart controlled heat pump water heaters as a strategy for load balancing.

For a future full scale deployment, the OpenEE Platform can become the basis for deploying behind the meter devices, tracking the impact, and sharing risk with the market.

How the OpenEE Platform Works

OpenEE offers organizations like PCE the capability to track and manage both energy efficiency and electrification efforts. Leveraging AMI data, we track projects, portfolios, and even entire customer populations, and put this data to work to enable market-based solutions to grid and climate problems.



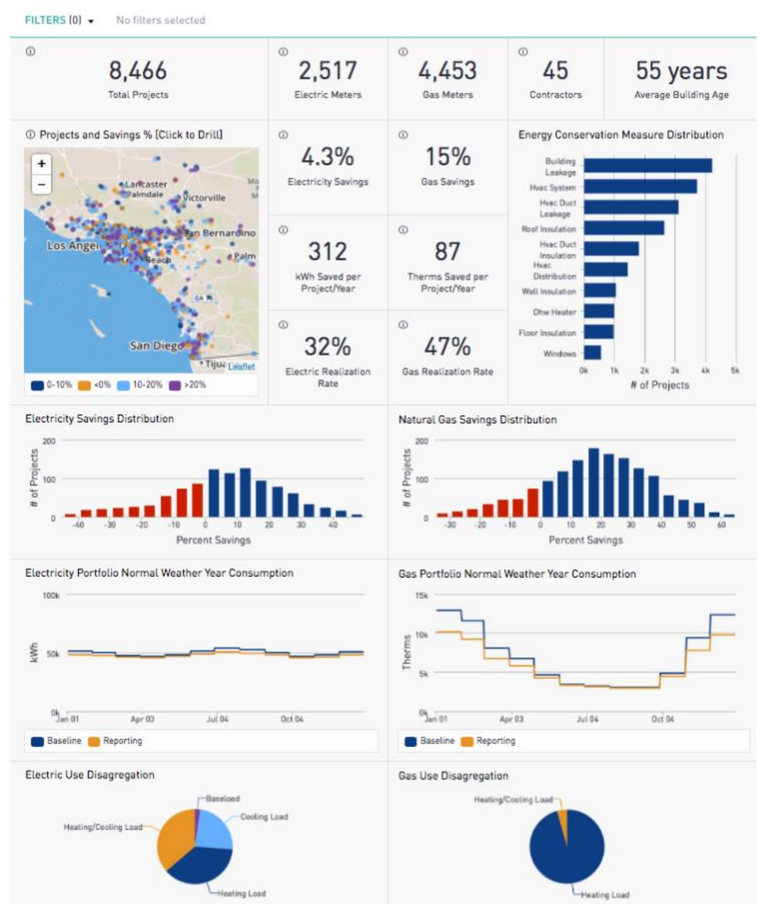
OpenEE Platform

The OpenEE Platform consists of a data pipeline (ETL) that acquires and cleans both meter data and project metadata and a deployment of the OpenEEmeter that calculates impact (normalized for weather and occupancy) along with a host of important derivatives. Results are stored in scalable warehouses; customer instances are individually hosted and secured with end-to-end encryption and security that meets the highest levels of scrutiny.

RecurveOS

Built on top of the OpenEE Platform, the RecurveOS provides an interface for programs or procurements that includes a range of analytics, management tools, and functionality to conduct pay-for-performance, targeting, and telemetry. A single OpenEE Platform can support multiple RecurveOS instances for different procurements and sectors, each of which typically has different valuation, metadata, and aggregators.

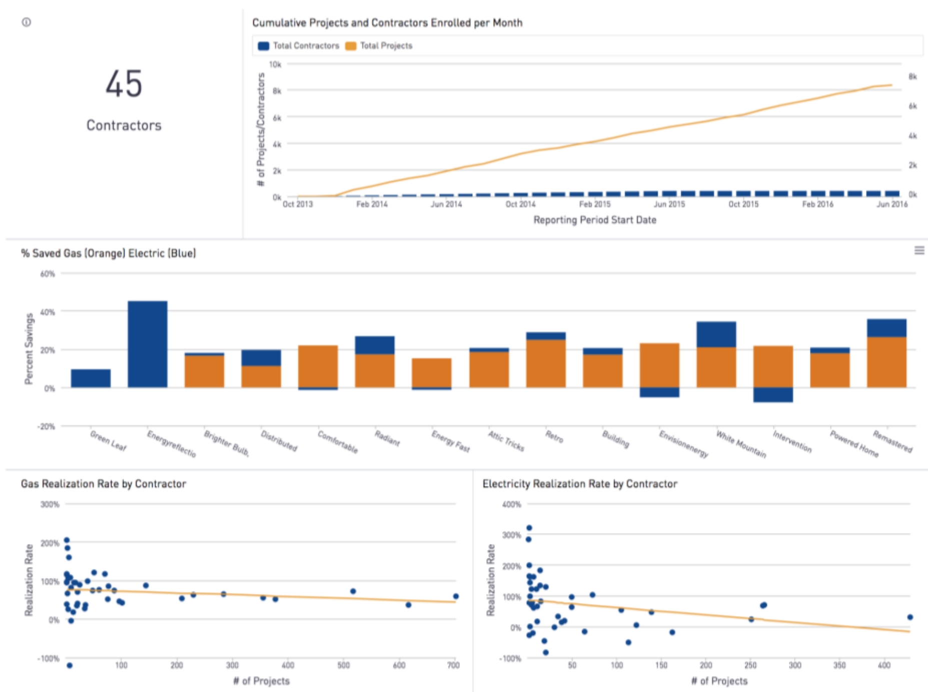
Together, the OpenEE Platform and RecurveOS provide comprehensive analytics on individual projects, project portfolios, contractors, measures, and overall program performance visualised through a set of customizable dashboards that can include portfolio or program telemetry, contractor or implementor dashboards, project analytics, and anonymized public aggregate views to support markets, reporting, and forecasting.



Contractor and Trade Ally Telemetry

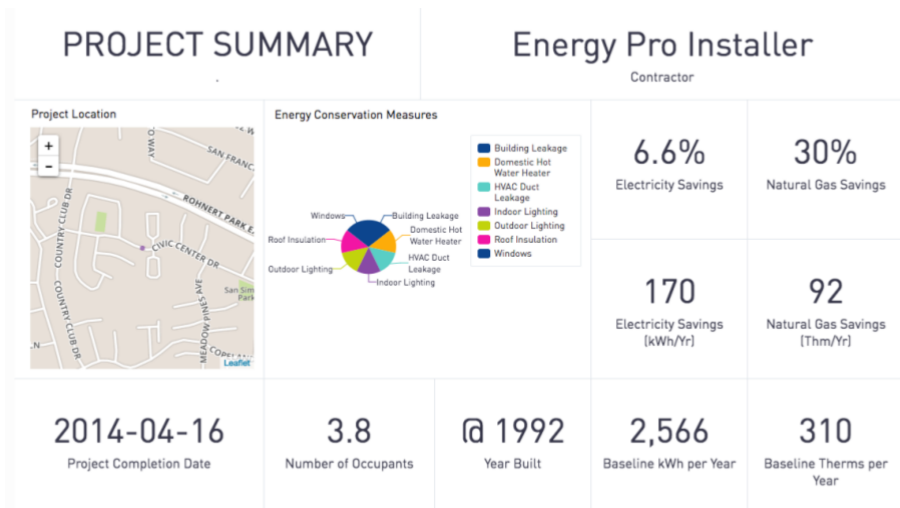
Track contractors or other channel partners in realtime to enable data-driven channel management. Compare key metrics such as realization rates, grid value, or variance in performance.

Use key performance indicators to drive quality assurance where it is most needed, send leads to the highest performing contractors, and generally align program goals with performance to encourage good outcomes improve cost effectiveness.



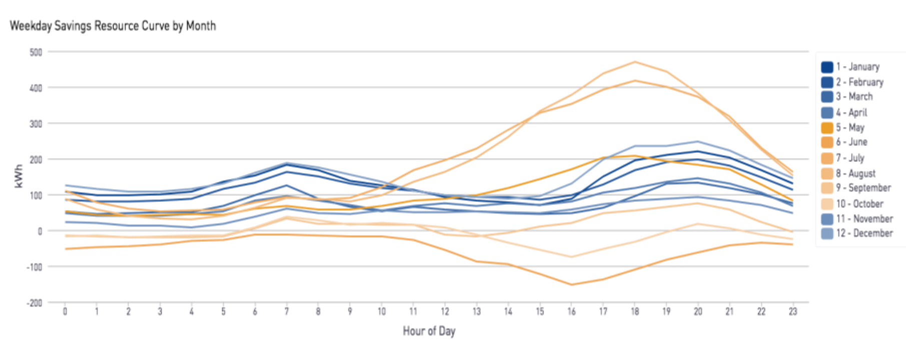
Customers and Projects

OpenEE conducts IPMVP Option C routine M&V on each individual customer. This data can be used to drive O&M activities and to account for directly attributable changes in site level consumption on individual customers sites when combined with OpenEE's non-routine events tracking system.



Resource Curve Analytics

Track the time and locational resource curves for portfolios of customers to determine grid and carbon value.



PCE Implementation Requirements

Moving to a distributed deployment mode dramatically lowers traditional administration costs by sharing performance risk with the market and aligning the interests of PCE and implementers. This means that many overhead-heavy, costly and ineffective program roles will now be the job of the market. Designing business models, picking technologies, and conducting quality assurance becomes the responsibility of implementers and aggregators who are accountable to actual outcomes, rather than upfront payments based on predictions.

PCE will need to be engaged in running the upfront procurement and establishing where demand flexibility will be valuable and will need to establish program delivery and data collection parameters to ensure ongoing quality and consumer protections. PCE can elect to engage in consumer outreach and targeting to support the market. As the procurer of the demand flexibility resources, PCE will be able to establish requirements such as use of the PCE brand or health and safety protocols as necessary.

OpenEE provides the OpenEE Platform and RecurveOS as a turnkey service. We provide enterprise level security, manage all servers and analytics, and engage PCE staff and third-party aggregators in understanding how savings are calculated. While some initial training of key PCE personnel will be required as we establish data pipelines and customize analytics, OpenEE is expert at making this process streamlined and easy for our customers.

Why We Are Uniquely Qualified

OpenEE is purpose built to enable demand flexibility as a resource. The OpenEE platform has been designed as an integrated system that enhances programs and allow demand flexibility to be deployed through markets paid-for-performance like other distributed energy resources. The following is a partial list of customers that provides a diverse range of use cases and demonstrates OpenEE's record of achievement.

- **California Energy Commission (CEC)**: For the CEC, OpenEE conducted an analysis for nearly 50 million statewide California buildings in a dataset containing five years of billing data across the four major utilities. OpenEE analyzed differences in consumption patterns across climate zones and building types, and estimated "naturally occurring" changes in consumption in non-treatment populations across California. Much of this work informed improvements to the CalTRACK methods that made them more applicable to a wider variety of buildings.

- **Pacific Gas and Electric (PG&E)**: OpenEE is currently under contract with Pacific Gas & Electric (PG&E) as the official CalTRACK Operator to calculate the time and locational savings payments for aggregators for the $25 million residential Pay-for-Performance (P4P) Program as well as to track savings associated with their portfolio of existing energy efficiency programs.

- **Sacramento Municipal Utility District (SMUD)**: OpenEE is deploying an OpenEEmeter to analyze residential and commercial energy efficiency and electrification programs at SMUD. We are collaborating with SMUD staff to evaluate models for calculating hourly savings and load shape and resulting marginal carbon impacts. This groundbreaking work will position SMUD as one of the first utilities to actively manage efficiency and electrification as a grid resource and is helping SMUD prepare for pay-for-performance efficiency and electrification programs that will be measured based on the impact to carbon emissions.

- **MCE (formerly Marin Clean Energy)**: MCE received an OpenEEmeter implementation to track the performance of projects in its small- and medium-sized business program, as well as analysis of the performance PACE projects in Marin County. Beyond this core implementation, OpenEE developed a Green Button connector for MCE to access its AMI data and provided policy guidance to help the organization cope with unique challenges associated with Community Choice Aggregation.

- **City of San Francisco Department of the Environment (SFE**): Open Energy Efficiency piloted a new model of customer engagement and measurement and verification (M&V) of energy savings from the Energy Watch program. In this model, a customer would enroll in PG&E's Share My Data service, allowing OpenEE, on behalf of SFE, to calculate the whole building energy savings that resulted from the project and provide this information back to the Energy Watch staff (and customers).

- **BayREN Integrated Commercial Retrofits (BRICR)**: This project will adapt the Standard Energy Efficiency Data Platform (SEED) to a new use case for merging and storing audit data. OpenEE will develop a secure algorithm testbed to perform analysis with data that is too sensitive to be stored in SEED (such as customer smart meter data). Use cases for the testbed include prediction of energy savings and validation/tuning of OpenStudio based energy models. The testbed will be demonstrated in several locations, including the City of San Francisco where a variety of public and private data streams are available.

- **Lawrence Berkeley National Laboratory (LBNL)**: OpenEE is currently under contract with Lawrence Berkeley National Lab for estimation of the energy usage impacts of residential PACE projects in California using the OpenEEmeter.

The OpenEE Team

OpenEE is committed to supporting PCE and can leverage our full team to initiate and sustain the proposal. Key employees are listed below:

Matt Golden - Matt is Co-founder and CEO of Open Energy Efficiency. Prior to OpenEE, Matt ran a large home performance company and led the development of the GBCI Investor Confidence Project, implementing a system to certify commercial and multifamily Investor Ready Energy

Efficiency™ projects in order to reduce transaction costs, and develop actuarial data to unlock capital markets for commercial and multifamily retrofit projects.

McGee Young - McGee is the Chief Product Officer and Senior Project Manager for OpenEE. McGee has been involved with OpenEE since the original CalTRACK process commenced. In between implementing the OpenEE product roadmap and overseeing all platform improvements, McGee also leads the contracting process with new clients and nearly all other business operations tasks.

Carmen Best - Carmen joined OpenEE after leading the Energy Efficiency Commercial Programs & Evaluation team at the California Public Utilities Commission (CPUC). While there, she facilitated the Commission’s transition to standardized data and reporting, priority-based evaluation planning, and stakeholder engagement processes to manage its large-scale energy efficiency evaluation portfolio.

Hassan Shaban - Coming from an engineering background, Hassan, Senior Data Scientist, has 7 years of experience in both the supply side and demand side of the energy industry, including energy efficiency program implementation. Prior to that, as an academic researcher, he worked on IoT applications in nuclear power plant safety and monitoring.

Our Proof of Concept Pilot Proposal

OpenEE proposes to provide PCE with a scalable platform for the deployment and tracking of flexible demand resources. The platform will enable the program implementer and PCE to measure and visualize time and locational load and carbon impacts and analyze results through a series of custom designed analytics interfaces. Since one of PCE’s foundational objectives is reduction of emissions, this pilot will serve to demonstrate a key piece of infrastructure that will empower PCE to achieve and monitor progress towards this goal.

The primary goal of the platform will be to provide PCE with scalable infrastructure for evaluating the effectiveness of its various greenhouse gas reduction initiatives (including electrification, energy efficiency and load shifting). The availability of time and locational carbon impacts of these initiatives provides PCE with standard weights and measures that can be used to compare impact across many different types of initiatives using a common accounting system.

Because the pilot is limited in budget, scope, and duration, this initial deployment will be conducted to analyze the impact at the midpoint and conclusion of an electrification program such as the approach suggested by CSE in a separate bid.

Metrics and Assumptions

While this proposal does not directly result in greenhouse gas reductions, it provides the metrics to evaluate most greenhouse gas reduction initiatives. These metrics can be oriented to intensity metrics, or absolute reductions, based on grid operations and the effect of interventions. The platform will use an industry-standard method for Normalized Metered Energy Consumption (NMEC), namely CalTRACK, to calculate raw savings metrics. These can then be combined with hourly greenhouse gas multipliers yielding the actual carbon savings stemming from these interventions.

As far as the pilot itself is concerned, the following milestones will be used as key measures of success:

- Raw consumption and project data is ingested into the platform and processed using CalTRACK methods.
- Carbon savings related to the evaluated projects are calculated and visualized in the platform.
- Results and analytics are made available to PCE in user-friendly dashboards.

Evaluation

OpenEE's core focus is to provide others' tools for evaluation of success based on the impacts of the interventions. Success to us is when others are able to seamlessly incorporate our tools into their everyday operations and utilize the information to deliver reliable grid impacts.

OpenEE provides real-time measurement and verification of projects and programs, providing managers and third-party evaluators a set of customizable analytical tools that allow them to spend their time answering their most important programmatic questions. We believe in transparent methods and open source code. Our tools have been tested against millions of buildings, had code reviewed by third parties, and built trust across the industry.

OpenEE will analyse the resource curve impact to load shape of interventions using normalized metered energy consumption pre and post the intervention. When evaluating smart electrification, OpenEE will, for example, request that devices are cycled from smart to traditional modes at defined intervals to evaluate the effect of smart controls specifically using an in-sample control group. Other evaluation designs will be dependent on the specific questions that PCE wishes to answer that can be conducted with the existing data and within the capabilities of the platform.

Budget

OpenEE will initiate platform deployment for PCE when 50% of customers in the pilot have at least six months worth of performance period data. Second analysis will be conducted once 80% or more of customers have at least six month of performance period data. The SaaS platform will be funded through the Community Pilot and will not require outside funding. This pricing model does not yield expenses beyond what is listed below as Standard Pricing. There will be no cost sharing, no revenue generated, no subcontractors, and no supplies/equipment.

Deliverables and Pricing

Deliverable Item	Quantity	Unit Cost	Total Cost
Setup	1	$24,000	$24,000
RecurveOS	6 months	$5,000/mo	$30,000
OpenEEmeter Analytics Outputs	Up to 200 meters	$5.00/meter	$1,000
Support	100 hours	See Table	$20,000
Total			**$75,000**

Insert YOUR ORGANIZATION'S NAME	Open Energy Efficiency ("OpenEE")	
Insert PROPOSAL TITLE	OpenEE Platform for DSM - Efficiency and Electrification	
Insert Date		August 3, 2018
Community Pilots		

Deliverable Item	Quantity	Unit Cost	Total Cost
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Support	100 hours	See Table	$20,000
Total			**$75,000**

Standard Pricing:

1) OpenEEmeter M&V Platform
   a) $0.20/meter/month tracking
   b) $5.00/meter analytics
   c) $0.50/meter targeting/baseline analytics
2) RecurveOS Platform
   a) $5,000/month per program
   b) $1,000/month per third party
3) Support
   a) 10 hours per month included with RecurveOS Platform
   b) $5,000 per month for 30 additional monthly hours
   c) A la carte support available at rates below

The SaaS platform will be funded through the Community Pilot and will not require outside funding. This pricing model does not yield expenses beyond what is listed above as Standard Pricing. There will be no cost sharing, no revenue generated, no subcontractors, and no supplies/equipment.

Home Energy Management Platform for Peninsula Clean Energy

Community Pilot Proposal

powerley

Table of Contents

Key Information

Project Name
Home Energy Management Platform

Organization
Powerley

Key Partners
Snug Home
Jabil
ALPS

Contacts

Primary Contact:
Jack Grinblatt

Senior Product Analyst

jgrinblatt@powerley.com

Secondary Contact:

Paul Wezner

Director, Product Mgmt & Mktg

pwezner@powerley.com

Project Overview

Description

Powerley proposes a residential Home Energy Management solution, branded as ”PCE LIVE” deployed to 50 households. Each household will receive

1. A PCE-branded Energy Bridge
2. PCE-branded Home Energy Management smartphone app
3. A Smart Thermostat, or could use existing Z-Wave or ecobee thermostat

The Energy Bridge is a hardware device, the hub of the Powerley platform and can communicate via Wi-Fi, Z-Wave, Zigbee, Bluetooth and Thread. The user will connect the Energy Bridge via Zigbee SEP to the PG&E AMI meter using the PG&E Stream My Data program. Connectivity to the meter will allow streaming of real-time (every 3 seconds) consumption data on whole home energy usage. The data captured from the meter allows the platform to providing the user with a better tool to reduce energy waste.

The PCE-branded Home Energy Management app will be the interface for the consumer to visualize the real-time data at the whole house level as well disaggregated individual appliances (e.g. Always On, Fridge, HVAC). The app enables the Powerley platform to present to the user coaching, push notifications and actionable insights to reduce energy waste while also managing connected devices within the home.

The Powerley thermostat is a Z-wave device controlled by the Energy Bridge to control, schedule and optimize HVAC usage, Powerley can also interface with any other Z-Wave or ecobee thermostat, in case a residential customer already has one installed. The Powerley platform enables DR events leveraging the thermostat while also providing coaching and insights on HVAC health and performance. Additionally, the Energy Bridge has the ability to connect to other connected devices (switches, plugs, lights bulbs etc.) to extend the scope of home automation for the user.

Within the coaching engine (titled Powerley Advisor), Powerley provides coaching cards to deliver energy efficiency and appliance performance insights. In addition to our existing library of insights, Powerley will create PCE specific cards that are relevant to PCE customers. Some examples below (to be discussed and finalized with PCE);

- Quantify amount of CO_2 emissions avoided by consumer by using clean energy delivered by PCE
- Social comparisons, CO_2 consumption across neighbors (opt in vs. opt out)
- Impact of upgrading to 100% clean energy plan provided by PCE

PCE will also have access to a program management portal which provides information regarding customer usage information, program metrics, asset deployments, mobile analytics, customer management, a notification center for customer communications, and content management to influence the creation and management of challenges/energy tips & projects.

Functionality/ Features

1	Peninsula Clean Energy branded mobile app for iOS and Android operating systems
2	Real-time (3-second) demand presentment and 60 second intervals on app “dial” via

3	Monthly kWh or $ budget target setting and monitoring
4	Disaggregation of HVAC, refrigerator, “Always On,”
5	Rules creation and maintenance for automating smart home including, HVAC
6	Push notification capabilities
7	Personalized coaching feed through Powerley Advisor providing summaries and analysis of user information, tips for improving experience and collection of critical information for better personalization (real-time data only)
8	Challenges and points for rewards to drive engagement and energy efficiency
9	Demand response with HVAC
10	Powerley Portal for program administration and reporting with features such as analytics, asset management, demand response event management, customer representative support, engagement tool management, content management

Objectives

Introduce and test Powerley’s innovative home energy management solution

- Drive up PCE brand and customer intimacy
- Promote clean energy usage and its environmental impact
- Eliminate energy waste through behavioral change and manage peak loads
- Provide insights and value to PCE customers through energy visualization and home control
- Unlock new services and revenue streams for PCE

Role of Partners

Powerley delivers a turnkey offering to its customers. We design and develop all software inhouse. We also design our Energy Bridge and Thermostat internally,

We partner for the following

1. Energy Bridge Manufacturing – Jabil, leading global contract manufacturer
2. Thermostat – ALPS Electric, leading Japanese OEM
3. Key Smart Devices – Aeotec, Amazon, ecobee, Jasco [some not in scope for this pilot]
4. Customer Support – Sutherland, Leading provider for Home Automation Devices [not in scope for initial pilot but available for full deployment]
5. Installation Support – Snug Home, provides local support across the US
6. Marketing Support – Based on customer preference, but have worked with many utility/energy-focused marketing agencies including Shelton Group, Illume-Diroddi, and Essense Partners and program implementers including CLEAResult and ICF

Sequence of Project Activities

1. 2-4 working sessions to define project plan
2. Pilot Definition
3. Enrollment
4. Hardware & software deployment

5. Ongoing program management

Outcomes

Accelerates GHG Reductions & Renewables

The Powerley platform delivers over 10% deemed energy savings*, when the app and Energy Bridge are paired with a smart thermostat.

Based on the GHG calculations provided by PCE, the Powerley platform will deliver a reduction in 3.57 Metric Tons of GHGs reduced for the 50 participants over the 1.5 year pilot period. If the Powerley Platform is commercialized to PCE's entire customer base, the potential GHG savings are 5,890,214.5 Metric Tons over 10 years.

** 10.07% savings, broken down by each component with source;*
2.29% app – Source: DTE Insight Program Year 2017 Evaluation Summary, conducted by Navigant
5.68% Energy Bridge – Source: DTE Insight Program Year 2017 Evaluation Summary, conducted by Navigant
2.1% Thermostat – Source: DTE Residential Tier III Thermostat Measure

Delivers Community Benefits

The platform is available for all PCE residential customers, and aims to increase awareness of energy consumption, encourage energy conservation and optimization, and deliver demand reduction when needed. Through this engagement at the residential customer level, the entire community will benefit from a more knowledgeable and energy-educated population.

Supports PCE's Load Shaping Needs

The platform can be used as a demand management platform and is effective at reducing or shifting peak consumption when needed. By creating demand response events, PCE can reduce demand at peak times of day, and by leveraging pre-cooling or pre-heating techniques, load can be shifted to maintain customer comfort while limiting the need for energy to be generated and delivered from non-renewable sources.

Additional Benefits

Deployment of the Powerley platform positions PCE as an innovator in the region and an organization that is actively taking steps toward the grid of the 21st century. Engaging customers behind the meter is an essential step to directly engaging customers in distributed energy management and PCE can assert itself as a leader in grid transformation. The platform also aligns with PCE's operational and business goals, converting users to high priced subscription products while reducing attrition in the program.

PCE Implementation Requirements

The Powerley platform is turnkey and designed for ease of implementation and minimum requirements from our customers. We will require support in following areas

1. Guidance to brand the platform according to PCE's brand guidelines
2. Time to conduct working sessions and updates
3. List of target participants
4. One PCE designated program manager

Qualifications

Powerley has executed deployments of its platform in seven utilities, two of which are in full commercialization. Powerley's deployment at DTE in particular has over 400k downloads in ~170k households across metro Detroit with over 30k energy bridges deployed. Powerley has developed capabilities across all key functions, allowing for a complete turnkey solution where Powerley has the capabilities to lean in and provide assistance across all key program facets, including business model design, customer support, evaluation, marketing and more.

Regarding the qualifications of our staff, Powerley has a strong leadership team and is fully staffed to scale and support this new program deployment. See below for bios of key leadership members.

Manoj Kumar – Chief Executive Officer

As Powerley's Chief Executive Officer, Manoj Kumar is growing Powerley into a multi-product, multi-solution, multi geo company in the energy management space. Manoj is a seasoned executive with over 25 years of experience in the public and private-equity space, working with high-tech, automotive, industrial and medical device companies across the globe. Manoj's strong understanding of the evolving home energy management market and his experience with building and developing businesses will drive the success and growth of the Powerley platform globally. Prior to joining Powerley, Manoj was most recently a Partner at McKinsey & Company's Silicon Valley office, where he was a leader in the North America Tech, Media and Telecom sector and the Operations practice. Earlier consulting experience includes Partner positions at PwC and PRTM and industry experience at Cypress Semiconductor and Allied Signal. Manoj has an MBA from the University of Michigan, an MS, Semiconductor Physics/Computer Engineering from Michigan State, and a BE, Electrical Engineering from Mangalore University.

https://www.linkedin.com/in/manoj-kumar-a5449b

Emmett Romine – Senior Vice President Business Development

Emmett leads the sales and delivery functions within Powerley and focuses on customer acquisition, Powerley growth and customer delivery of the Powerley platform. Emmett has almost 20 years of experience in the utilities industry, spending over 12 years working at DTE Energy in Detroit, Michigan. Emmett spent roughly half of that time focused on architecting and building DTE's energy efficiency business and was deeply involved with the development of DTE Insight, the precursor to Powerley. Emmett has served as the Chairman of the Midwest Energy Efficiency Alliance and holds three degrees including a BA in Physics from William Jewell College, a BS in Mechanical Engineering from Washington University in St. Louis, and an MBA from the Olin School of Business at Washington University.

https://www.linkedin.com/in/eromine

Kevin Foreman – Chief Technology Officer

Kevin serves as Powerley's Chief Technology Officer, driving the core technology platform and product experience of Powerley's home energy management platform. Prior to Powerley, Kevin served as Royal Oak-based Vectorform's Director of Product Vision, where he was a leading force in developing the innovative DTE Insight app, the award-winning mobile app that was developed by Vectorform in partnership with DTE Energy, and the precursor to Powerley. Kevin is a passionate innovator who places user experience at the core of every product decision, and tries to seamlessly integrate emerging technology into everyday life. Kevin holds a Bachelor of Science from Lawrence Technological University.

https://www.linkedin.com/in/kevin-foreman-8b876610

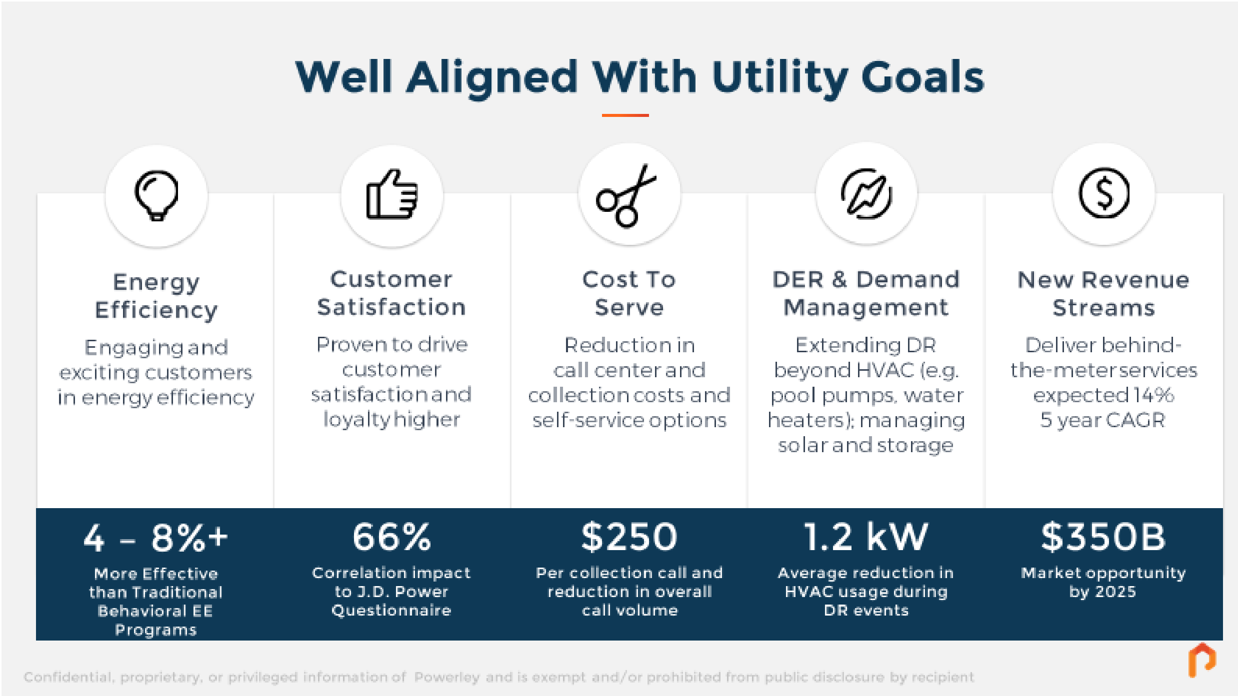
Paul Wezner – Director, Product Management

Paul leads Powerley's product management discipline, directing the company's product roadmap, strategy, and analysis. Paul has over a decade of experience in the digital realm, with work spanning research, strategy, analytics and development. Prior to joining Powerley, Paul mostly recently served as marketing intelligence director of Organic, Inc., a digital experience consultancy, driving the positioning and performance of Organic's work for its clients across the hospitality, CPG and automotive verticals. Paul prides himself on his relentless and pragmatic approach, with a keen focus on performance and measurement, including developing advanced analytics solutions to measure cross-channel platform success. Paul holds a BA in Economics and an MBA from the University of Michigan's Stephen M. Ross School of Business.

https://www.linkedin.com/in/paul-wezner-1454106

Evaluation

Powerley evaluates the program based on a number of metrics, but the platform is focused on five key value propositions all aimed at aligning with utility objectives, with the associated measurements below. Powerley evaluates measures of these objectives through a combination of evaluation efforts, including traditional EM&V measurement approaches for energy and demand savings, customer surveys to measure satisfaction and reduction of confusion and high-bill understanding, and conversion rates to and market penetration to value-add programs and services to determine revenue opportunity.



Metrics & Assumptions

Key metrics will be established early on in this project to assure that the mobile app solution is meeting PCE's and its customers' expectations. Recommended metrics are as follows (to be updated based on feedback):

1	Energy Bridges bound
2	Weekly user sessions and time per session
3	Customer satisfaction through customer surveys of solution
4	System and Energy Bridges uptime

Budget

The budget for this project is estimated to be at $89,350, in the event all 50 customers require a Powerley smart thermostat. If PCE chooses to select customers that have another supported thermostat (i.e. ecobee3/ ecobee3 lite/ ecobee 4), the total program costs would be reduced for each thermostat not needed.

Powerley is requesting the full $75,000 possible from PCE and will make an internal investment to cover the program costs in delivering the rest of the project. Full breakdown via the budget proposal below.

Powerley					
Home Energy Management Platform					
3-Aug-18					
Community Pilots					
		YEAR 1	**TOTAL**		**STATUS***
REVENUE SOURCES	**SOURCE**				
Income #1	**Requested from PCE**	$75,000	**$75,000**	84%	Requested
Income #2	Powerley Investment	$14,350	**$14,350**	16%	Received
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$89,350**	**$89,350**		
REVENUE SUMMARY					
Total Requested			**$75,000**	84%	
Total Pledged			**$0**	0%	
Total Received			**$14,350**	16%	
Total Estimated			**$0**	0%	
TOTAL PROPOSAL REVENUE			**$89,350**	100%	
					If the expense request is classified as capital*, what is its anticipated**
EXPENSE	**DESCRIPTION****	**YEAR 1**	**TOTAL**		
Expense #1	50 PCE-branded Energy Bridges	$4,500	**$4,500**	5%	
Expense #2	50 Powerley Smart Thermostats (can be reduced if customer has ecobee)	$3,500	**$3,500**	4%	
Expense #3	In-home Installation Services (50 customers)	$4,950	**$4,950**	6%	
Expense #4	PCE-branded app & portal - setup and launch	$20,700	**$20,700**	23%	
Expense #5	Customer Support - 1 Year	$25,920	**$25,920**	29%	
Expense #6	Program Management - 1 Year	$17,280	**$17,280**	19%	
Expense #7	Development for 100% Clean Energy Calc and Value Prop/Upsell	$12,500	**$12,500**	14%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$89,350**	**$89,350**	**100%**	
Net Income - Expenses		-	-		

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Powerley
Home Energy Management Platform
3-Aug-18
Community Pilots

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
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REVENUE SUMMARY		
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Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$89,350**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
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Proposal
Peninsula Clean Energy
2018 Community Pilots
August 3, 2018

Renewable Energy Policies: Pilot Programs for San Mateo Businesses & Communities

Applying Organization: Presidio Graduate School
1202 Ralston Avenue, Suite 300
San Francisco, CA 94129
www.presidio.edu

Key Partners: City of Pacific Economic Development Manager Thomas Myers, and peers in the cities of South San Francisco and San Bruno

Primary Contact: Pamela J. Gordon,
Director of Partnerships, Presidio Graduate School
Pamela.Gordon@presidio.edu
+1.415.655.8920

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1.0 Project Description

PROJECT DESCRIPTION

1.1 Objective

Reduce Business' GHG

Lower Energy Costs

Community Benefits

Three San Mateo County cities will demonstrate that commercial buildings powered by renewable energy increases company profitability, improves communities' environmental and financial wellness, and bolsters the region's clean-energy infrastructure.

The objective of this pilot project is to implement sustainable development of existing and new commercial (and home-based) businesses through piloting a commercial building renewable energy standard. The pilot will establish a replicable model of Greenhouse Gas (GHG) emission reductions that will catalyze broader county action. Through developing and implementing renewable-energy-focused commercial building codes, energy consumption and greenhouse gas emissions will measurably decline.

The results will advance Senate Bill (SB-350) – requiring that California increase procurement of renewable energy to 50% by 2030 – and the proposed SB-100 – establishing a State target of 100% clean energy for California by 2045.[1,2] The three cities' exemplary action will inspire the County of San Mateo and State of California to achieve reliance on clean energy and zero carbon resources by 2045, as part of a global energy transition.

1.2 Roles of Partners: Three Pilot Cities in San Mateo County

The first pilot is in the City of Pacifica, which already leads the county in open-space preservation. Pacifica's leaders are shaping its future, recognizing that promoting the adoption of renewable energy responds to the dual challenge of climate change and energy security. When Presidio Graduate School presented this pilot to Economic Development Manager Thomas Myers, Mr. Myers immediately embraced the greening of Pacifica's commercial business as an accelerator to achieving the City of Pacifica's

[1] http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350

[2] http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100

goal of reducing emissions by 35% below 2005 levels by 2020, and 80% below 1990 levels by 2050 by promoting the adoption of renewable energy.[3] Pacifica's 1,812 commercial business are an engaged community group; several have already been identified as likely leaders for this pilot project.

The project is scalable and applies also to cities with economically-vulnerable communities. South San Francisco and San Bruno are second and third cities planned for this pilot. (Kindly refer to section 2.2 for the three cities' Community Vulnerability Index (CVI) diversity.)

1.3 Sequence of Activities

Activity	Brief Description	Months from PCE Contract Receipt
Kick-Off Meeting	All project stakeholders including commercial businesses formulate and confirm methodology, deliverables, and communications.	**1**
Pacifica Pilot Launch*	Identify businesses, analyze GHG emissions and forecasts, review commercial building policies, hold community event, draft policies for feedback.	**1-9**
2nd and 3rd City Pilot Launches	Conduct above activities in each city – having learned some best practices in Pacifica. Look for additional community-strengthening activities and benefits.	**9-14**
Evaluate Pilots	Using the tools and metrics listed in section 5.0 of this proposal, evaluate efficacy, and recommend improvements.	**12-15**
Final Presentations	Report back to PCE, the three cities, the businesses, and the communities the environmental, business, and community benefits and limitations of the pilots.	**15**
Prepare for Scale-up	Coach PCE in carrying the most effective aspects of the pilot program forward into other San Mateo County Cities.	**15**

**We will engage Presidio Graduate School student teams during the Spring and Fall 2019 semesters to support this project's research, community outreach, analysis, and drafts. The student teams will be supervised by Professor and MPA Program Director Donna LaSala.*

[3] http://www.cityofpacifica.org/civicax/filebank/blobdload.aspx?blobid=7490

2.0 Project Outcomes

PROJECT OUTCOMES

This pilot project, *Policies for Advancing Renewable Energy in Commercial Buildings: Three Pilots in San Mateo County*, aligns with Peninsula Clean Energy's goals to create new local, power (20 MW by 2025); meet 100% GHG-free power (for 2021), and achieve 100% renewable energy (by 2025). We estimate a Another enormous advantage of this strategy is that stored power can be shared, at low or no cost, across local residential communities, in addition to meeting business needs; more people will benefit, at a lower cost, and with the least negative impact to the environment.

2.1 Accelerate GHG Reductions and Renewables

In 2014, the City of Pacifica – one of the three pilot cities – adopted a Climate Action Plan (CAP) that outlines several bold measures to address the challenge of climate change. Existing measures to reduce GHG emissions in the built-environment include participating in Energy Upgrade Programs and implementing energy efficiency measures (EEM's) in existing municipal buildings.[4] This GHG-reduction plan presents a challenge, given that Pacifica's building' emissions are forecast to rise 11% to more than 80,102 Mt CO_2-equivalent by 2028, from 71,433 Mt CO2 during an average year from 2005-2011 (1.1 billion kBTU).[5] This forecast, based upon historical data from SMC Energy Watch, assumes business as usual conditions without adding any new commercial or residential development. The pilot ordinances will call for leveraging on-property renewable energy generation and the purchase of renewable electricity through Peninsula Clean Energy.

In addition to helping the community meet Pacifica's existing Climate Action Plan goals, this project will reduce operational costs; improve building occupants' health, comfort and productivity; reduce pollution; provide green jobs; and promote the City of Pacifica as an exciting and responsible place to work and live. More about the community benefits of this pilot project is covered below, in section 2.2.

2.2 Deliver Community Benefits

The proposed joint-partnership will generate a progressive and leading-edge policy to bolster the adoption of local renewable energy generation. Progressive action taken by the City of Pacifica is expected to stimulate a sustainable the local economy by providing long-term energy stability and job creation. Furthermore, this model can be replicated throughout other economically disadvantaged cities and municipalities in San Mateo

[4] http://www.cityofpacifica.org/civicax/filebank/blobdload.aspx?BlobID=13498
[5] http://www.smcenergywatch.com/reportcards/rc_Pacifica.pdf

County. The Community Vulnerability Index (CVI) utilizes seven metrics to identify geographic areas of economic vulnerability, including Health Insurance Coverage, Educational Attainment, Supplemental Security Income, Gross Rent as a Percentage of Household Income, Poverty, Unemployment, and Disability Status.[6] [6]CIties targeted for the second and third pilots include San Bruno and South San Francisco, with a moderate and high CVI respectively (Figure 1).

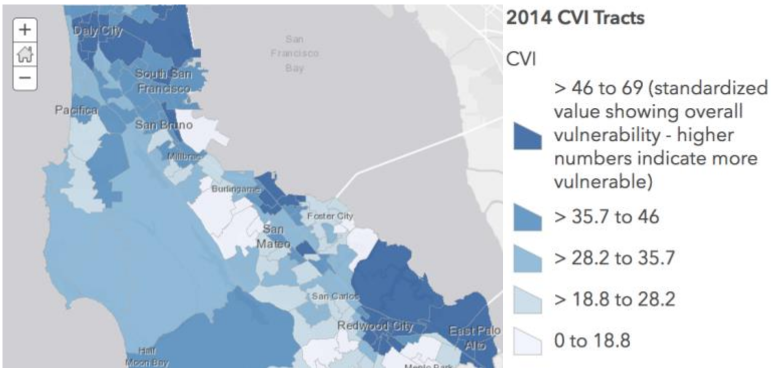


Figure 1: A Map of Community Vulnerability Indexes in San Mateo County.
Source: http://arcg.is/2f2yEIb

2.3 Support PCE's Load Serving Needs

Maximizing commercial buildings' ability to leverage renewable energy ideally calls for:

(1) *generating* renewable energy on-site, and
(2) *purchasing* renewable energy for needs beyond on-site generation.

In this pilot project, we will work with Pacifica and the other cities to leverage these combined methods of "going renewable."

When businesses design and build new buildings, it makes sense to gear the construction projects around renewable energy generation and use. This includes planning such as positioning buildings on the lot to gather the most sunlight and wind and/or installing storage to make energy readily available no matter the weather conditions or time of day. The latter consideration – storing generated energy – supports PCE's load-serving needs. Not only do businesses benefit from balancing load for 24/7 access to power, but also the community benefits when the stored power can be shared.

Additionally, existing commercial buildings that have current in-efficiencies due to operating under older standards will immediately benefit from energy retrofits while improving cost-savings and supports PCE's load serving need.

[6] https://cmo.smcgov.org/sites/cmo.smcgov.org/files/Attachment%203.PDF

2.4 Additional Benefits

We understand that a holistic approach in partnership with others will help the community of Pacifica and greater county of San Mateo better understand and respond to climate change risks. We aim to develop an innovative regulatory framework that advances existing clean energy programs in San Mateo County as well as PCE and California's state environmental goals. This regulatory framework developed for the promotion of renewable energy can be replicated and scaled throughout San Mateo County and across California. We propose to engage stakeholders through a series of community workshops to capture insights into the validity and practical use of a new regulatory framework. This will create a platform for collaboration between nonprofits, government, and the private sector while also promoting public education and awareness about available renewable energy sources. Additionally, this project may yield financial incentives for the development, production, and utilization of renewable energy as well as generate local clean energy jobs. This pilot project promotes sustainable development and will ensure the supply of sustainable, cost-effective and reliable energy that builds resilience; enhances community disaster risk reduction and helps the community prepare for extreme weather events.

3.0 PCE Implementation Requirements

PCE IMPLEMENTATION REQUIREMENTS

3.1 Community Events

As part of this pilot project, we plan to hold a community-engagement event in each city. The purpose of the event is to hear the communities' ideas and hear concerns about transitioning their cities' commercial buildings to 100% renewable energy use. We ask that a representative from PCE attend each of the events, if possible, to share PCE's commitment to clean energy in San Mateo County.

3.2 Additional Pilot Cities

We have already secured participation interest by the City of Pacifica. We have tentatively targeted two cities nearby Pacifica with more economic vulnerability: South San Francisco and San Bruno. We have not yet secured these two cities' participation, and would like input from PCE on whether these, or other San Mateo County cities, are ideal for the second and third pilots.

3.3 Policy Input

We will work closely with Pacifica first and then the other two pilot cities to evaluate the each location's current and future energy needs, interview business leaders about generating and purchasing renewable energy, and drafting ordinances, building codes, and/or other policies that result in renewable sources of energy for commercial buildings.

To be most efficient and effective, we would like for PCE to share related policies and/or provide input for the policies we draft. Ideally, a PCE representative will be available to "sit at the table" with us during key sessions with the cities' policy makers. We would minimize our use of PCE staff's time, however, we see great value in this collaboration and solidarity.

After all, the success of this pilot project is meant to be replicated throughout San Mateo County. Therefore, we want to ensure that PCE can stand behind the recommended policies.

4.0 Qualifications

QUALIFICATIONS

This project represents a collaboration between numerous passionate and experienced partners from the private sector, non-profit sector, and government all dedicated to make an impact.

PRESIDIO GRADUATE SCHOOL TEAM

Donna LaSala, MPA Program Director and Professor at Presidio Graduate School

Donna LaSala is a strategic, results-oriented executive with 28+ years of experience leading public, private, and non-profit organizations. She served the City of Berkeley, CA for eighteen years, the final eight as CIO/IT Director, and recently co-founded the Triple Bottom Line Institute. Passionate about collaborative engagement for economic renewal, she is currently working with PGS colleagues to publish an updated *Guide to Sustainable Community Development*; this pilot could serve as a case study for that publication. She holds a BSc in Policy Analysis & Economics from Cornell University, an MPA from University of San Francisco, and is a graduate of Harvard University's Senior Executives in State & Local Government' program. MPA University of San Francisco

Pamela J. Gordon, Director of Strategic Partnerships at Presidio Graduate School

Pamela J. Gordon is a sustainability thought leader with proven track record of developing successful execution plans for top tech companies to reduce environmental footprint through profitable business models. Keynote speaker and award winning author of books and articles on the intersection of environmental/social sustainability and business value. Author of the 2001 book *Lean and Green: Profit for Your Workplace and the Environment* (Berrett-Koehler Publishers). BA San Jose State University.

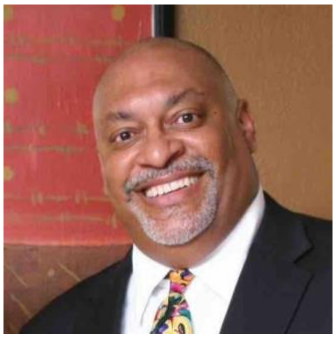
Alice Roberts, Sustainability Consultant at Carbon Lens LLC

Alice Roberts is passionate about using business as a vehicle for positive impact. Accomplished in analyzing and improving operational activities in order to drive sustainable growth. Areas of expertise include renewable energy, sustainability reporting, carbon emission footprinting, carbon emission verification, facility based energy auditing, facility energy baseline and benchmarking, identification of facility energy efficiency measures and financial analysis. Alice partners with customers and other companies to share environmental knowledge and best practices. MBA Presidio Graduate School.

Presidio Graduate School Experiential Learning Graduate Student Consultants

Additionally, we plan to engage Presidio Graduate School student consultants during the Spring 2019 and Fall 2019 academic semesters to support this project. These teams will analyze best practices and develop recommendations to address a new policy framework drawing upon the analytic and problem-solving skills learned in their MBA/MPA coursework.

PARTNERS FROM THE THREE CITIES



Thomas Myers, Economic Development Manager, City of Pacifica

Before joining the City of Pacifica, Mr. Myers served in key city management roles for numerous California (especially Bay Area) cities. For the City and County of San Francisco, he was Deputy Director of Workforce Development. For the City of Berkeley, he was (in reverse chronological order) Manager of Economic Development, Assistant to the City Manager, and Economic Development Project Coordinator. Before that, Mr. Myers held the position of Grants Management Specialist and Industrial/Commercial Finance Officer for the City of Los Angeles. Mr. Myers also owns the music-and-entertainment company, The Equanimous Jones Co. J.D. UCLA School of Law, MBA UCLA Anderson School of Management, AB Economics Stanford University.

Economic Development Managers from Two More Cities

At this point, we target South San Francisco and San Bruno for the other two pilot cities, and have been offered personal introductions to these cities' economic development managers. Whether these two cities participate in the pilot or two others, we will partner with the cities' economic development managers, or other appropriate title.

5.0 Evaluation

EVALUATION

We have designed this pilot project to yield both quantitative and qualitative outcomes. Examples of evaluation tools and metrics include the following:

- **Community Workshop Participation / Effectiveness**
  - Number of participants from each city
  - Results of an evaluation / ideas form
- **Projected Renewable Energy Installed Capacity**

- Before pilot and projected after pilot installation, in each city
- Projected increases in renewable-energy storage capability

- **Projected GHG Emission Reductions**
  - Before pilot and projected after pilot reductions, in each city

- **The Partners' Satisfaction with the Pilot and Results**
  - Survey eliciting the Economic Development Managers' (and/or similar titles) experience of the pilot project's efficacy
  - Another satisfaction survey for the participating business managers in each city

6.0 Metrics & Assumptions

METRICS & ASSUMPTIONS

A data set available from SMC Energy watch was used to estimate long-term (10 year) avoided GHG emissions from the City of Pacifica. Using regression analysis, data was extrapolated to 2028 and modeled based upon annualized commercial (non-residential) energy consumption data, separated by type (e.g., electricity, natural gas). The projected energy values assumes operating as business as usual and does not include projected increases in new construction. We calculated GHG's based upon the WRI GHG Protocol using the EPA eGRID emission factors for the Western Coordinating Council (WECC) California region (529.9 lbs CO_2e/MWh).[7,8] We performed a greenhouse gas equivalency (Mt CO_2-equiv) calculation which allows us to evaluate environmental impact by taking into consideration all greenhouse emitting gases, including CO_2, CH_4 and N_2O emissions directly associated with the consumption of electricity. This metric will be used to make meaningful comparisons across cities in San Mateo County. As a conservative estimate, we applied a multiplier factor of 3 to account for possible additional two pilot cities to obtain the projected 459,644 Mt of CO_2-equiv savings.

We estimate the total project cost to be $85,000 and with $75,000 funds from PCE and the remaining $10,000 from the three pilot cities. The primary cost effectiveness driver for this project is using graduate student consultants at PGS. We anticipate utilizing two student teams of 4-5 that will collectively provide 320-400 hours per semester at a 20% reduced PGS Experiential Learning Fee of $4,000 per semester.

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[7] https://ghgprotocol.org/sites/default/files/standards/GHGP_GPC_0.pdf

[8] https://www.epa.gov/sites/production/files/2018-02/documents/egrid2016_summarytables.pdf

Insert YOUR ORGANIZATION'S NAME	**Presidio Graduate School**
Insert PROPOSAL TITLE	**Policies for Advancing Renewable Energy in Commercial Buildings: Pilots in Three San Mateo County Cities**
Insert Date	**8/3/2018**
Community Pilots	

REVENUE SOURCES	**SOURCE**	**15 months**	**TOTAL**		**STATUS***
Income #1	**Requested from PCE**	$75,000	**$75,000**	88%	Requested
Income #2	**Requested from City of Pacifica**	$5,000	**$5,000**	6%	Estimated
	Requested from City of South Bruno	$2,500	**$2,500**	3%	Estimated
Income #3	**Requested from City of South San Francisco**	$2,500	**$2,500**	3%	Estimated
	Total	**$85,000**	**$85,000**		

REVENUE SUMMARY		
Total Requested	**$75,000**	88%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$10,000**	12%
TOTAL PROPOSAL REVENUE	**$85,000**	100%

EXPENSE	**DESCRIPTION****	**15 months**	**TOTAL**		**If the expense request is classified as capital***, what is its anticipated length of service**
Community Policy & Outreach Director	Currently oversees community policy & outreach. This person's hourly rate is $295.00 for 50 hours.	$14,750	**$14,750**	17%	
Sustainability Consultant & Director of Strategic Partnerships	Provides direct services to the project. This person's hourly rate is $295.00 for 50 hours.	$14,750	**$14,750**	17%	
Sustainability Consultant/ Analyst(s)	Provides direct services to the project. This person's hourly rate is $100.00 for 240 hours.	$24,000	**$24,000**	28%	
Project Manager	Responsible for keeping pilot program on track, metric and budget. This person's hourly rate is $75.00 for 120 hours.	$9,000	**$9,000**	11%	
Outreach & Education Workshops	Propose 2-4 community workshops during the duration of the project	$8,500	**$8,500**	10%	
Materials & Supplies	Materials & Supplies to support pilot project	$2,000	**$2,000**	2%	
Administrative Support	Graphics, Editing and Administrative Support	$4,000	**$4,000**	5%	
PGS Experiential Learning Fees	Discounted PGS Experiential Learning project fee for 2 courses (normally $10,000 for 2 semesters' projects)	$8,000	**$8,000**	9%	
TOTAL PROPOSAL EXPENSES		**$85,000**	**$85,000**	**100%**	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

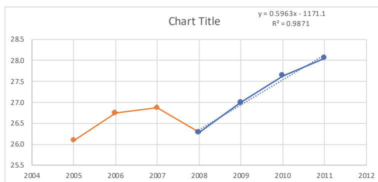
*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

2014 Pacifica Energy & GHG's

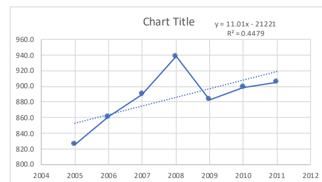
Total Bldg kBTU	Gas-therms	Elec-kWh	Gas-Comm-.1	Elect-Comm-.22	Total Comm-kBTU
1,197,864,163	7,904,528	119,405,431	790,453	26,269,195	27,059,648

Comm Elec	Comm Gas	Res Elect	Res Gas	Total
2,587	1,324	730	4,029	**8,669**

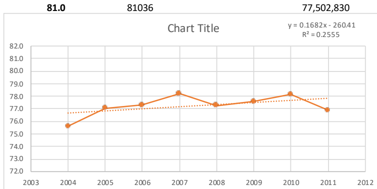
Comm Elect	% change	(mill kWH)	MWh	lb CO2	lbs CO2-equiv	metric tonnes CO2-equiv	
2003		**26.3**	26269	956.4	25,123,858	11,396	
2004	-0.003	**26.2**	26190		25,048,486	11,362	
2005	-0.004	**26.1**	26086		24,948,292	11,316	
2006	0.025	**26.7**	26738		25,572,000	11,599	
2007	0.005	**26.9**	26871		25,699,860	11,657	
2008	-0.022	**26.3**	26280		25,134,463	11,401	
2009	0.027	**27.0**	26990		25,813,093	11,709	
2010	0.024	**27.6**	27638		26,432,608	11,990	
2011	0.015	**28.1**	28052		26,829,097	12,169	
					-	-	
2012		**28.7**	28656		27,406,216	12,431	
2013		**29.3**	29252		27,976,517	12,690	
2014		**29.8**	29848		28,546,818	12,949	
2015		**30.4**	30445		29,117,120	13,207	
2016		**31.0**	31041		29,687,421	13,466	
2017		**31.6**	31637		30,257,722	13,725	
2018		**32.2**	32233		30,828,024	**13,983**	
2019		**32.8**	32830	71433	31,398,325	14,242	
2020		**33.4**	33426	80102	31,968,626	14,501	
2021		**34.0**	34022	0.891775486	32,538,928	14,759	
2022		**34.6**	34619		33,109,229	15,018	
2023		**35.2**	35215		33,679,530	15,277	
2024		**35.8**	35811		34,249,832	15,535	
2025		**36.4**	36408		34,820,133	15,794	71333
2026		**37.0**	37004		35,390,434	16,053	
2027		**37.6**	37600		35,960,736	16,312	
2028		**38.2**	38196		36,531,037	**16,570**	
2029		**38.8**	38793		37,101,338	16,829	
2030		**39.4**	39389		37,671,640	17,088	



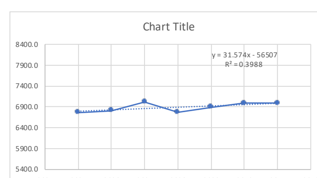
Comm Gas	% change	(thous therms)	MWh	lb CO2	lbs CO2-equiv	metric tonnes CO2-equiv	
2003		**790.5**	23249	956.4	22,234,972	10,086	
2004	0.016	**803.1**	23621		22,590,732	10,247	
2005	0.028	**825.6**	24282		23,223,272	10,534	
2006	0.043	**861.1**	25326		24,221,873	10,987	
2007	0.033	**889.5**	26162		25,021,195	11,349	
2008	0.055	**938.4**	27601		26,397,361	11,974	
2009	-0.059	**883.1**	25972		24,839,916	11,267	
2010	0.018	**899.0**	26440		25,287,035	11,470	
2011	0.007	**905.2**	26625		25,464,044	11,550	
					-	-	
2012		**875.5**	25750		24,627,638	11,171	
2013		**885.9**	26056		24,919,508	11,303	
2014		**896.3**	26361		25,211,379	11,436	
2015		**906.6**	26666		25,503,250	11,568	
2016		**917.0**	26971		25,795,121	11,700	
2017		**927.4**	27276		26,086,991	11,833	
2018		**937.8**	27581		26,378,862	**11,965**	25,949
2019		**948.1**	27887		26,670,733	12,098	
2020		**958.5**	28192		26,962,604	12,230	
2021		**968.9**	28497		27,254,475	12,362	
2022		**979.3**	28802		27,546,345	12,495	
2023		**989.6**	29107		27,838,216	12,627	
2024		**1000.0**	29412		28,130,087	12,760	
2025		**1010.4**	29718		28,421,958	12,892	
2026		**1020.8**	30023		28,713,828	13,024	
2027		**1031.2**	30328		29,005,699	13,157	
2028		**1041.5**	30633		29,297,570	**13,289**	29,859
2029		**1051.9**	30938		29,589,441	13,422	
2030		**1062.3**	31244		29,881,312	13,554	



ResElect	% change	(mill kWH)	MWh	lb CO2	lbs CO2-equiv	metric tonnes CO2-equiv
2003		**72.5**	72500	956.4	69,339,000	31,452
2004	0.043	**75.6**	75618		72,320,577	32,804
2005	0.019	**77.1**	77054		73,694,668	33,427
2006	0.003	**77.3**	77285		73,915,752	33,528
2007	0.012	**78.2**	78213		74,802,741	33,930
2008	-0.012	**77.3**	77274		73,905,108	33,523
2009	0.004	**77.6**	77583		74,200,729	33,657
2010	0.007	**78.1**	78126		74,720,134	33,892
2011	-0.016	**76.9**	76876		73,524,611	33,350
					-	-
2012		**78.0**	78008		74,607,234	33,841
2013		**78.2**	78177		74,768,100	33,914
2014		**78.3**	78345		74,928,967	33,987
2015		**78.5**	78513		75,089,833	34,060
2016		**78.7**	78681		75,250,700	34,133
2017		**78.8**	78849		75,411,566	34,206
2018		**79.0**	79018		75,572,433	**34,279**
2019		**79.2**	79186		75,733,299	34,352
2020		**79.4**	79354		75,894,166	34,425
2021		**79.5**	79522		76,055,032	34,498
2022		**79.7**	79690		76,215,899	34,571
2023		**79.9**	79859		76,376,765	34,644
2024		**80.0**	80027		76,537,632	34,717
2025		**80.2**	80195		76,698,498	34,790
2026		**80.4**	80363		76,859,364	34,863
2027		**80.5**	80531		77,020,231	34,936
2028		**80.7**	80700		77,181,097	**35,009**
2029		**80.9**	80868		77,341,964	35,082
2030		**81.0**	81036		77,502,830	35,155



Res Gas	% change	(thous therms)	MWh	lb CO2	lbs CO2-equiv	metric tonnes CO2-equiv	
2003		**6880.0**	202353	956.4	193,530,353	87,784	
2004	0.02	**7017.6**	206400		197,400,960	89,539	
2005	-0.035	**6772.0**	199176		190,491,926	86,406	
2006	0.006	**6812.6**	200371		191,634,878	86,924	
2007	0.03	**7017.0**	206382		197,383,924	89,532	
2008	-0.035	**6771.4**	199159		190,475,487	86,398	
2009	0.018	**6893.3**	202744		193,904,046	87,953	
2010	0.014	**6989.8**	205582		196,618,702	89,185	
2011		**6989.8**	205582		196,618,702	89,185	
					-	-	
2012		**7019.9**	206467		197,465,320	89,569	
2013		**7051.5**	207396		198,353,478	89,972	
2014		**7083.0**	208325		199,241,636	90,374	
2015		**7114.6**	209253		200,129,794	90,777	
2016		**7146.2**	210182		201,017,952	91,180	
2017		**7177.8**	211111		201,906,110	91,583	
2018		**7209.3**	212039		202,794,268	**91,986**	126,265
2019		**7240.9**	212968		203,682,426	92,389	
2020		**7272.5**	213896		204,570,584	92,792	
2021		**7304.1**	214825		205,458,743	93,194	
2022		**7335.6**	215754		206,346,901	93,597	
2023		**7367.2**	216682		207,235,059	94,000	
2024		**7398.8**	217611		208,123,217	94,403	
2025		**7430.4**	218540		209,011,375	94,806	
2026		**7461.9**	219468		209,899,533	95,209	
2027		**7493.5**	220397		210,787,691	95,612	
2028		**7525.1**	221326		211,675,849	**96,014**	131,023
2029		**7556.6**	222254		212,564,007	96,417	
2030		**7588.2**	223183		213,452,165	96,820	



PCE Solar Energy Grant

Proposal for the

San Mateo County Event Center

Key Partners: The San Mateo Exposition and Fair Association, San Mateo County Office of Sustainability

Contact: Dana Stoehr, CEO San Mateo County Event Center/ www.smcec.co

Email: dstoehr@smcec.co

Phone: 650-574-3247, Ext. 305

Description of Project

The San Mateo Event Center with the support of San Mateo County is seeking installation of a Solar PV rooftop and potential ground installation system to offset SMCEC's retail energy usage and potentially generate excess supply that could be provided back to Peninsula Clean Energy (PCE). P roject components include a system electrically interconnected to SMCEC's onsite electrical facilities and planned as net energy metering, providing energy savings that would accrue toward SMCEC's annual operating budget. This project would underscores PCE's, the Event Center, and the County's commitment toward environmental sustainability, GHG reductions, and resilience planning. The Event Center is a designated site for shelter in case of natural disasters.

Additional consideration is being given to Solar PV rooftop and/or ground installation for wholesale energy supply to Peninsula Clean Energy due to available land and rooftop space by way of adding a Tier 1 stationary battery system, which would open the possibility for a solar storage system for PCE. If realized, this would be the largest solar-microgrid site in San Mateo County.

The San Mateo County Event Center is centrally located in the City of San Mateo and owned by the County of San Mateo. The Event Center encompasses 48 acres with seven buildings ranging in size from 5,000 to 105,000 square feet. The Event Center is operated by the San Mateo Exposition and Fair Association and has been in existence by contractual agreement with the County for over seventy years. The Association is a 501 (c3) Not for Profit and its Board of Directors are appointed by the San Mateo County Board of Supervisors. The San Mateo County Event Center holds an Office of Emergency Services designation in the event of community need in times of crises and hosts over 750,000 visitors at the SMCEC campus each year.

A highly visible solar PV project of this size located in San Mateo offers enormous education potential and would represent an irrefutable demonstration of commitment to local renewable energy.

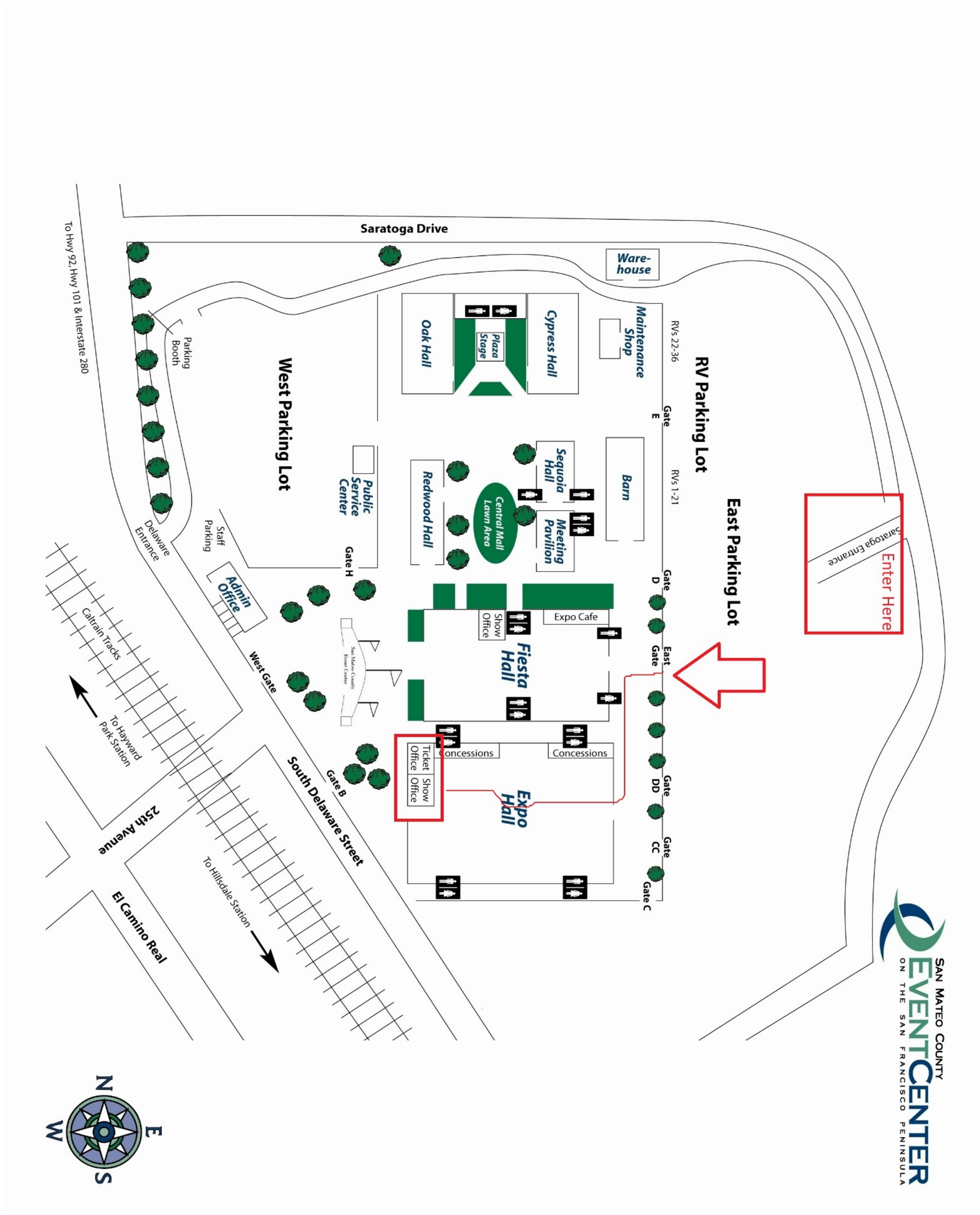
The San Mateo Event Center and County Office of Sustainability is committed to sourcing best outcomes for a highly-visible solar and possibly microgrid installation, utilizing existing ground and rooftop space at the San Mateo County Event Center. This installation can be prominently labeled as funded in part by Peninsula Clean Energy (or in whole if PCE desires to fund the final installation of the eventual complete system).

To accomplish the installation goal, a feasibility assessment for solar, energy storage and community micro grid capabilities at the Event Center site must be conducted. Once a feasibility study has been completed we are seeking further consultation and preparation for a Request for Proposal with technical content generated through the Feasibility Study.

The implementation of a solar plan at the Event Center could be substantially beneficial for all parties involved. With the cost of solar implementation and panels declining, this project has become a more feasible project for the Event Center and is a cleaner way of obtaining a source of energy. Our campus has the potential for very high output gains due to the amount of space available for solar panels.

Buildings have already been identified as meeting or exceeding required load capacity for solar panel installation including Expo Hall at 105,000 sq. ft., Jockey Club (formerly Oak Hall) 20,000 sq. ft., Cypress Hall, 18,000 sq. ft., Meeting Pavilion and Sequoia Halls both 6,500 sq. ft.

Next Steps are to secure funding for a Feasibility assessment for solar, energy storage and Community Micro grid capabilities at the Event Center campus, develop cost estimates and prepare a Request for Proposal for installation of the selected solar or microgrid system. We look to Peninsula Clean Energy’s grant opportunity to implement this study and develop a Request for Proposal as soon as possible.


Saratoga Drive
Ware-house
Oak Hall
Plaza Stage
Cypress Hall
Maintenance Shop
RVs 22-36
RV Parking Lot
West Parking Lot
Parking Booth
To Hwy 92, Hwy 101 & Interstate 280
Gate E
Sequoia Hall
Barn
RVs 1-21
Public Service Center
Redwood Hall
Central Mall Lawn Area
Meeting Pavilion
East Parking Lot
Saratoga Entrance
Enter Here
Staff Parking
Gate H
Delaware Entrance
Gate D
Admin Office
Show Office
Expo Cafe
Fiesta Hall
East Gate
West Gate
Caltrain Tracks
To Hayward Park Station
Concessions
Concessions
Ticket Office
Show Office
Expo Hall
Gate DD
Gate B
South Delaware Street
25th Avenue
Gate CC
Gate C
El Camino Real
To Hillsdale Station
San Mateo County EventCenter on the San Francisco Peninsula
N
E
S
W

OVERVIEW
NTS

BUILDING A: - 1554 solar modules

Building B & C - 176 solar Modules

Building D & E - 600 solar modules

TOTAL NUMBER OF SOLAR MODULES SHOWN ON CONCEPTUAL LAYOUT: - 2330

* Engineering Analysis required to confirm feasibility of conceptual capacities

CONCEPTUAL PLANS
PREPARED FOR:

GOLDEN STATE
RENEWABLE ENERGY

SATTLER SOLAR
SUN POWER SIMPLIFIED

0.9 MWp

San Mateo Event Center
1346 Saratoga Dr., San Mateo, CA 94403

CP-1.0

Outcomes:

The project planned encompasses an initial projection of 800kw-1200kw system. Conservative estimates of a 900 kw system would reduce C02 emissions by approximately 120 Tons per year, based on 1.7M kWh estimated annual energy use and the current ECOPlus energy mix and the 2017 PCE ECOPlus coefficient of 0.14226 lbs/kWh, and provide some additional generation.

Community Benefit:

Due to the scope of the project and tremendous benefits combined with the Event Center's large attendee draw for numerous year-round events and the annual San Mateo County Fair; the educational and cost saving benefits to the community are numerous. The Event Center is a key component in San Mateo County's emergency planning inventory. Once the project is complete there will be planned educational areas throughout the property to educate visitors.

This would be a model project not just for the Event Center but the County and PCE as well. In addition the Event Center extends benefits to other San Mateo County based not profits in need of meeting space and for fund raising events. Operational cost savings further the mission of the Event Center to serve the citizens of San Mateo County and other San Mateo County not for profit organizations.

PCE Implementation Requirements:

This project encompasses the values and objectives of PCE:

- The project supports a San Mateo County not for profit business that exists to not only serve commercial clients but also as a benefit to San Mateo County Citizens through the San Mateo County Fair, hosted to support youth and adults in both Technology and Agriculture; discounted rental opportunities for events and meetings for other San Mateo County not for profit organizations. As well as low cost or complimentary space provided for local safety services trainings and other educational and governmental programs.

- The San Mateo Event Center and County of San Mateo look forward to working with IBEW and other professional union labor trades in support of this project

- The project provides locally-generated renewable energy

- The Event Center and the County of San Mateo are committed to the implementation of this project

- The San Mateo County Fair's motto is "Where Tradition meets Innovation" This project would serve as the pinnacle of success for a sustainable clean renewable energy project. As noted in the grant application San Mateo County has a history at being at the forefront of innovation. This project in every way is demonstrative of that innovation.

- The project has the potential to provide resilience to the residents of San Mateo County

Qualifications

The San Mateo County Exhibition and Fair Association has a long and successful history working collaboratively with the County over the last seventy plus years. The Event Center and Fair are regarded and respected institutions in San Mateo County. The County Office of Sustainability, the County Manager, Supervisor Carole Groom and Supervisor Dave Pine are in support of our efforts to become more efficient and reduce GHG emissions. The scope of this project extends beyond the needs of the Event Center, creating opportunity to generate local sustainable energy.

Evaluation

The San Mateo County Event Center is working closely with the San Mateo County Office of Sustainability. Measurable evaluation criteria will be developed based on the scope of the final project. We do know that the project exceeds benefits beyond:

- Creating abundant local renewable and sustainable power generation
- Educationally enriching for San Mateo Citizens
- Environmentally Friendly
- Reduction of Green House Gases
- Reduction of Electricity Costs
- Job creation to install the project
- Reliable power in the event of Bay Area or County Emergency

Metrics and Assumptions

The basis of this application is to determine best outcomes through a feasibility study. While specific metrics and assumptions will be determined by the size and scope of the project. The potential for the Event Center Campus to host the largest San Mateo County Solar Microgrid system provides extreme benefit to the citizens of San Mateo County, San Mateo County Government, Peninsula Clean Energy and the San Mateo County Event Center and Fair.

References

San Mateo County Event Center
San Mateo County Event Center Solar Project
08/202/18
Community Pilots

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**	$50,000	**$50,000**	77%	Requested
Income #2	**San Mateo County Event Center initial project contribution**	$15,000	**$15,000**	23%	
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$65,000**	**$65,000**		

REVENUE SUMMARY				
Total Requested	**PCE Grant**		**$50,000**	77%
Total Pledged			**$0**	
Total Received	**San Mateo County Event Center initial project contribution**	**$15,000**	**$15,000**	23%
Total Estimated			**$0**	0%
TOTAL PROPOSAL REVENUE			**$65,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Feasibility Study to determine the best size and scope of project	$50,000	**$50,000**	77%	
Expense #2	Preparation of a Request for Proposal	$15,000	**$15,000**	23%	
Expense #3			**$0**	0%	
Expense #4			**$0**	0%	
Expense #5			**$0**	0%	
Expense #6			**$0**	0%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$65,000**	**$65,000**	**100%**	

Net Income - Expenses		-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Peninsula Clean Energy

2018 Community Pilot Program

Project Name:	Aeration System Blower Efficiency Pilot Study
Applicant:	Sewer Authority Mid-Coastside
Key Partners:	SRT Consultants, San Francisco, CA
Point of Contact:	Mr. Kishen Prathivadi

Mr. Kishen Prathivadi

Engineering & Construction Contracts Manager

Sewer Authority Mid-Coastside

1000 N Cabrillo Highway

Half Moon Bay, CA 94019

Tel: (650) 726 0124

Email id: kishen@samcleanswater.org

Project Description

SAM was founded as a Joint Powers Authority in 1976 to provide wastewater treatment services to its member agencies: City of Half Moon Bay, Granada Community Services District, and the Montara Water and Sanitary District. SAM is also contracted to perform maintenance service on the sewer collection systems for a population of approximately 27,000 in the following areas: City of Half Moon Bay, El Granada, Miramar, Montara, Moss Beach and Princeton by the Sea.

SAM's wastewater treatment plant (WWTP) has was designed to treat an average dry weather flow of 4 million gallons per day (MGD). The typical flow is much less with the average dry weather flow being close to 2 MGD. The treatment system consists of influent screening, grit removal, primary clarification, activated sludge, secondary clarification, chlorination, and de-chlorination. Sludge is treated by anaerobic digestion, dewatered by belt filter press, and transported to a sanitary landfill for disposal.

SAM currently uses three 125 horsepower (hp) centrifugal multistage blowers that provide air for the secondary aeration process (Figure 1). Two blowers are equipped with variable frequency drives (VFDs) and the third unit is constant speed. One or more of these blowers are in continuous operation and are critical components for the secondary treatment biological process. The units are more than 30 years old and beyond the expected useful life for similar equipment. Due to mechanical issues, the speed of the VFD-equipped units cannot be turned down below 52 Hz or 86% of their rated speed.

Figure 1. SAM's existing 125-hp Aeration Blower

Project Objectives

This project seeks to evaluate the feasibility of replacing these blowers with high-speed turbo blowers and optimize the operation of system to reduce energy consumption. This will reduce operating cost, improve biological treatment process, and provide operational flexibility. The pilot study will:

- Determine current aeration needs (air flow rate and pressure)
- Determine current baseline energy consumption
- Evaluate on-site performance of up to three blower manufacturers
- Evaluate controls for efficient secondary aeration system operation
- Determine potential energy savings
- Develop procurement and construction cost to install the new blowers

Role of Partners
SAM will take the lead in this pilot study with process and mechanical engineering support provided by SRT Consultants in San Francisco, CA. The blower manufacturers to be evaluated under this study have not yet been finalized at this time. The manufacturers will be expected to deliver trial units, provide a technician on site for start-up and the duration of the trial period, coordinate with SAM staff, and assist with other related tasks.

Sequence of Activities
- Preparation Phase - 6 weeks:
    - SAM is selected for pilot study program
    - SAM enters contract with PCE
    - PCE site visit
    - PCE approves and releases funding
    - SAM contacts vendors and schedules trial blowers to be delivered
    - SAM makes necessary modifications to existing piping, power supply, and controls in preparation for pilot study
- Pilot Study Phase - 12 weeks (4 weeks for each blower to be evaluated):
    - Blower unit arrive at SAM
    - Blower unit startup and testing
    - Pilot study starts
    - SAM monitors energy consumption and modifies controls as necessary
    - SAM submits mid-term report to PCE
- Conclusion Phase - 3 weeks
    - SAM to summarize all gathered data and evaluate performance of blower units
    - SAM submits final report to PCE

Outcomes
a) Accelerates GHG reduction and renewables
Replacement of the existing inefficient blowers will reduce GHG emissions by reducing the energy required to maintain the biological process in SAM's aeration system. Currently aeration process uses over 50% of the energy at SAM's WWTP, and the blowers consume a total energy of 780,000 kWh each year. A 35% energy reduction can be expected by installing high speed turbo blower with high efficiency and high turn-down ratio. Appendix A shows the calculated energy savings and GHG avoided.

b) Delivers community benefits

Secondary aeration is one of the key biological processes in wastewater treatment. Improving the aeration blower's efficiency will increase resilience of SAM's WWTP, and reliable and efficient equipment at the WWTP will benefit the coastal communities that SAM serves. Additionally, reduction in energy demand from SAM will benefit PCE's other customers by making more energy available.

c) Supports PCE's load serving needs

Installing blowers with VFDs and a high turn-down ratio, will provide SAM the ability to reduce the blower(s) speed during peak electricity demand hours and return them to normal operation during off-peak hours. This will help PCE to better manage the supply and demand of the power it distributes.

d) Additional benefits

SAM's existing blowers are beyond their useful life, and installing new blowers will significantly increase the WWTP's resilience in both normal operation and extreme wet weather events. The local communities will benefit from a more reliable and robust sewer infrastructure.
The pilot study will allow SAM to determine the most efficient and cost-effective blowers that are appropriate for their WWTP. The result of this study would be scalable to installing multiple aeration blowers and further reducing energy consumption and GHG emissions.

PCE Implementation Requirements

SAM is prepared to implement this pilot study using its plant staff, local contractors, and assistance from blower vendors. This collaborative approach will minimize PCE's administrative burden. SAM will coordinate with PCE regarding a potential visit to the WWTP, submitting additional information, and reporting.

Qualifications

SAM has conducted many pilot studies in the past prior to purchasing other wastewater treatment equipment. This project will be done with existing SAM staff with assistance from SRT consultants, vendors, and contractors.

Kishen Prathivadi, P.E. is the engineering and construction contracts manager at SAM and he will be leading the Aeration System Blower Efficiency Pilot study. Mr. Prathivadi is a licensed professional mechanical engineer with over 30 years of engineering experience. He has extensive experience in project management and has managed technical and financial aspects of a broad range of wastewater projects from concept through construction.

Tim Monahan, P.E. is a project manager and senior engineer at SRT Consultants. Mr. Monahan is a licensed civil engineer with over 30 years design experience in the water and wastewater industry. He has extensive experience in managing pre-design and evaluation studies, infrastructure condition assessment, and design of new and retrofit facilities.

Evaluation
A baseline of energy consumption of the existing blowers will be established at the beginning of the pilot study. This will be used to compare with the new blower(s) installed during pilot study, and energy savings and GHG avoided will be extrapolated from the study results.
The methodology of establishing baseline and new energy consumptions, the pilot study results and conclusions will be summarized in the final report delivered to PCE.

Metrics and Assumptions
Appendix A include the metrics utilized to calculate GHG emission avoided. It assumes that the air flow rate and pressure required for the new blower(s) will not change. It also demonstrates the immediate energy savings and avoided GHG production. Figure 2 demonstrates the long-term energy savings and payback period.

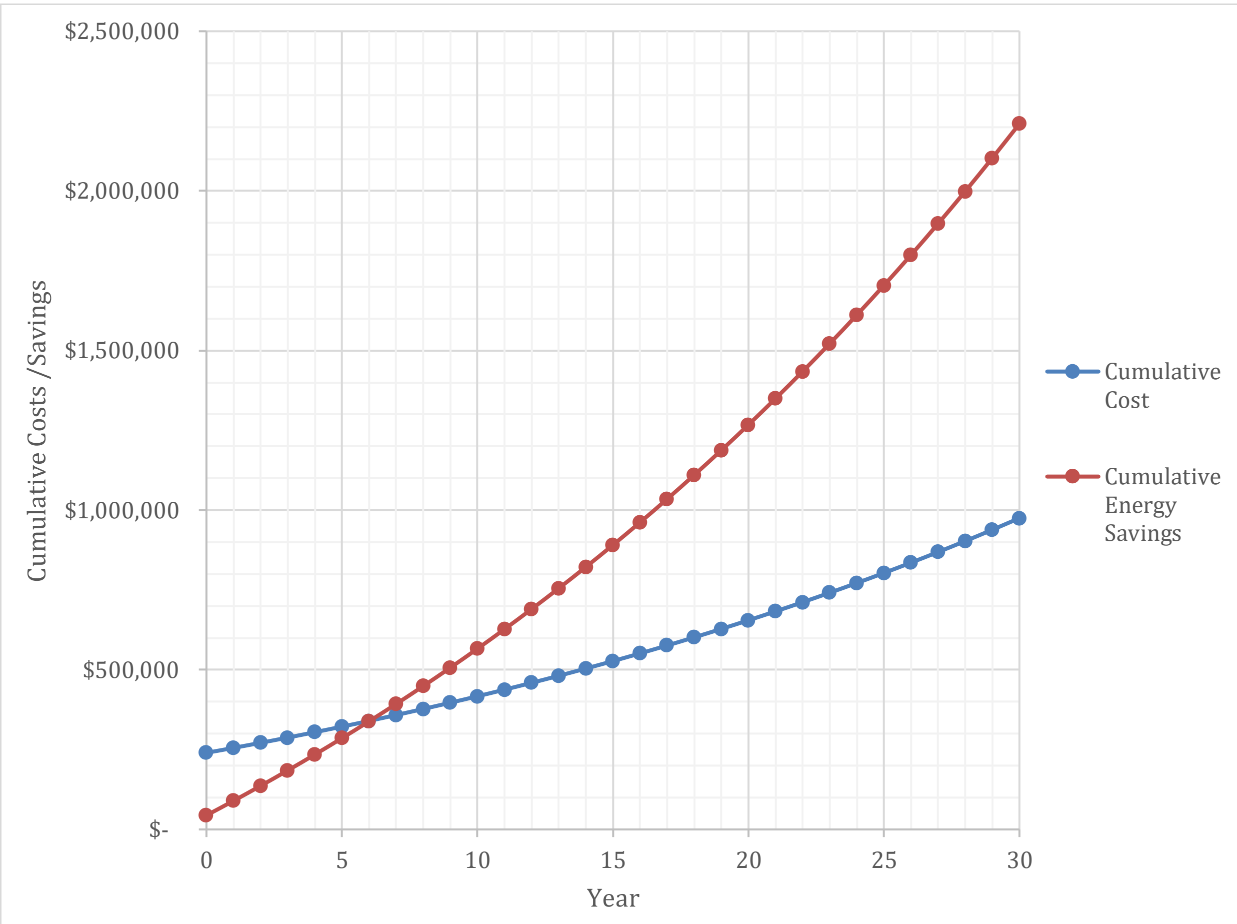


Figure 2. Cumulative Costs of new blowers and their energy savings[1]

[1] Assumptions: (1) Capital cost of 1 new blowers $225,000; (2) Annual operation and maintenance cost $15,000; (3) Energy savings, see Appendix A; (4) Assume 3% inflation rate.

Appendix A GHG Reduction and Energy Cost Savings Calculation

Description	Qty.	Unit	Comment
Baseline Scenario - Average Day			
No. of Blowers	1.0		Assume 1 blower operating continuously
Blower Horsepower	125.0	hp	Rated horsepower
Blower HP in KW	93.4	kW	Rated horsepower converted into kW
Blower Average Speed	86%		Average speed which the blower(s)operate at over 24 hours
Operating Hours/ Day	24.0	hours	
Blower Energy Consumption	1928.6	kWh/day	Blower Energy Consumption = Blower Horsepower (in kW) x Average Speed x Operating Hours
% Energy from PG&E	50%		SAM has 50:50 PG&E and PCE power
% Energy from PCE	50%		
Blower Energy - PG&E	964.3	kWh/day	Blower Energy - PG&E = Blower Energy Consumption x (% Energy from PG&E)
PG&E GHG Emission Factor	0.524	lb. CO2/kWh	Source: https://www.pge.com/includes/docs/pdfs/about/environment/calculator/assumptions.pdf
Blower CO2 Emission - PG&E	505.3	lb. CO2/day	Blower CO2 Emission - PG&E = Blower Energy - PG&E x PG&E GHG Emission Factor
Blower Energy - PCE	964.3	kWh/day	Blower Energy PCE = Blower Energy Consumption x (% Energy from PCE)
PCE GHG Emission Factor	0.142	lb. CO2/kWh	Source: State and PCE Data References
Blower CO2 Emission - PCE	136.9	lb. CO2/day	Blower CO2 Emission - PCE = Blower Energy - PCE x PCE GHG Emission Factor
Total Blower CO2 Emission	**642.2**	**lb. CO2/day**	Total Blower CO2 Emission = Blower CO2 Emission - PG&E + Blower CO2 Emission - PCE
Scenario 1 - High Speed Turbo Blowers, Average Day			
No. of Blowers	1.0		Assume 1 blower operating continuously
Blower Rated Horsepower	100.0	hp	
Blower HP in KW	74.8	kW	Assume Neuro Turbo Blower NX100 Series (NW100-C060 OR C070), motor rated power 75 kW
Blower Average Speed	70%		Average speed which the blower(s)operate at over 24 hours
Operating Hours/ Day	24.0	hours	

Description	Qty.	Unit	Comment
Blower Energy Consumption	1255.8	kWh/day	Blower Energy Consumption = Blower Horsepower (in kW) x Average Speed x Operating Hours
% Energy from PG&E	50%		SAM has 50:50 PG&E and PCE power
% Energy from PCE	50%		
Blower Energy - PG&E	627.9	kWh/day	Blower Energy - PG&E = Blower Energy Consumption x (% Energy from PG&E)
PG&E GHG Emission Factor	0.524	lb. CO2/kWh	Source: https://www.pge.com/includes/docs/pdfs/about/environment/calculator/assumptions.pdf
Blower CO2 Emission - PG&E	329.0	lb. CO2/day	Blower CO2 Emission - PG&E = Blower Energy - PG&E x PG&E GHG Emission Factor
Blower Energy - PCE	627.9	kWh/day	Blower Energy PCE = Blower Energy Consumption x (% Energy from PCE)
PCE GHG Emission Factor	0.142	lb. CO2/kWh	Source: State and PCE Data References
Blower CO2 Emission - PCE	89.2	lb. CO2/day	Blower CO2 Emission - PCE = Blower Energy - PCE x PCE GHG Emission Factor
Total Blower CO2 Emission	**418.2**	**lb. CO2/day**	Total Blower CO2 Emission = Blower CO2 Emission - PG&E + Blower CO2 Emission - PCE
CO2 Emission Avoided	**224.0**	lb. CO2/day	
	40.9	ton CO2/ year	
10 Year CO2 Emission Avoided	**408.8**	**ton CO2**	
% of CO2 Emission Avoided	35%		
Energy Cost Savings	$121.10	per day	SAM's average energy cost is approximately $0.18/ kWh
Annual Energy Cost Savings	$44,199.68		

Insert YOUR ORGANIZATION'S NAME	Sewer Authority Mid-Coastside
Insert PROPOSAL TITLE	Aeration System Blower Efficiency Pilot Study
Insert Date	August 3, 2018
Community Pilots	

REVENUE SOURCES	**SOURCE**	**YEAR 1**	**TOTAL**		**STATUS***
Income #1	Requested from PCE	75,000	**$75,000**	#DIV/0!	Requested
Income #2	Sewer Authority Mid-Coastside	20,000	**$20,000**	#DIV/0!	Pledged
Income #3			**$0**	#DIV/0!	
Income #4			**$0**	#DIV/0!	
Income #5			**$0**	#DIV/0!	
Income #6			**$0**	#DIV/0!	
Income #7			**$0**	#DIV/0!	
Income #8			**$0**	#DIV/0!	
Income #9			**$0**	#DIV/0!	
Income #10			**$0**	#DIV/0!	
	Total	**$95,000**	**$95,000**		

REVENUE SUMMARY		
Total Requested	**$75,000**	#DIV/0!
Total Pledged	**$20,000**	#DIV/0!
Total Received	**$0**	#DIV/0!
Total Estimated	**$0**	#DIV/0!
TOTAL PROPOSAL REVENUE	**$0**	#DIV/0!

EXPENSE	**DESCRIPTION****	**YEAR 1**	**TOTAL**		**If the expense request is classified as capital***, what is its anticipated length of service in years?**
Expense #1	Equipment Leasing ($7,000/month, 3 months/vendor, 3 vendors)	$63,000	**$63,000**	#DIV/0!	
Expense #2	Construction costs for piping modification	$20,000	**$20,000**	#DIV/0!	
Expense #3	Staff Hours (Senior Engineer, $200/hour, 60 hours)	$12,000	**$12,000**	#DIV/0!	
Expense #4				#DIV/0!	
Expense #5				#DIV/0!	
Expense #6				#DIV/0!	
Expense #7				#DIV/0!	
Expense #8				#DIV/0!	
Expense #9				#DIV/0!	
Expense #10				#DIV/0!	
TOTAL PROPOSAL EXPENSES		**$95,000**	**$95,000**	**#DIV/0!**	

Net Income - Expenses		-	-

* For "Status," choose "Received" for all income currently under your organization's control. Choose "Pledged" for sources which have been promised to your organization, but not yet received. Choose "Requested" for all income sources for which your organization has applied or asked that have not been received or pledged. Choose "Estimated" for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Sewer Authority Mid-Coastside
PCE 2018 COMMUNITY PILOT PROPOSAL
Aeration System Blower Efficiency Pilot Study Appendix A

Description	Qty.	Unit	Comment
Baseline Scenario - Average Day			
No. of Blowers	1.0		Assume 1 blower operating continuously
Blower Horsepower	125.0	hp	Rated horsepower
Blower HP in KW	93.4	kW	Rated horsepower converted into kW
Blower Average Speed	86%		Average speed which the blower(s)operate at over 24 hours
Operating Hours/ Day	24.0	hours	
Blower Energy Consumption	1928.6	kWh/day	Blower Energy Consumption = Blower Horsepower (in kW) x Average Speed x Operating Hours
% Energy from PG&E	50%		SAM has 50:50 PG&E and PCE power
% Energy from PCE	50%		
Blower Energy - PG&E	964.3	kWh/day	Blower Energy - PG&E = Blower Energy Consumption x (% Energy from PG&E)
PG&E GHG Emission Factor	0.524	lb. CO2/kWh	Source: https://www.pge.com/includes/docs/pdfs/about/environment/calculator/assumptions.pdf
Blower CO2 Emission - PG&E	505.3	lb. CO2/day	Blower CO2 Emission - PG&E = Blower Energy - PG&E x PG&E GHG Emission Factor
Blower Energy - PCE	964.3	kWh/day	Blower Energy PCE = Blower Energy Consumption x (% Energy from PCE)
PCE GHG Emission Factor	0.142	lb. CO2/kWh	Source: State and PCE Data References
Blower CO2 Emission - PCE	136.9	lb. CO2/day	Blower CO2 Emission - PCE = Blower Energy - PCE x PCE GHG Emission Factor
Total Blower CO2 Emission	**642.2**	**lb. CO2/day**	Total Blower CO2 Emission = Blower CO2 Emission - PG&E + Blower CO2 Emission - PCE
Scenario 1 - High Speed Turbo Blowers, Average Day			
No. of Blowers	1.0		Assume 1 blower operating continuously
Blower Rated Horsepower	100.0	hp	
Blower HP in KW	74.8	kW	Assume Neuro Turbo Blower NX100 Series (NW100-C060 OR C070), motor rated power 75 kW
Blower Average Speed	70%		Average speed which the blower(s)operate at over 24 hours
Operating Hours/ Day	24.0	hours	
Blower Energy Consumption	1255.8	kWh/day	Blower Energy Consumption = Blower Horsepower (in kW) x Average Speed x Operating Hours
% Energy from PG&E	50%		SAM has 50:50 PG&E and PCE power
% Energy from PCE	50%		
Blower Energy - PG&E	627.9	kWh/day	Blower Energy - PG&E = Blower Energy Consumption x (% Energy from PG&E)
PG&E GHG Emission Factor	0.524	lb. CO2/kWh	Source: https://www.pge.com/includes/docs/pdfs/about/environment/calculator/assumptions.pdf
Blower CO2 Emission - PG&E	329.0	lb. CO2/day	Blower CO2 Emission - PG&E = Blower Energy - PG&E x PG&E GHG Emission Factor
Blower Energy - PCE	627.9	kWh/day	Blower Energy PCE = Blower Energy Consumption x (% Energy from PCE)
PCE GHG Emission Factor	0.142	lb. CO2/kWh	Source: State and PCE Data References
Blower CO2 Emission - PCE	89.2	lb. CO2/day	Blower CO2 Emission - PCE = Blower Energy - PCE x PCE GHG Emission Factor
Total Blower CO2 Emission	**418.2**	**lb. CO2/day**	Total Blower CO2 Emission = Blower CO2 Emission - PG&E + Blower CO2 Emission - PCE
CO2 Emission Avoided	**224.0**	lb. CO2/day	
	40.9	ton CO2/ year	
10 Year CO2 Emission Avoided	**408.8**	ton CO2	
% of CO2 Emission Avoided	35%		
Energy Cost Savings	$ 121.10	per day	SAM's average energy cost is around $0.18/ kWh
Annual Energy Cost Savings	$ 44,199.68		

Peninsula Clean Energy

2018 Community Pilot Program

Name of the Project:	Cogeneration System Feasibility Study
Applicant:	Sewer Authority Mid-Coastside
Key Partners:	kW Engineering
Point of Contact:	Mr. Kishen Prathivadi
	Engineering & Construction Contracts Manager
	Sewer Authority Mid-Coastside
	1000 N Cabrillo Highway
	Half Moon Bay, CA 94019
	Tel: (650) 726 0124
	Email id: kishen@samcleanswater.org

PCE Proposal Narrative

Description of the project

Sewer Authority Mid-Coastside (SAM) requests a grant from Peninsula Clean Energy (PCE) to perform a detailed feasibility study of a cogeneration system to produce clean electricity and heat from renewable, digester gas (biogas) already produced at SAM's wastewater treatment plant. If awarded the grant, SAM would partner with kW Engineering, an energy efficiency and renewables engineering firm in Oakland, CA, to investigate current potential cogeneration (electric energy generation plus heat generation) capacity of the plant's anaerobic digester's biogas production, avoided utility energy costs from onsite generation, associated GHG reduction, secondary environmental benefits, project costs, and project financing options. When completed, the feasibility study will be presented to SAM's board of directors to decide whether to pursue construction of a cogeneration system to produce clean electricity and heat from renewable biogas.

<u>Background</u>

SAM's Regional Wastewater Treatment Facility serves the City of Half Moon Bay, and the Granada and Montara Sanitary Districts. The plant performs primary and secondary treatment of organic matter (received sewage), solids stabilization by anaerobic digestion, and disinfection of plant effluent that is discharged to the Pacific Ocean.

In the anaerobic digesters, organic matter in the treated sludge (from primary and secondary treatment) is further decomposed by microorganisms that results in a stable form of humus with low odor and reduced disease-causing organisms. The anaerobic digestion process also creates a gaseous mixture of methane (CH_4) and carbon dioxide (CO_2). Currently, the biogas is used to fuel a hot water boiler that produces hot water to heat the anaerobic digesters to 95°F. All of the biogas is used to fuel the hot water boilers to heat hot water, unless the hot water boiler system is offline then the biogas burned is a waste gas flare. When the digesters are at operating temperature and don't need any more heat, excess heat is "dumped" into the treated plant effluent discharged into the Ocean.

A cogeneration system would use the biogas to generate electricity, with the waste heat from combustion used to heat the digesters. The feasibility study, to be authored by kW Engineering with the assistance of SAM personnel, will determine:

- The size, capacity, and associated capital investment
- Availability of financing, rates, and terms,
- Cost and availability of fuel (biogas)
- Energy efficiency or renewable grants from local utilities or state
- Operation and maintenance costs
- Value of the thermal energy produced

The evaluation of cogeneration alternatives and options can be quite complex. The optimal configuration, with room for future growth, depends on operating and design characteristics specific to SAM treatment plant and subject to engineering design, financing, and fuel resource constraints.

Outcomes

Accelerates GHG reduction and renewables

If the feasibility study shows favorable economic results and the SAM board decides to construct a cogeneration system, then the project will likely be:

- GHG reduction neutral
- A new renewable electric generation source within PCE territory

The biogas produced by the digester is about 60% methane, which is a potent GHG. Currently, all of the biogas produced by the digesters is burned in the hot water boilers or in the waste gas flare, which is a requirement of the plant's operating permit. When burned, methane is converted into carbon dioxide (CO_2) and water (H_2O). Therefore, the anaerobic digestion process produces biogas (methane and carbon dioxide), which is burned and converted into CO_2.

A cogeneration system will not change the amount of GHG produced at this site, as the same amount of biogas is expected to be produced and the biogas will be burned as fuel in an engine or microturbine. However, the cogeneration system will produce electricity that will be used at the plant and will displace a portion of the electricity purchased from the local grid. Depending on the generating sources purchased for the local grid, the electricity displaced by the cogeneration produced electricity may positively impact PCE's procurement goals. Because the cogeneration fuel source (biogas) already exists and is being burned onsite, installing a cogeneration system is considered a GHG reduction neutral project.

However, biogas is considered a renewable fuel source for electric generation, and so a cogeneration system fueled with biogas should be considered a local source of renewable energy.

Delivers community benefits

Installing a biogas-fueled cogeneration system will enhance the community benefits that SAM wastewater treatment plant already provides by demonstrating a unique form of clean renewable electric power generation.

Supports PCE's load serving needs

Since biogas production can vary because of a number of factors, onsite gas storage is generally required to help even out cogeneration system operations. If the installed storage volume capacity is adequate, it's possible to vary the cogeneration system's electric output based on electric system demand. In this scenario, during times of excess electric supply, the cogeneration system shutoff and biogas produced by the digesters would be pumped into onsite gas storage. During periods of high electric demand, the cogeneration system can be operated to draw down the stored biogas and generate more electricity for onsite usage, thus reducing the plant's draw on the local grid. When tied into the plant's supervisory control and data acquisition (SCADA) system, this variable output generation could be controlled via pricing signals.

Additional benefits

SAM's Regional Wastewater Treatment Facility receives about 4.0 million gallons of wastewater per day (MGD) during the dry season, with wet weather flows peaking at 9.0 MGD. Generally, wastewater treatment plants of this size do not have anaerobic digesters to stabilize treated solids, as anaerobic digesters are large structures that are very costly to build and operate. However, if properly stabilized the resulting biosolids may be suitable for agricultural use and thus a wastewater treatment waste product can be turned into a useful, local byproduct.

Like SAM's Regional Wastewater Treatment Facility, most treatment plants of this size use the anaerobic digesters' biogas to fuel hot water boilers and vent or dump the heating system's excess heat into plant discharge (effluent) or to the atmosphere. This is because the first cost of hot water boilers is several times lower than a comparably-sized cogeneration system. While anaerobic digesters at plants of SAM's size are rare, plants of SAM's size with anaerobic digesters and cogeneration are very rare. A cogeneration system at a plant SAM's size is not innovative, it would be a useful demonstration system for other, local wastewater treatment plants to observe and learn from.

PCE Implementation Requirements

PCE's role in the proposed cogeneration feasibility study would be to advise on project scope regarding the cogeneration system's electrical generation dispatchability in period of high and low electric demand.

Qualifications

Bryan Hackett is a project manager and senior engineer at kW Engineering and he will be leading the cogeneration feasibility study. Mr. Hackett is a licensed professional mechanical engineer with over 20 years of engineering experience.

Kishen Prathivadi is the engineering and construction contracts manager at SAM. Mr. Prathivadi is a licensed professional mechanical engineer with over 30 years of engineering experience. He has extensive experience in project management and has managed technical and financial aspects of a broad range of wastewater projects from concept through construction.

Evaluation

A feasibility study's success can be evaluated by how closely the study addresses SAM's objectives for environmental, economic, and other constraints as well at the project's benefits to costs. A successful feasibility study should balance factors such as design, economic, operational, and environmental so that an optimal choice may be presented to SAM's board of directors.

Metrics and Assumptions

The proposed feasibility study will evaluate cogeneration systems of several configurations including generating unit type (i.e. internal combustion engine, microturbine or fuel cell), electric output, heat recovery capacity, biogas pretreatment, gas storage capacity, operating and maintenance costs, etc. Each evaluated parameter will have metrics and assumptions that will be fully documented and annotated in the study and its appendices.

Greenhouse Gas (GHG) emissions reductions and cost effective will be calculated in a spreadsheet using PCE’s data sources and conservative estimates. All data sources and estimate values will be properly noted in the spreadsheet.

Sewer Authority Mid-Coastside
Biogas Cogeneration Feasibility Study
8/3/18
Community Pilots

REVENUE SOURCE	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**	$58,550	**$58,550**	79%	Requested
Income #2			**$0**	0%	
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$74,150**	**$74,150**		

REVENUE SUMMARY		
Total Requested	**$74,150**	100%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$74,150**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	kW Engineering, Managing Engineer, $201/hr, 100 hr	$20,100	**$20,100**	27%	
Expense #2	kW Engineering, Project Engineer, $175/hr, 150 hr	$26,250	**$26,250**	35%	
Expense #3	SAM Engineer/Operator, $90/hr, 160 hr	$14,400	**$14,400**	19%	
Expense #4	Laboratory Testing Services (company TBD)	$5,000	**$5,000**	7%	
Expense #5	SAM Technician, $70/hr,120hr	$8,400	**$8,400**	11%	
Expense #6			**$0**	0%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$74,150**	**$74,150**	**100%**	

Net Income - Expenses		-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Exisiting System			Notes
Digester Produced Gas	781,000	BTU/hr	25,000 cuft/day @ 750 BTU/SCF
Current CO2 emissions	400	T/yr	Gas is used in a boiler with excess flared
Proposaed digester gas fueled CHP system			
Digester Produced Gas	781,000	BTU/hr	
Microturbine utilsed digester fuel	781,000	BTU/hr	
Cogen heat recovered	221,000	BTU/hr	
Power	60	kw	
Power produced annually	526	MW-hr	
CA grid CO2 rate	619.9	lb/MW-hr	From WECC subregion e-grid calcs
Central plant CO2 emissions avoided	163	T/yr	

Peninsula Clean Energy

2018 Community Pilot Program

Name of the Project:	Methane Fueled Microturbine Project
Applicant:	Sewer Authority Mid-Coastside
Key Partners:	SRT Consultants, San Francisco, CA
Point of Contact:	Mr. Kishen Prathivadi
	Engineering & Construction Contracts Manager
	Sewer Authority Mid-Coastside
	1000 N Cabrillo Highway
	Half Moon Bay, CA 94019
	Tel: (650) 726 0124
	Email id: kishen@samcleanswater.org

Project Description

SAM was founded as a Joint Powers Authority in 1976 to provide wastewater treatment services to its member agencies: City of Half Moon Bay, Granada Community Services District, and the Montara Sanitary District. SAM also provides contract collection maintenance services for a population of approximately 27,000 in the following areas:

- City of Half Moon Bay
- El Granada
- Miramar
- Montara
- Moss Beach
- Princeton by the Sea

SAM's wastewater treatment plant (WWTP) has an average dry weather design capacity of 4 million gallons per day (MGD); the typical flow is much less with the average dry weather flow being close to 2 MGD. The treatment system consists of influent screening, grit removal, primary clarification, activated sludge, secondary clarification, chlorination, and de-chlorination. Sludge is treated by anaerobic digestion, dewatered by belt filter press, and transported to a sanitary landfill for disposal.

All organic solids removed from the flow are pumped to the anaerobic digestors. The digestors hold the solids long enough for anaerobic bacteria to break down the organic sludge. The digesters are mixed temperature is maintained at approximately 86 to 100ºF (30-38ºC) to facilitate the digestion process. Organic matter in the sludge is decomposed by microorganisms, producing a stable form of biosolids. Anaerobic digestion stabilizes the sludge, provides pathogen reduction, and reduces volume of sludge to be landfilled.

The anaerobic digestion produces biogas that is primarily a mixture of methane and carbon dioxide gases. It also contains a small amount of hydrogen sulfide gas and siloxane. Currently SAM uses part of this biogas as fuel for the boilers that provide heat to the digesters. Excessive biogas (about 10%) is burned in the waste gas flare. Although flaring is not the most ideal way of disposing biogas, it is preferred to releasing biogas to the atmosphere since methane is a more potent GHG than carbon dioxide.

In order to further reduce GHG emissions from the anaerobic digestion process and put all biogas to beneficiary use, SAM is also proposing to conduct a feasibility study on cogeneration of power and heat. This proposal assumes that installing a microturbine system would be one of the preferred alternatives from this feasibility study. The microturbine-based system will combust the methane gas to generate heat and electricity for the WWTP. This will allow SAM to reduce its electricity consumption and energy cost.

<u>Digester fuel availability:</u>

The SAM WWTP has a small digester that produces biogas at a rate of approximately 25,000 standard cubic feet (scf)/day at a heating value of about 750 BTU/scf. This supply is equal to about 781,000 BTU/hr and is well suited for use in any low-emission micro turbine system. This rate of production of biogas is well suited for use in the microturbine system and will provide about 60kW of clean power and about 221,000 BTU/hr of process heat (replacing the previous digester fueled boiler system). This system will be able to utilize all available digester gas, eliminating the need to flare unused gas.

<u>Description of the Proposed System:</u>

The combined heat and power system consist of an integrated combined heat and power generation unit, a gas processing skid, and ancillary equipment for waste heat recovery.

The proposed unit (similar to Figure 1) is a fully integrated 65kW gas turbine system that includes outpower electronics for safe, clean power output and a hot water heat exchanger roof mounted.

Figure 1. 65 kW gas turbine system

The gas processing skid includes media for moisture removal, Siloxane removal and gas compression to provide a clean and usable digester gas feed to the turbine. Additional pumps and valving are used to integrate the heat recovery system to the existing boiler system.

<u>How Combined Heat and Power Systems Reduce GHG Emissions:</u>

Combined heat and power systems reduce SAM's GHG emissions in two ways. First, it captures all the biogas produced by the digester and eliminates the need for flaring. Second, the electricity generated by the CHP system reduces the amount of power that SAM requires from the PG&E and PCE to run its facilities. By producing power at the WWTP, SAM will also be able to utilize the exhaust heat generated by the CHP system on site. In a central plant the exhaust heat is lost because it is not possible to transport heat to end users. SAM can utilize the heat recovered from the CHP system on site for digester heating and further offset the energy that would be used in a boiler on site. The net increase in overall efficiency (the biogas can be used for both power generation and heat generation) results in a reduction in overall electricity use, which reduce GHG emissions and reduce operating cost for SAM.

Figure 2 summarizes the advantage and net decreases in GHG by using CHP instead of a traditional central power plant and an on-site boiler:

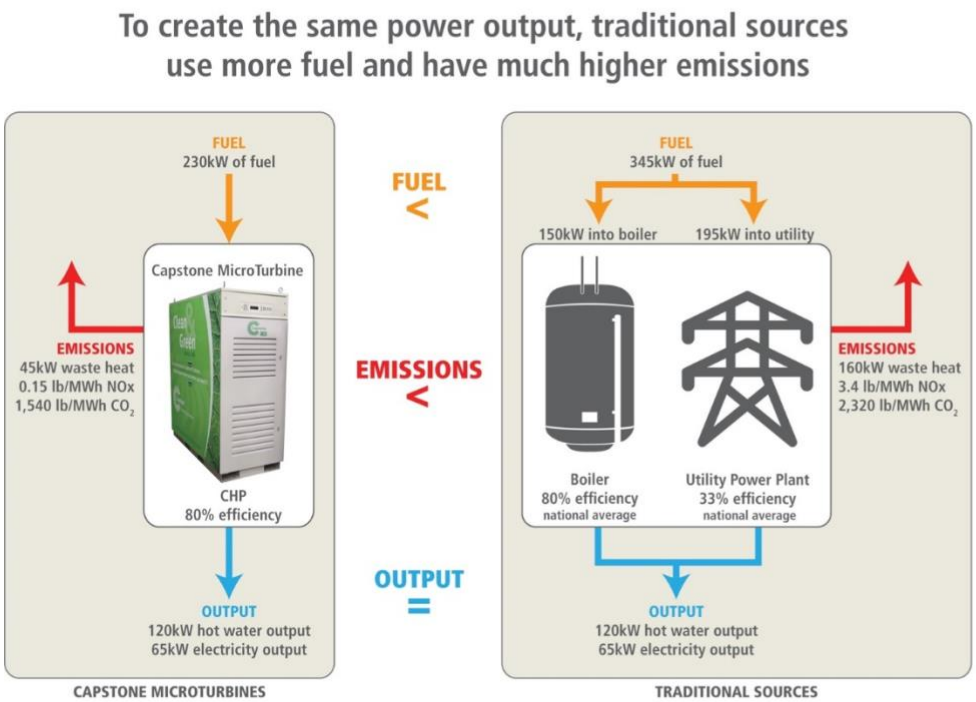


Figure 2. Comparison between Microturbine and Traditional Energy Generation

Role of Partners

SAM will take the lead in this pilot study with process and mechanical engineering support from SRT Consultants, San Francisco. The microturbine vendor currently in discussion with SAM is Cal Microturbine. They are expected to deliver the unit(s), provide a technician on site for startup and the duration of the study, coordinate with SAM staff and assist with other related tasks.

Sequence of Activities

- Preparation Phase - 6 weeks:
  - SAM is selected for pilot study program
  - SAM enters contract with PCE
  - PCE site visit
  - PCE approves and releases funding
  - SAM contacts Cal Microturbine
  - SAM makes necessary modifications to existing piping, power supply, and controls in preparation for pilot study
- Pilot Study Phase - 8 weeks
  - CHP system arrives at SAM
  - System startup and testing
  - Pilot study starts
  - SAM monitors energy production and modifies controls as necessary
  - SAM submits mid-term report to PCE

- Conclusion Phase - 4 weeks
    - SAM to summarize all data and evaluate performance system
    - SAM submits final report to PCE

Outcomes

a) Accelerates GHG reductions for SAM WWTP:

Net GHG reduction for this project is calculated by first taking the CO2 generated through combustion of the biogas at both the boiler and the flare as a baseline. Then, the amount of power generation from the microturbine can be determined by using all available biogas and take credit for the reduction in central plant GHG emissions avoided by the on-site power production. Appendix A summarizes the amount of CO2 reduction for PG&E/PCE by installing a CHP system at SAM's WWTP.

b) Delivers community benefits

Biogas production is a critical biological process at SAM's WWTP. The beneficial reuse of this resource will increase resilience of SAM's WWTP and reduce the amount of power purchased from PG&E and PCE. This project will benefit the coastal communities that SAM serves by keeping utility cost low and stable while also beneficially utilizing the abundant and consistently produced fuel source. Additionally, reduction in energy demand from SAM will benefit PCE's other customers by making more energy available.

c) Supports PCE's load serving needs

Installing a CHP system at SAM's WWTP will reduce the baseline energy demand of the plant all day. This will help PCE to better manage the supply and demand of the power it distributes.

d) Additional benefits

SAM's WWTP consumes a significant amount of electricity and natural gas. The biogas byproduct of its sludge digestion process is underutilized and frequently wasted by flare. Capturing all of the power of the biogas and using it to produce electricity for the WWTP and heat to maintain the biological activity in the digester significantly increase the WWTP's resilience in both normal operation and extreme wet weather events.

The pilot study will allow SAM to determine the microturbine power and heat recovery system that are most appropriate for the WWTP and that will reduce energy consumption and GHG emissions.

PCE Implementation Requirements

SAM is prepared to implement this pilot study using its plant staff, local contractors, SRT, and assistance from microturbine equipment vendors. This collaborative approach will minimize PCE's administrative burden. SAM will coordinate with PCE regarding a potential visit to the WWTP, submitting additional information, and reporting.

Qualifications

SAM has conducted many pilot studies in the past prior to purchasing other wastewater treatment equipment. This project will be done with existing SAM staff with assistance from SRT consultants, vendors, and contractors.

Kishen Prathivadi, P.E. is the engineering and construction contracts manager at SAM and he will be leading the Aeration System Blower Efficiency Pilot study. Mr. Prathivadi is a licensed professional mechanical engineer with over 30 years of engineering experience. He has extensive experience in project management and has managed technical and financial aspects of a broad range of wastewater projects from concept through construction.

Tim Monahan, P.E. is a project manager and senior engineer at SRT Consultants. Mr. Monahan is a licensed civil engineer with over 30 years design experience in the water and wastewater industry. He has extensive experience in managing pre-design and evaluation studies, infrastructure condition assessment, and design of new and retrofit facilities.

Evaluation

A baseline of energy consumption of the existing digester boilers and flare will be established at the beginning of the pilot study. This will be used to compare with the GHP microturbine(s) used during pilot study, and energy savings and GHG avoided will be extrapolated from the study results.

The methodology of establishing baseline and new energy consumptions, the pilot study results and conclusions will be summarized in the final report delivered to PCE.

Metrics and Assumptions

This proposal assumes that microturbine would be the most feasible CHP alternative for SAM. Appendix A includes the metrics utilized to calculate PG&E/CPE GHG emissions avoided under this proposed project. It assumes that all digester gas will be combusted in the CHP system.

Appendix A GHG Reduction and Energy Cost Savings Calculation

Description	Qty.	Unit	Comment
Existing System			
Digester Produced Gas	781,000	BTU/hour	25,000 cu ft./day @ 750 BTU/SCF
Current CO2 emissions	400	T/year	Gas is used in a boiler with excess flared
Proposed digester gas fueled CHP system			
Digester Produced Gas	781,000	BTU/hour	
Microturbine utilized digester fuel	781,000	BTU/hour	
Cogen heat recovered	221,000	BTU/hour	
Power	60	kw	
Power produced annually	526	MW-hour	
PG&E GHG Emission Factor	524	lb/MW-hour	Source: https://www.pge.com/includes/docs/pdfs/about/environment/calculator/assumptions.pdf
% of Electricity from PG&E	50%		
% of Electricity from PCE	50%		
CO2 Emission Avoided - PG&E	137707	lb/year	
PCE GHG Emission Factor	142	lb/MW-hour	
CO2 Emission Avoided - PCE	37318	lb/year	
Total CO2 Emissions Avoided	**88**	**ton/year**	
Total CO2 Emissions Avoided over 10 Years	**875**	**ton**	

Sewer Authority Mid-Coastside
Methane Fueled Microturbine Project
8/3/18
2018 Community Pilots

		YEAR 1	TOTAL		STATUS*
REVENUE SOUR(SOURCE					
Income #1	**Funding for Equipment from PCE**		**$75,000**	100%	Requested
Income #2			**$0**	0%	
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$75,000**		

REVENUE SUMMARY		
Total Requested	**$75,000**	56%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$60,000**	44%
TOTAL PROPOSAL REVENUE	**$135,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Microturbine Equipment	$120,000	**$120,000**	50%	
Expense #2	Gas Compression Unit	$120,000	**$120,000**	50%	
Expense #3	Acoustic inlet hood kit	$1,140	**$1,140**	0%	
Expense #4			**$0**	0%	
Expense #5			**$0**	0%	
Expense #6			**$0**	0%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$241,140**	**$241,140**	**100%**	

Net Income - Expenses	**(241,140)**	**(166,140)**

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Description	Qty.	Unit	Comment
Existing System			
Digester Produced Gas	781,000	BTU/hour	25,000 cu ft./day @ 750 BTU/SCF
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Proposed digester gas fueled CHP system			
Digester Produced Gas	781,000	BTU/hour	
Microturbine utilized digester fuel	781,000	BTU/hour	
Cogen heat recovered	221,000	BTU/hour	
Power	60	kw	
Power produced annually	526	MW-hour	
PG&E GHG Emission Factor	524	lb/MW-hour	Source: https://www.pge.com/includes/docs/pdfs/about/environment/calculator/assumptions.pdf
% of Electricity from PG&E	50%		
% of Electricity from PCE	50%		
CO2 Emission Avoided - PG&E	137707	lb/year	
PCE GHG Emission Factor	142	lb/MW-hour	
CO2 Emission Avoided - PCE	37318	lb/year	
Total CO2 Emissions Avoided	**88**	**ton/year**	
Total CO2 Emissions Avoided over 10 Years	**875**	**ton**	

SPIN

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SPIN

Description of the project

SPIN Storage Systems is a Burlingame, CA manufacturer of advanced high-efficiency flywheel systems for grid and off-grid energy storage. Each unit can store up to 30kWh of energy and deliver/store power at the rate of up to 10kW. We propose to install up to five of these units in San Mateo County in 2019 in suitable solar and/or wind power generation sites to be determined as part of the project. Candidate sites may include any generation site ranging from utility to residential and will be selected on the basis of maximizing GHG benefit while staying within the site preparation, installation and operating/monitoring budgets.

Outcomes

Accelerates GHG reductions and renewables

Energy storage is an essential tool in expanding the economic frontier for renewable energy sources. It provides two core benefits: **energy firming**, by which the minute-to-minute intermittency of renewable sources is smoothed by buffering supply through a storage system, and **supply/demand matching** where the peak supply period of renewables is moved to meet the peak demand hours of 4-8pm.

Delivers community benefits

In addition to improving the economics of renewable supply, SPIN is based in San Mateo County and funds for this project will support hiring in the county and tax payments to the county.

Supports PCE's load serving needs

Supply/demand matching means that renewable power buffered through the SPIN systems can be delivered as needed by PCE. Once this pilot demonstrates feasibility, more systems of the same type can be deployed throughout the county.

Additional benefits

The main competing alternative for storage is systems based on Lithium Ion battery cells. Compared to these, our systems are lower cost, non-flammable, 100% recyclable, and use no toxic materials.

PCE Implementation Requirements

No implementation help required though we would like to consult with PCE in the site survey and possibly in identifying permitting requirements in the County.

Qualifications

SPIN has spent $5M and 7 years building a working prototype of this system which is currently spinning in our labs in Burlingame. We are now building full-scale systems and project delivery of these in early 2019. The founding team has a stellar track record in developing and implementing novel technologies including the first private space vehicle (Dolphin, 1984), first webcam (QuickCam, 1995) and first virtual server (now Microsoft Hyper-V, 2006).

SPIN

Evaluation
We will evaluate the project based on three criteria: 1) budget compliance, 2) total system reliability (uptime % over the course of the pilot and 3) GHG benefit as measured against the delivery of similar power through natural gas turbines.

Metrics and Assumptions

- Greenhouse Gas (GHG) Emissions Reductions: We will calculate the amount of GHG that would be emitted in delivering power equivalent to the renewable/storage system.

- Cost Effectiveness: We will estimate the total cost to supply energy either using natural gas turbines or renewable paired with Lithium Ion storage. Our reporting will present our findings of cost effectiveness based on these comparisons.

SPIN Storage Systems
SPIN Flywheel Energy Storage
23-Jul-18
Community Pilots

REVENUE SOUR	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	Requested from PCE		$66,000	100%	Requested
Income #2			$0	0%	
Income #3			$0	0%	
Income #4			$0	0%	
Income #5			$0	0%	
Income #6			$0	0%	
Income #7			$0	0%	
Income #8			$0	0%	
Income #9			$0	0%	
Income #10			$0	0%	
	Total	**$0**	**$66,000**		

REVENUE SUMMARY		
Total Requested	**$66,000**	100%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$66,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
SPIN System	One 30kWh/10kW Revolution Flywheel (could be up to five)	**$6,000**	**$6,000**	9%	10 Years
Site Survey	Survey new and eisting solar installaions in SMC, select best use	**$25,000**	**$25,000**	38%	
Site Prep	Permits and site construciton	**$25,000**	**$25,000**	38%	
Installation	Transport, installation, securing, elctrical hook up	**$4,000**	**$4,000**	6%	
Monitoring	Ongoing remote monitoring of system health and storage use cylce	$1,000	**$1,000**	2%	
Reporting	Annual repot of monitoring results	$5,000	**$5,000**	8%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$66,000**	**$66,000**	**100%**	

Net Income - Expenses	**(66,000)**	**-**

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

kWh/day	**30**
GHG/kWh	**0.6**
Days/decade	**3650**
Kgs	**65700**
Metric tons	**32.85**
five units	**164.25**

Solar Powered Learning

The HEAL Project

in partnership with

University of California Cooperative Extension

Elkus Ranch Environmental Education Center

Rhiannon Rogstad
Grants and Development Manager
The HEAL Project www.thehealproject.org
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Project Description

In partnership with University of California Cooperative Extension, The HEAL Project proposes Solar Powered Learning, a collaborative effort toward meeting Peninsula Clean Energy's objectives for San Mateo County.

The HEAL Project (THP) is a 501(c)3 located in Half Moon Bay offering garden- and farm-based outdoor education to the students of San Mateo County (SMC). The largest portion of our operation occurs at the San Mateo County School Farm, a 2+ acre farm dedicated to serving students year-round. Through support from SMC Health System, THP provides educational programming to over 2600 SMC students each year. Students learn about sustainable food crop production, composting, nutrition, and their connection to the larger world around them during their visits to the farm.

UC Cooperative Extension operates the Elkus Ranch Environmental Education Center in Half Moon Bay. Similarly to THP, Elkus Ranch provides hands-on, farm-based outdoor education. Elkus Ranch has been delivering environmental education programming to the greater San Francisco Bay Area since 1975, reaching some 9000 youth and adults annually. Students learn lessons about farming, food, and fiber while interacting with goats, sheep, donkeys, and other farm animals through a lens of environmental stewardship and connection with the natural world.

THP has taken the leadership role for this proposed solar project with the intent to support PCE's goal of achieving 100% renewable energy in SMC by 2025 through solar implementation and community education at two Coastside locations.

Solar Powered Learning is a proposed pilot program to meet the following objectives:

- Upgrade Elkus Ranch to solar energy production and contribute power to PCE's load
- Upgrade SMC School Farm to solar energy production by replacing THP gas generator with a solar island
- Contribute 2,287 kWh renewable energy to PCE's load serving needs annually beyond Elkus Ranch's energy needs (a total of 18,229 kWh of solar energy produced yearly)
- Provide community benefit to SMC students at SMC School Farm through education about renewable energy and its part in the larger picture of sustainability
- Provide community benefit to SMC students and the greater San Francisco Bay area at Elkus Ranch through education about renewable energy and its part in the larger picture of sustainability
- Provide community visibility and support at both sites for PCE's goals to achieve 100% GHG-free power by 2021 and 100% renewable energy by 2025
- Provide press release and engagement with local media about PCE grant support powering two local environmental education sites
- Develop and implement successful pilot that can be scaled and replicated at other similar organizations in SMC and beyond

These objectives will be met over the course of the 18-month grant period with the exception of renewable energy education, which will continue beyond the scope of the grant term. Upon receiving approval and funding for this proposal, THP will oversee the following sequence of activities:

- Step One--Construction Phase. InterMountain Electric will prepare the site and install solar panels at Elkus Ranch; ensure panels are producing energy; ensure and measure energy contribution to PCE's load. InterMountain Electric will build and install a solar island at the SMC School Farm to provide power and serve as a learning lab station at the SMC School Farm for renewable energy lesson.
- Step Two--Implementation Phase. THP and Elkus Ranch will both update existing sustainability lessons to include instruction about renewable energy, especially solar power production.
- Step Three--Education and Evaluation Phase. Elkus Ranch will provide power back to the grid beyond annual energy needs; Elkus Ranch will also provide educational engagement about the solar array and how renewable energy contributes to sustainability. THP will instate renewable energy lessons as a part of regular sustainability programming at the SMC School Farm. Combined, over 11,000 bay area students and chaperones annually will receive renewable energy lessons and education at the two sites.

Partner roles and expectations:
THP and Elkus Ranch work collaboratively on several county committees designed to foster community amongst the environmental education groups in the region. On a more local level, THP and Elkus Ranch programs are complementary, so we work collaboratively on various projects in the Half Moon Bay community.

- THP roles include overseeing the proposal, reporting, and grant management as well as serving as the point of contact with Peninsula Clean Energy. THP will work with Elkus and InterMountain Electric to deliver the project schedule and implementation. THP will design and implement renewable energy lessons at the SMC School Farm. THP will provide a press release and coordinate media outreach.
- Elkus Ranch roles include working with InterMountain Electric to install a solar array capable of serving the ranch needs *and* delivering energy back to PCE's supply. Elkus will provide information about energy usage at the ranch. THP will share renewable energy lessons with Elkus staff to modify for Elkus programs. Elkus staff will assist THP staff with final grant report.

<u>Outcomes</u>

a) **Accelerates GHG reductions and renewables**
Solar Powered Learning provides a small GHG reduction at the SMC School Farm by replacing the gas generator with a solar powered island. THP's farmer Doug Millar is in the initial stages of designing a Carbon Farm Plan and will factor in renewable energy

use as he calculates overall GHG reduction and carbon sequestration at the SMC School Farm site. Solar Powered Learning also increases renewables and contributes energy toward PCE's renewable energy supply. Detailed information can be found below in InterMountain Electric's Project Summary.

b) Delivers community benefits

Solar Powered Learning will provide several community benefits in alignment with the strategic goals outlined in PCE's Integrated Resource Plan. Specifically:

- Workforce benefit: THP will hire local SMC contractor InterMountain Electric Company to design and install the solar array at Elkus Ranch and the solar island at the SMC School Farm. As per PCE's workforce policy, InterMountain Electric is a signatory contractor and will hire local, union labor to complete the construction phase. InterMountain Electric recently completed a large solar project at the San Mateo IBEW L.U.617 Joint Apprenticeship Training Committee facility and has established itself as a valuable local business in the county.
- Customers within PCE's geography: Excess power produced by the Elkus Ranch solar array will contribute to power needs in San Mateo County. THP and Elkus Ranch host a combined 11,000+ visitors a year, most of whom are residents of PCE's service area. These visitors will receive educational information about solar and renewable energy and the goals that the county and PCE have set for GHG-free and renewable energy in the coming decade. This project would also provide an opportunity to develop PCE brand awareness and loyalty throughout the county, assisting with PCE's strategic goal to "maximize and maintain customer participation in PCE."
- Tangible benefits for low income and vulnerable communities: THP's programming operates on a sliding-scale basis for fee structuring; low income schools are also eligible to receive grant-funded transportation stipends to visit the farm at little to no cost (eligibility is determined based on the percentage participation in the school's Free or Reduced Lunch Program). Elkus Ranch provides full scholarship funding for low income school groups for a portion of their programming year. Many of the visitors to each site have little to no opportunity to access farm space due to their disadvantaged or vulnerable position; Elkus and THP work with several organizations in the greater Bay Area to increase access to environmental education for students in vulnerable communities. Students from all of the districts listed in the Community Vulnerability Index participate in programming at either or both THP and Elkus Ranch each year.

c) Supports PCE's load serving needs

Solar Powered Learning will not include storage capacity for mitigating over-generation imbalance.

d) Additional benefits

PCE's strategic goals include developing "a diverse power portfolio that is greenhouse gas free" and to "stimulate development of new renewable energy projects and clean-tech innovation in SMC." Solar Powered Learning will contribute to both of these goals, and, should PCE decide to pursue such a measure, the project is both scalable and replicable. There are several educational farms located in SMC, and it would be possible to repeat this project with other similar organizations, both to increase renewable energy generation and to increase PCE's visibility while increasing the general understanding about renewable energy in the county through educational efforts.

PCE Implementation Requirements

At this time, we do not foresee any additional staff burden for PCE employees beyond establishing the contract to provide power to the grid and coordinating with InterMountain Electric and/or PG&E. PCE will be welcome to perform site visits at both sites at any time during the grant period.

Qualifications

- THP and Elkus Ranch are both stable, established nonprofit organizations and well-versed in carrying out grant-funded projects.
- Brandon Bradford will serve as the principal contact for InterMountain Electric Company. Mr. Bradford is Energy Design and Sales Manager and has familiarity with PCE's goals for the county.
- Both THP and Elkus Ranch already provide educational programming about sustainability and build curriculum that is based on Next Generation Science Standards.

Evaluation

Success will be evaluated through the following measures:

- The solar array at Elkus Ranch provides for all annual energy needs as well as contributes power to PCE's supply. Measurement in kWh will provide numerical data.
- THP will eliminate reliance on the gas generator and instead provide for power needs with solar energy.
- THP and Elkus Ranch will develop and deliver renewable energy curriculum to visitors. Measurement of numbers of visitors to receive renewable energy lesson will provide numerical data.
- THP will engage with local media to provide attention to PCE's strategic plan for SMC.

Metrics and Assumptions

Solar Powered Learning operates under the assumption that programs about sustainable food systems must include education about water, waste, and energy management. THP's recent funding from Natural Resource Conservation Service provided water delivery improvements and rainwater catchment on the SMC Farm and current funding from the SMC Office of Sustainability provides for SMC Compost, a program to teach students in the county about waste management and compost usage. Renewable energy completes the whole picture and provides students with a working example of sustainable food systems from start to finish. The SMC School Farm and Elkus Ranch have both started work on Carbon Farm Plans this year, along with many farms in California under California's Healthy Soils Initiative. Providing for the energy portion of GHG reduction is essential to creating sustainable and secure food systems in the state.

InterMountain Electric's Project Summary, below, will provide metrics about cost effectiveness and renewable energy production.

Budget

The largest portion of the budget will go directly to InterMountain Electric to provide materials and labor for the installation of the solar array at Elkus Ranch and the solar island at the SMC School Farm. The largest part of the remaining funds will cover administrative and curriculum development costs billed as a portion of staff time. Indirect costs cover the development portion, including grant reporting, site visits, and media engagement. A small portion will cover the cost of printing and purchasing curriculum and marketing materials.

The remaining portion of this document provides InterMountain Electric's Project Summary and includes detailed metrics for energy production and cost effectiveness.

Project Summary

Payment Options	Cash Purchase
Upfront Payment	$64,000
Total Payments	$64,000
Rebates and Incentives	-
Net Payments	$64,000
25-Year Electric Bill Savings	$130,112
25-Year IRR	5.53%
25-Year LCOE PV	$0.155
25-Year NPV	$3,975
Payback Period	14.6 Years

Combined Solar PV Rating
Power Rating: 14,400 W-DC
Power Rating: 12,865 W-AC-CEC

InterMountain Electric Company

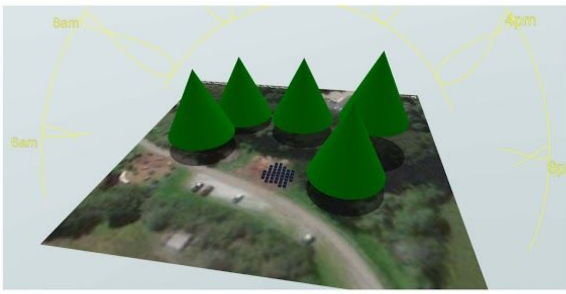
Prepared By: Brandon Bradford
P: (650) 222-7244, **E:** brandon@im-electric.com

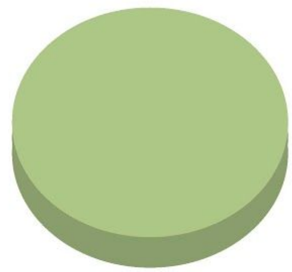
PV System Details

Solar PV Equipment Description
Solar Panels: 14.4kW-DC Premium Modules
Inverters: Standard Inverter

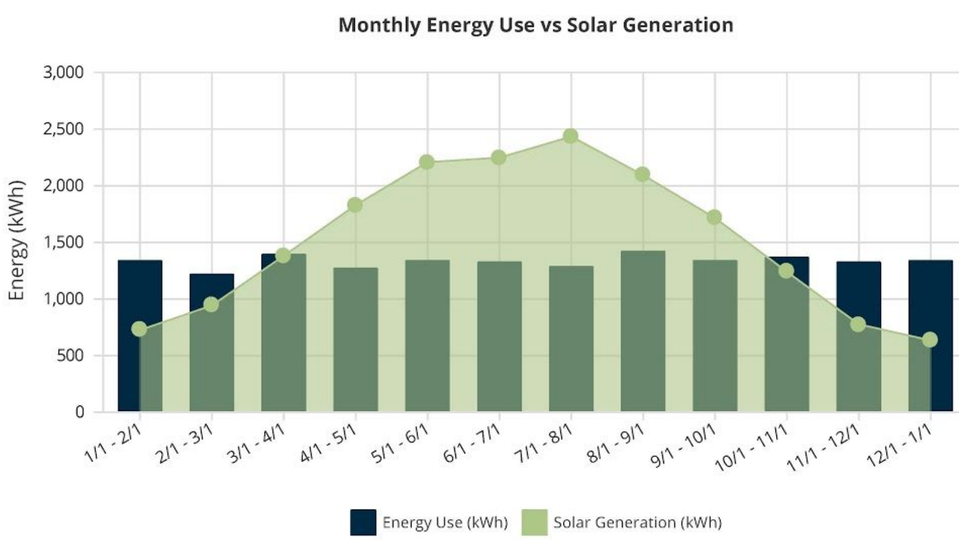
Solar PV System Rating
Power Rating: 14,400 W-DC
Power Rating: 12,865 W-AC-CEC

Energy Consumption Mix
Annual Energy Use: 15,942 kWh





Utility	-2,287 kWh (0.00%)
Solar PV	18,229 kWh (100.00%)



InterMountain Electric Company

Prepared By: Brandon Bradford
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Utility Rates

The table below shows the rates associate with your current utility rate schedule (A-1). Your estimated electric bills after solar are shown on the following page.

Fixed Charges		Energy Charges	
Type	A-1	Type	A-1
W Daily	$0.66	W Flat Rate	$0.19670
S Daily	$0.66	S Flat Rate	$0.25386

Current Electric Bill

The table below shows your annual electricity costs based on the most current utility rates and your previous 12 months of electrical usage.

Rate Schedule: PG&E - A-1

Time Periods	Energy Use (kWh)	Charges	Charges		
Bill Ranges & Seasons	Total	Other	NBC	Energy	Total
1/1/2018 - 2/1/2018 W	1,344	$20	$34	$231	$285
2/1/2018 - 3/1/2018 W	1,216	$18	$30	$209	$258
3/1/2018 - 4/1/2018 W	1,393	$20	$35	$239	$294
4/1/2018 - 5/1/2018 W	1,267	$20	$32	$218	$269
5/1/2018 - 6/1/2018 S	1,339	$20	$33	$306	$360
6/1/2018 - 7/1/2018 S	1,327	$20	$33	$304	$357
7/1/2018 - 8/1/2018 S	1,289	$20	$32	$295	$348
8/1/2017 - 9/1/2017 S	1,414	$20	$35	$324	$379
9/1/2017 - 10/1/2017 S	1,332	$20	$33	$305	$358
10/1/2017 - 11/1/2017 S	1,367	$20	$34	$313	$367
11/1/2017 - 12/1/2017 W	1,322	$20	$33	$227	$280
12/1/2017 - 1/1/2018 W	1,332	$20	$33	$229	$282
Totals:	15,942	$240	$399	$3,198	$3,837

New Electric Bill

Rate Schedule: PG&E - A-1

Time Periods	Energy Use (kWh)	Charges	Charges		
Bill Ranges & Seasons	Total	Other	NBC	Energy	Total
1/1/2018 - 2/1/2018 W	618	$20	$22	$106	$148
2/1/2018 - 3/1/2018 W	273	$18	$17	$47	$82
3/1/2018 - 4/1/2018 W	12	$20	$18	$2	$40
4/1/2018 - 5/1/2018 W	-562	$20	$13	-$96	-$64
5/1/2018 - 6/1/2018 S	-869	$20	$12	-$199	-$167
6/1/2018 - 7/1/2018 S	-921	$20	$11	-$211	-$180
7/1/2018 - 8/1/2018 S	-1,145	$20	$11	-$262	-$230
8/1/2017 - 9/1/2017 S	-679	$20	$14	-$155	-$122
9/1/2017 - 10/1/2017 S	-383	$20	$14	-$88	-$54
10/1/2017 - 11/1/2017 S	127	$20	$17	$29	$67
11/1/2017 - 12/1/2017 W	545	$20	$21	$94	$134
12/1/2017 - 1/1/2018 W	697	$20	$23	$120	$163
Totals:	-2,287	$240	$193	-$114	$318

Annual Electricity Savings: $3,519

InterMountain
ELECTRIC COMPANY

Prepared By: Brandon Bradford
P: (650) 222-7244, **E:** brandon@im-electric.com

Cash Purchase

Inputs and Key Financial Metrics

Total Project Costs	$64,000	25-Year NPV	$3,975	Discount Rate	5%
10-Year IRR	-7.23%	Payback Period	14.6 Years	Electricity Escalation Rate	4%
20-Year IRR	3.76%	25-Year ROI	103.3%	Federal Income Tax Rate	0%
25-Year IRR	5.53%	PV Degradation Rate	0.8%	State Income Tax Rate	0%

Years	Project Costs	Electric Bill Savings	Total Cash Flow	Cumulative Cash Flow
Upfront	-$64,000	-	-$64,000	-$64,000
1	-	$3,519	$3,519	-$60,481
2	-	$3,630	$3,630	-$56,851
3	-	$3,745	$3,745	-$53,107
4	-	$3,863	$3,863	-$49,244
5	-	$3,984	$3,984	-$45,259
6	-	$4,110	$4,110	-$41,150
7	-	$4,238	$4,238	-$36,911
8	-	$4,371	$4,371	-$32,541
9	-	$4,507	$4,507	-$28,033
10	-	$4,647	$4,647	-$23,386
11	-	$4,792	$4,792	-$18,594
12	-	$4,940	$4,940	-$13,654
13	-	$5,092	$5,092	-$8,562
14	-	$5,249	$5,249	-$3,313
15	-	$5,411	$5,411	$2,098
16	-	$5,576	$5,576	$7,674
17	-	$5,747	$5,747	$13,421
18	-	$5,922	$5,922	$19,343
19	-	$6,101	$6,101	$25,444
20	-	$6,286	$6,286	$31,730
21	-	$6,476	$6,476	$38,206
22	-	$6,671	$6,671	$44,877
23	-	$6,871	$6,871	$51,748
24	-	$7,077	$7,077	$58,825
25	-	$7,287	$7,287	$66,112
Totals:	-$64,000	$130,112	$66,112	-

InterMountain ELECTRIC COMPANY

Prepared By: Brandon Bradford

P: (650) 222-7244, **E:** brandon@im-electric.com

The HEAL Project and Elkus Ranch
Solar Powered Learning
August 3, 2018
Community Pilots

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**		**$75,000**	100%	Requested
Income #2			**$0**	0%	
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$75,000**		

REVENUE SUMMARY		
Total Requested	**$75,000**	100%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$75,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Materials for the installation of the solar array at Elkus Ranch and the solar array at the SMC School		**$46,000**	61%	25 years
Expense #2	Design/permit		**$3,000**	4%	
Expense #3	Labor		**$15,000**	20%	
Expense #4	.16FTE THP Farm Programs Manager-Curriculum Development/Implementation		**$9,200**	12%	
Expense #5	Printing/materials for curriculum/marketing		**$420**	1%	
Expense #6	Indirect costs at 15% of remaining budget above construction cost		**$1,380**	2%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$0**	**$75,000**	**100%**	
Net Income - Expenses		-	-		

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

OYSTER POINT HEAT PUMP REPLACEMENT

University of California, San Francisco

Peninsula Clean Energy Grant Proposal

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Contents

1 Description of the project

UCSF Oyster Point is a 144,000 square footage mixed use building constructed in 1973 and is located in South San Francisco. For heating, the building is served by 2 roof top heat pumps and 6 small space heaters which require natural gas. The roof top units account for roughly half of the annual natural gas usage at this building.

University of California has pledged to become carbon neutral by 2025, becoming the first major university to accomplish this achievement[1]. At UCSF, nearly 75% of our carbon emissions is due to on site burning of natural gas for heating and electrical generation. UCSF Oyster Point building is currently in the process of installing solar panels on the roof. The panels are expected to generate enough electricity to serve the entire building. UCSF is exploring the possibility of increasing the solar generating capacity and replacing natural gas burning equipment to all electric equipment. Replacing the natural gas burning carbon emitting heat pumps with solar electric heat pumps will contribute to UCSF overall pledge of reducing carbon emissions.

2 Outcomes

2.1 Accelerates GHG reductions and renewables

Oyster point typically uses an average of 13,000 therms annually. Converting the roof top heat pumps from natural gas to electric would reduce the therm use by an estimated 7,500 therms annually or about 35 mtCO2[2]. Because solar electricity does not emit greenhouse gas, the additional electric load would emit 0 mtCO2.

2.2 Delivers community benefits

In addition to reducing carbon emissions in the community, this project will aim to hire local contractors from the bay area. UCSF requires private construction contractors to follow public works laws and pay their workers prevailing wages.

2.3 Supports PCE's load serving needs

We understand that PCE may face over-generation of electricity. Our project would add load by 'electrifying' our building's heating systems.

2.4 Additional benefits

UCSF is in the process of working with SunPower, a San Jose solar energy company, to install 470 KW of solar on the roof top of Oyster point. The project is currently in the final design phase with construction expected to begin by the end of 2018. UCSF is considering increasing the capacity to 600 kW to accommodate the additional electric loads from converting natural gas

[1] https://ucop.edu/carbon-neutrality-initiative/index.html

[2] CO2 emissions calculated using The Climate Registry's 2018 Default Emissions Factors, Table 12.1 for Natural Gas (0.00531 Metric tons of Co2/therm)

burning equipment with all electric. This project would replace ½ the natural gas equipment with plans to replace the remaining equipment by 2020.

3 PCE Implementation Requirements

With exception to support providing the grant, there are no additional expectations from PCE.

4 Qualifications

UCSF Facilities Services has a wealth of knowledge composed of experienced professionals including professional engineers, trades, planners, building engineers, and project managers. The majority of this work to replace the heat pumps will be completed by an outside contractor to supply and install the heat pumps and an engineering firm to complete the design and permitting with close guidance and review by existing UCSF staff.

5 Evaluation

Replacing natural gas heat pumps with all electric heat pumps would have an immediate and quantifiable reduction in natural gas usage. In combination with the solar installation, this project would position the building to be on the path to net zero during periods when the solar production meets or exceeds the total building load.

6 Metrics and Assumptions

This is a pilot project for UCSF. Nearly all of our buildings throughout the San Francisco Bay Area are heated with natural gas. Typically when HVAC units show signs of aging, building managers solicit facilities investment, which are used to replace units one-for-one. We hope that this project helps prove 'electrifying' buildings with electric heat pumps as feasible for our buildings. If it proves successful, we plan to develop similar projects in other UCSF facilities, leveraging sustainability funds with facilities investment funds. UCSF's total annual emissions are about 105,000 metric tons, the majority of which comes from burning natural gas.

7 Budget

This project is expected to be funded by the PCE Grant and the UC Climate Neutrality Initiative Grant. UCSF is in the process of applying for both grants. The project is still in the development phase and the total project cost is estimated at $155,000. The heat pump replacement has been quoted for $76,000. UCSF estimates an additional $35,000 to hire a mechanical engineering firm to complete the design and permitting, $25,000 for project management fees, and $19,000 for internal engineering support and permit fees.

This project is not expected to generate a revenue stream. Please find the costs breakout on the attached budget worksheet.

UNIVERSTIY OF CALIFORNIA, SAN FRANCISCO
Oyster Point Heat Pump Replacement
3-Aug-18
Community Pilots

		YEAR 1	TOTAL		STATUS*
REVENUE SOUR(	**SOURCE**				
Income #1	**Requested from PCE**	$75,000	**$75,000**	48%	Requested
Income #2	**UC Climate Neutrality Initiative (CNI) Grants**	$80,000	**$80,000**	52%	Requested
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$155,000**	**$155,000**		

REVENUE SUMMARY		
Total Requested	**$155,000**	100%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$155,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	AC-1 Heat Pump Replacement (Outside Contractor)	$44,000	**$44,000**	28%	
Expense #2	AC-2 Heat Pump Replacement (Outside Contractor)	$32,000	**$32,000**	21%	
Expense #3	Mechanical Engineer - Design and Permitting (Outside Engineering Consultant)	$35,000	**$35,000**	23%	
Expense #4	Project Management (Project Manager $171/hr - 146 hours)	$25,000	**$25,000**	16%	
Expense #5	Design Reviews (Mechanical Engineer $160/hr - 31 hours)	$5,000	**$5,000**	3%	
Expense #6	In-house Building Engineer Support (Stationary Engineers $139/hr - 72 hours)	$10,000	**$10,000**	6%	
Expense #7	State Fire Marshal Review Fee (One time Fee)	$4,000	**$4,000**	3%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$155,000**	**$155,000**	**100%**	

Net Income - Expenses	-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Smart Charging Management for Connected Electric Vehicles

Point of Contact:

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Description of the Project

Executive Summary

Weave Grid uses connected vehicle data from electric vehicles to remotely optimize EV charging management. By utilizing machine learning to predict consumer driving patterns and create “virtual fleets”, we aggregate the EVs into a powerful grid asset that can reduce the strain on the grid. The EVs can then be used as a flexible demand-side resource, both at the macro grid level and also at the nodal, neighborhood-level distribution grid. This enables us to better predict EV demand and then manage the charging of electric vehicles, hence reducing the cost of real time supply-demand imbalances for Community Choice Aggregators (CCAs) and utilities. Additionally this reduces the need for costly grid upgrades, can help better integrate renewable energy (esp. excess solar), and save EV owners money on their energy bills. Our use of vehicle telematics data enables us to be agnostic to charger or car type, and given driving behaviors can optimize EV charging both across time and location.

Background and Solution Description

Electric vehicles are increasingly seen as a critical tool in the efforts to decarbonize economies, and California is leading the charge through its 5 million zero-emission-vehicles (ZEVs) by 2030 target. Accelerating the adoption of electric vehicles also helps bring down the cost of transportation, given the rapidly decreasing total-cost-of-ownership (TCO) of an electric vehicle, which as per several recent studies is already on par with an internal combustion engine (ICE) car in California.

However, there are several unintended consequences of a rapidly electrifying transportation sector which could be problematic to Peninsula Clean Energy (PCE). As electric vehicle owners come home, they plug their cars in to recharge for the next day’s commute. According to the Department of Energy, 80%+ of charging happens at home, and this trend of home charging is set to continue for several years. This charging happens in an uncoordinated manner leading to an unpredictable spike in end customer demand in the extremely expensive evening time period, forcing PCE to make additional real time purchases to supply the extra demand. This is particularly problematic given the power requirements of EVs, where on average Level 2 home chargers draw 7-10 kW per car.

Evidence has shown that even with Time-of-Use (TOU) rates, there is still a peaking problem caused by EVs, either because several customers are not on the rates or because of secondary spikes caused by all the cars starting their charging at the TOU lower price time (e.g. 8 PM).

A secondary impact for CCAs is that EVs can also cause overloading of distribution transformers and low-voltage distribution lines, since they were not sized to deal with multiple, correlated 7kW+ charging loads from transportation. This causes reliability issues for the distribution utilities, and will lead to higher utility rates from unplanned distribution upgrades unless smarter, charging management is utilized to defer those upgrade costs. That means that CCA customers will end up having higher overall bills.

However, many of these challenges can be solved by better utilizing the battery inside the EV more optimally through managed charging, as shown by NREL, the California Energy Commission (CEC), and several other leading researchers. Given actual daily energy needs and the size of modern EV batteries, there is immense flexibility in the EV resource that can be tapped into. The reason we have struggled to do so till date is because the charger (especially the residential charger) and automotive markets are highly fragmented, leading to a very difficult data problem for any one of those hardware providers to solve these problems for a CCA or utility. Also, almost all chargers actually do not have the ability to see what is happening inside of the EV, both from a battery level and a driving pattern behavior standpoint - the two key metrics needed to actually determine and provide the flexibility from EVs.

Weave Grid solves that problem by connecting straight with the car - the actual controller of charging, where the “master switch” for modulating the charge into the car exists. In fact according to both the Electric Power Research Institute (EPRI) and the Rocky Mountain Institute (RMI), there is a very critical need for a cross platform vehicle telematics provider in order to solve the many grid integration challenges of EVs. Weave Grid is building that by leveraging the many connected vehicle platforms that have recently come up in the automotive space that enable us to speak straight to the car and solve for the needs of both the EV drivers as well as their CCA / utility.

The solution works by accessing vehicle telematics data that is transmitted by the car to a cloud. Our approach pings an API on that cloud and accesses the relevant information, before making the relevant optimization calculations and sending back a signal to the car via the same cloud. BMW has tested these telematics capabilities in their vehicles for energy purposes and found it to be highly successful. The vehicle data also enables us to use machine learning to segment and predict customer driving patterns. This allows us to manage the charging in the most intelligent fashion for both the customer and the utility’s needs, e.g. staggering the charging based on estimated departure times, transformer load, battery charging needs, etc.

EVs can also be a very powerful resource for PCE if they were charged optimally during the middle of the day in order to soak up extremely cheap solar generation. This load shifting would enable to PCE to source more extremely cheap renewable energy and reduce the need to purchase more electricity in the evening as the drivers come home. Of course in order to do so under current circumstances, PCE would need to talk to the several different workplace charging operators at the campuses in San Mateo county and they would have to guess the amount of flexibility in the vehicles at that time. With Weave’s solution, since we communicate directly with the vehicle we can see and manage the charging across both time and space, and could work with PCE to encourage customers that we know have plenty of charge in their car to charge at work, especially if there are extremely expensive peak demand days on the horizon. This also enables PCE to have one clear end-to-end view on EV demand and their flexibility.

Project Details

Weave Grid proposes breaking up the project into three phases. Phase 1 (which would last for about three months) is focused on learning driving patterns and hence charging and demand profiles from a pilot group of EV drivers in San Mateo county using the telematics data in the cars. These data will enable us to improve our own prediction models around EV driver behavior, and see granular details about the amount of battery charge available for demand flexibility. We would also request customers to give us some simple data points about their expected driving behavior via our app (developed for the pilot) to add extra granularity to our forecasting. These data will be highly valuable to PCE in load forecasting as well as load shifting, especially as the adoption of electric vehicles accelerates in the county. These drivers will be a combination of existing EV customers as well as new ones in order to test different incentives schemes need for pilot participation and see if there is a difference between early adopter behavior vs. newer EV owners. We would anticipate working closely with PCE to acquire pilot participants including via PCE’s marketing channels and also tying the pilot incentives to already existing PCE EV incentive programs.

Phase 2 will bring together the EV driver data we have with PCE’s daily load forecast data, and then use Weave’s charging management capability to shift load as needed. We shall be able to provide predictions on existing charging patterns and hence demand, and working with PCE’s procurement team, we can shift the charging times in an optimized way so that the customer is still fully charged when they need their car, but PCE also is not faced with a supply-demand imbalance and has to pay for extremely expensive (and most carbon-intensive) power at peak times. As an example, if PCE has contracts for 100 MW of power at 7 pm, and due to the EVs in our pilot we estimate that they would have to procure an extra MW at that time, we can shift the load to the middle of the night in a highly granular and personalized approach, in order to save PCE the real-time imabance costs. We would want to test this on a daily basis as a demand management tool for PCE for upto 6 months. This approach would allow us to test and provide EV grid flexibility without any need to bid into CAISO capacity requirement proceedings, greatly reducing the burden on PCE from an administrative standpoint. It would only require a daily forecast data at the beginning of the day and a signal is a real time shift is needed or not. We anticipate that this daily demand management could save PCE $150-200 / EV / year in the pilot, based on a very conservative daily imbalance of $20/MWh. Of course the higher the real time mismatch, the more we could save. The optimized charging schedules would be sent to the car automatically with no customer input needed, though customers could always opt out of an event through the pilot app that we would develop.

Phase 3 would add on an extra layer by encouraging some of the EV charging load to move to the middle of the day, especially at workplaces (both campuses and small businesses). This phase would involve sending pilot participants personalized suggestions on charging at work or home based on their driving patterns, real time power prices, EV type, charging availability, etc. By moving some of the load to the middle of the day, PCE could encourage consumption when power prices are extremely low. This would require Weave to make the best assessment of which EVs could be charged at work and PCE to provide us with the best times to charge based on renewable production, as PCE would continue being the Load Serving Entity and market participant. The pilot participants would be alerted to these changes and provided these suggestions through the front end app developed for the pilot, and the charging schedules would be transmitted directly to the car so that again no actions are needed from the customers. Our objective here would be to investigate how much flexibility there really is in middle of the day charging, and how that could improve PCE's renewable power procurement.

Our only partners in this are certain connected vehicle data platform providers. These companies have collected access to different vehicles across all the different automotive OEMs and we have partnered with them (in some cases exclusively) to try this particular use case of connected vehicle data and control. Thanks to these partners and the standardization we are building through the APIs, we have access to over 5 of the leading EV manufacturers, providing a coverage of at least 70%+ of all EVs in San Mateo county. Almost all EVs are built as connected vehicles given how new they are, and come in-built with telematics packages. Our partners follow extremely strict data privacy and security standards, given their access to customer vehicle data. We will also be adhering to the industry standards on security and privacy.

We propose this pilot be sized at about 200 EV drivers in San Mateo county, across all geographic areas, and limited to EV drivers living in single family homes with Level 2 chargers. At an average of 7 kW, this will provide over a MW of flexible load to test in this pilot while keeping the customer number manageable. In order to access the vehicle data, customers have to opt in to sharing only very specific vehicle endpoints useful for these purposes. We limit these endpoints to just the battery state-of-charge, charging control, and miles driven. Customers can provide us access through a very straightforward login page, where they just need to enter their username and password for their vehicle account. Each automotive company has their own account for modern cars, which is how we access the Application Programming Interface (API) that connects to the car. Customers who have an EV without such an account created already will be walked through quick and easy signup for their account. The entire data access process (no matter which OEM brand) takes five minutes at most.

Outcomes

Accelerates GHG reductions and renewables

Personal vehicles frequently represents the largest single source of greenhouse gas emissions for households, especially in relatively mild climates like San Mateo County. With the accelerating adoption of electric vehicles, they also represent perhaps the largest and most effective opportunity for emissions reductions. Currently on the California grid, a typical electric vehicle is responsible for about 85 gCO2e per mile, more than an 80% reduction relative to a typical gasoline vehicle, and over half relative to even the best conventional hybrid. Given PCE's even cleaner electricity supply, emissions reductions for every electric mile driven exceed 90% and are eliminated entirely as PCE goes to 100% GHG-free power.
Supporting calculations:

Parameter	Value	Units	Source
Electric Vehicles			Source
Assumed EV efficiency	0.3	kWh/mi	Assumption
2018 Tesla Model 3	0.26	-	FuelEconomy.gov
2018 GM Bolt	0.28	-	FuelEconomy.gov
2018 Volkswagon eGolf	0.28	-	FuelEconomy.gov
2018 BMW i3	0.29	-	FuelEconomy.gov
2018 Nissan Leaf	0.3	-	FuelEconomy.gov
CA Statewide Electricity Carbon Intensity	283	gCO2e/kWh	PCE website
PCE Carbon Intensity	64.5	gCO2e/kWh	PCE website
Conventional ICE Vehicles			
Average gasoline Vehicle Emissions (2018)	476	gCO2e/mile	CARB
2018 Prius Fuel Economy	52	miles/gallon	FuelEconomy.gov
Gasoline Carbon Intensity (Full Lifecycle)	10676	gCOe/gallon	GREET 2017
Calculations			
Electric Vehicle (CA)	85	gCO2e/mi	
Electric Vehicle (PCE)	19	gCO2e/mi	
ICE (average)	476	gCO2e/mi	
ICE (best)	205	gCO2e/mi	
EV (CA) vs. ICE (avg)	**-82%**		
EV (CA) vs. ICE (best)	**-59%**		
EV (PCE) vs. ICE (avg)	**-96%**		
EV (PCE) vs. ICE (best)	**-91%**		

Accordingly, efforts which accelerate the adoption of electric vehicle by are likely to have a very large impact on GHG emissions for PCE customers, as recognized by PCEs existing programs to encourage both new and used EV purchases and sales. There are many different factors which affect this decision. Upfront cost matters a lot, but so do availability of charging, cost of charging, understanding and familiarity with the technology, and communication of its related environmental benefits.

This project would help address some of these ancillary factors and limit the challenges that arise as adoption becomes more widespread. By ensuring vehicles are charged when wholesale prices are lowest and avoiding expensive peaks, charging management keeps operational costs low for EV owners and improves the sales proposition. For PCE, these savings can be passed along directly to those owners or shared more broadly through lower rates. Meanwhile, added distribution system costs which would otherwise spike without charging management can be reduced or avoided, limiting the EV-induced inflation on the PG&E distribution portion of customers' bills. As low prices also frequently correspond to high renewable electricity availability, some reduction in CO2-intensity of charging-related electricity can also be expected.

In the medium term, availability of charging can also be improved through this solution. While large employers are increasingly installing dedicated EV charge points, this option remains expensive and out of reach for many small and medium sized businesses with limited capital or where renting predominates. Accordingly, allowing managed charging through the vehicle on existing outlets and through low-expense upgrades would enable greater uptake, addressing not only the evening peak power demand but also enabling midday absorption of excess solar capacity. This value stream grows even more as EV OEMs begin to enable vehicle-to-grid uses.

Without significant amounts of storage and demand response, PCE functionally cannot meet its 100% renewable goals given their intermittency. EVs provide a large, low-cost source for these services, and this pilot will help with both understanding that resource and developing the enabling platform for utilizing it in optimal fashion. PCE has already experienced rapid uptake of EVs, and thus is poised to lead in their effective integration as well.

Delivers community benefits

Initially, community benefits from this project come from reduced wholesale market purchases and hedging requirements due to added load flexibility and control. These are realized through lower energy procurement costs to PCE, which can be passed on directly to EV owners, shared among ratepayers, or utilized to further incent EV adoption.

Small independent business customers may also benefit from PCE's better understanding and control of charging patterns away from home. Charging at workplaces through normal outlets can be managed to limit peak usage and demand charges. Follow-on phases of the project could utilize data from the pilot to work with local electricians to better target panel and outlet upgrades for these types of independent businesses and rental housing arrangements. Ultimately, full-scale implementation of the system could cover all customers of all types who have or are interested in purchasing a new or used electric vehicle.

Supports PCE's load serving needs

This pilot would provide tangible load-serving benefits in several ways. First, by allowing demand-shifting away from the evening peak, managed charging would allow for cheaper power procurement. Flexibility in exactly how and when this demand is met further reduces costs by limiting risks for open market procurement and adding real-time optionality (in effect achieving the hypothetical benefits of real-time pricing without requiring significant user involvement), all without needing to operate in capacity markets. By spreading out charging load over the available time, we reduce the stress on local distribution grids, limiting associated growth in pass-through distribution costs from PG&E. Over time, better understanding of charging and driving behavior for PCE customers, as well as related options for managing midday charging can help better match their EV loads to low-cost solar resources.

Additional benefits

The PCE pilot would provide a first-of-its-kind innovative approach to the challenges posed by large-scale distributed EV charging. Weave Grid's proposed platform provides a unique, cross-manufacturer, non-hardware solution which offers advantages in cost, coverage, and capabilities. Cost reductions come from leveraging existing utility programs and relationships while eliminating the need for proprietary and specialized equipment. Coverage is enhanced through the ability to work across the majority of EV types and use of multiple parallel acquisition channels. High levels of coverage and close engagement with the utility allow capabilities in excess of typical third-party aggregators, as more localized impacts can be targeted and the full resource can be coordinated in concert.

Weave Grid is a recent winner of a Stanford TomKat Innovation Transfer Grant, and is currently a finalist for Plug & Play's energy-focused startup cohort, with results to be announced on August 21st. A pilot effort in conjunction with PCE would be a critical step in testing the data and assumptions around EV driver charging behaviors and available flexible load capacity, while also providing a detailed view into how EV adoption is proceeding within its customer territory beyond just numbers. Knowledge gained in this pilot should aid broader planning processes for the CCA as both local adoption of EVs accelerates and PCE moves to meet its 100% renewable procurement goals.

PCE Implementation Requirements

PCE is our main partner in this project, with the vast majority of benefits generated assisting PCE's mission and bottom line. PCE would be our primary partner for acquiring the customers needed for the pilot project. In order to do so, we would request support from PCE's marketing team to send out mailers and / or social media blasts to find EV driver participants. We would provide all the content and prepare the materials, but would request PCE's help in final outreach. In order to reduce administrative burden and costs, we would suggest acquiring some new EV owners by tying the pilot incentive to PCE's upcoming EV rebate in order to investigate the impact of the acquisition at point-of-sale and to reduce incentive costs.

For Phase 2 and 3 of our pilot, we would suggest that PCE send us forecast data in their standard formats (and we shall manage data editing) so that we can estimate our daily load shifting capacity. From there we can then estimate when and how much we can manage the charging, according to the constraints and optimal conditions for PCE. This would require us to spend some time with the PCE procurement team and understand how the purchase decisions are made and when load shifting would be most valuable. The frequency of data transfer would depend on PCE's capability to send that data, and we will build the requisite data portal to make that process easy. Phase 2 and 3 will of course build on PCE's capabilities as it will help predict load far better for the procurement team, reducing real time imbalance costs, and will also enable PCE to shift that load to other time periods (at night or in the middle of the day) when renewable costs are far better. PCE may also find eventually that EVs can become an interesting hedging tool against extremely high price days.

This particular pilot approach also greatly reduces the administrative burden on PCE, since we are not bidding into DRAM or providing any capacity needs for CAISO purposes. We are only testing the ability of EVs to act as a demand management tool to reduce peak purchases and enable a higher level of renewable energy use. This allows us to not go through complicated demand response requirements etc.

Qualifications

Our team is extremely qualified and knowledgeable in the space of EV - grid integration. We have all spent several years between us working in demand management and / or electric vehicles.

Apoorv Bhargava has an extensive background in the energy and transportation sector. A recent graduate of Stanford University with an MBA and an MS in Energy & Resources, Apoorv worked at Opower - the leading energy behavior analytics company. He is bringing much of that knowledge to the EV space now. He also led an effort at NRG Energy to develop their behind-the-meter storage solution and has worked in the EV space at Joby Aviation.

John Taggart is wrapping up his PhD at Stanford University in Management Science and Engineering on the intersection of electric vehicles and the grid, including lifecycle analyses of electric vehicles. He has previously worked at Tesla and Nissan and has a deep understanding of the EV and automotive space. He is a PCE customer.

Rebecca Wolkoff is a graduate of Stanford University with a Masters in Mechanical Engineering and currently works at Enel as their lead for optimization of battery systems for demand response and other applications. She has previously also worked at Tesla, Betterplace and Toyota and is building out our optimization algorithms.

Nicholas Vollmar is a graduate of Rice University and has been a backend developer for platforms at Retail Me Not for 4 years. He is building out our backend systems on Amazon Web Services.

We also have a group of extremely knowledgeable advisors, including Sila Killicotte (Director of Bits & Watts initiative at Stanford), Alicia Seiger (Associate Director of the Steyer Taylor Center at Stanford), Brian Bartholomeusz (Director of the TomKat Center at Stanford) and Tom Mercer (former head of Product Management at Opower).

This is an emerging technology company that started its development efforts in February of this year. We are currently building out our platform in order to accept data from the different vehicles, but have already tested our ability to control charging through telematics across different EVs. Our optimization algorithms are under development and will only improve with the PCE partnership and better understanding of the needs.
The main risks are as follows:

- Customer satisfaction - we shall gather as much feedback as possible from customer to assess if there are ways we can improve in order to mitigate the risk. We shall also be collecting feedback during the pilot after and during each phase and benchmark the feedback using an NPS score
- Data privacy - we are adhering to the industry best practices to avoid any data privacy risks
- System integration challenges - we are building in three months (more than what is needed) for Phase 1 in order to make sure that all glitches can be caught during the development

Evaluation

As Phase 1 of the pilot represents the initial exploratory portion, evaluation would involve the following areas of interest and success metrics:

- Number of drivers engaged and acquired (both new and existing EV owners)
- Estimates of resource flexibility/availability (in-program and extrapolated)
- Solicitation of initial driver feedback on interface design and user needs
- Scoping of savings opportunities and strategies for Phase 2
- Data analysis of existing charging behavior

In Phase 2, we would begin active management of charging loads in order to reduce PCE's real-time imbalance and moving load away from expensive evening peak times. One of the largest benefits of using Weave's approach is there is no need for additional metering infrastructure to assess how much energy and power was shifted, since we can see the amount of kWh added (or not added) from the vehicles' telematics. Evaluation there would consist of the following metrics:

- Number of load shifting events
- Amount of load shifted per event (MW and MWh) and per EV, broken out by different vehicle types
- Driver feedback on charging management event and if they noticed the charging schedules changing
- Number of opt outs and reasons for them
- Monetary value of shifting load per event (calculated by considering the counter-factual of otherwise paying for that extra EV demand at peak)
- Latency of signal from PCE to Weave to the vehicles
- Increase in PCE sourced renewable energy (MWh) vs. grid energy bought at peak times for pilot participants

The focus of Phase 3 is on shifting more EV charging to the middle of the day to take advantage of cheaper excess solar production. Phase 3 would continue many of the same evaluation criteria, with feedback and input from PCE based on how Phase 2 had progressed but with some additional metrics:

- Number of alerts and personalized suggestions sent to EV drivers
- Number of opt-outs and reasons for them
- Availability and better understanding of flexibility in workplace charging, both for larger campuses and SME charging
- Customer satisfaction and feedback on solar charging alerts
- Monetary savings to PCE from shifting load to the middle of the day
- MWh of extra renewable energy used to charge EVs and the GHG impact

A successful pilot for us would be one where we could prove out and define the flexibility available in EVs and demonstrate the ease of using telematics in order to use said flexibility. We would also hope for a high customer satisfaction Net Promoter Score and significant savings or savings potential for PCE. Finally we are striving to maximize the amount of EV charging done using the cleanest energy possible.

Metrics and Assumptions

Several key metrics for success that we shall be monitoring are mentioned above. We are going to be solving to best understand the ability of EVs to drive savings power procurement savings for PCE, hence better understanding the cost effectiveness of this solution in the long run. Of course, given that this is a software solution our costs are very low as this solution scales vs. any form of hardware alternative. The vast majority of costs are initial setup and integration. If we were to scale beyond the pilot, it would be very easy to do so very cost effectively.

Additionally we are assessing the impact on GHGs reductions. The bulk of our savings are indirect either through EV adoption or through charging at times with higher renewable energy content, for example load shifting from the evening when the most gas plants are on and when real time imbalances would lead to purchasing more carbon intensive energy. A calculation of our GHG reduction potential can be found below.

Total EV GHG Savings for San Mateo (2019-2028)	1,500,311 tCO2e
Share assigned to Weave project & follow-on implementation	10%
10-year extrapolated project savings	**150,031 tCO2e**

Weave Grid
Smart Charging Management for Connected Electric Vehicles
8/3/18
Community Pilots

REVENUE SOUR	SOURCE	YEAR 1	TOTAL		STATUS*	
Income #1	**Requested from PCE**	$75,000	**$75,000**	43%	Requested	
Income #2	TomKat Center, Stanford University	$50,000	**$50,000**	29%	Received	
Income #3	Angel investors	$50,000	**$50,000**	29%	Pledged	
Income #4	Other pilot income	see note	**$0**	0%	Estimated	Currently in the running for two other pilots (estimate at least $100,000 of revenue)
Income #5	Seed funding	see note	**$0**	0%	Estimated	Have been in 20+ very positive investor conversations so far; LOI for pilots will accelerate the timeline for funding as investors are looking for customer demand before comitting; founders' backgrounds help make this an interesting investment for investors. (estimate $500,000 of seed money)
Income #6			**$0**	0%		
Income #7			**$0**	0%		
Income #8			**$0**	0%		
Income #9			**$0**	0%		
Income #10			**$0**	0%		
	Total	**$175,000**	**$175,000**			

REVENUE SUMMARY		
Total Requested	**$75,000**	43%
Total Pledged	**$50,000**	29%
Total Received	**$50,000**	29%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$175,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service
Expense #1	Data infrastructure costs (for PCE pilot)	$5,000	**$5,000**	5%	
Expense #2	Contracted platform developer; $75/hour for 2 weeks (80 hours)	$6,000	**$6,000**	6%	Portion of development cost being allocated to PCE vs. other pilots
Expense #3	Implementation & customization for PCE (includes PCE branded front end app)	$15,000	**$15,000**	15%	
Expense #4	Optimization & demand management lead (cofounder); $40/hour for 4 weeks equivalent	$6,400	**$6,400**	6%	Portion of fully loaded staff time allocated to PCE specific work
Expense #5	Project manager (cofounder); $40/hour for 8 weeks equivalent	$6,400	**$6,400**	6%	Portion of fully loaded staff time allocated to PCE specific work
Expense #6	CEO (cofounder in charge of closing other funds); $40/hour for 4 weeks equivalent	$6,400	**$6,400**	6%	Portion of fully loaded staff time allocated to PCE specific work
Expense #7	Back end software developer staff; $60/hour for 4 weeks equivalent	$9,600	**$9,600**	10%	Portion of fully loaded staff time allocated to PCE specific work
Expense #8	Incentives for pilot for end customers (upto $150 * approx 200 EV owners)	$30,000	**$30,000**	30%	This could be tied to an existing PCE subsidy
Expense #9	Contracted machine learning engineer; $100/hour for 4 weeks (160 hours)	$16,000	**$16,000**	16%	Portion of development cost being allocated to PCE vs. other pilots
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$100,800**	**$100,800**	**100%**	
Net Income - Expenses		**74,200**	**74,200**		

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

Impact of EVs on San Mateo GHG Emissions

Year	Total Population (thousands)	Total Vehicles (thousands)	Existing EVs (thousands)	New EV Sales	Electric share of miles	GHG savings per mile	Total Miles Driven	Savings (tCO2e/yr)
2019	800	642	10	2,916	1.6%	90%	7,300,000,000	30,684
2020	808	649	13	3,937	2.0%	95%	7,373,000,000	41,419
2021	816	655	17	5,314	2.6%	100%	7,446,730,000	56,324
2022	824	662	22	7,174	3.3%	100%	7,521,197,300	73,351
2023	832	668	29	9,686	4.4%	100%	7,596,409,273	96,131
2024	841	675	39	13,075	5.8%	100%	7,672,373,366	126,597
2025	849	682	52	17,652	7.6%	100%	7,749,097,099	167,338
2026	858	689	70	23,830	10.1%	100%	7,826,588,070	221,813
2027	866	696	94	32,170	13.5%	100%	7,904,853,951	294,644
2028	875	703	126	43,430	17.9%	100%	7,983,902,491	392,010

** Note: these estimates are very approximate!*

Total EV GHG Savings for San Mateo (2019-2028)	1,500,311	tCO2e
Share assigned to Weave project & follow-on implementation	10%	
10-year extrapolated project savings	**150,031**	**tCO2e**

Parameter	Value	Unit	Source/Note
Existing EV population in San Mateo	10	thousand vehicles	https://www.nrel.gov/docs/fy18osti/70893.pdf
2018 Vehicle Registrations in San Mateo	636	thousand vehicles	https://www.dmv.ca.gov/portal/wcm/connect/add5eb07-c676-40b4-98b5-8011b059260a/est_fees_pd_by_county.pdf?MOD=AJPERES
Assumed growth rate	1%		Assumes vehicle growth corresponds to population growth; could be less with transit-oriented development and TNCs
Existing EV sales rate (monthly)	180	vehicles/mo	Approximate, using CVRP program data for San Mateo County
YoY EV sales growth	35%	Y/Y	
ICE vehicle emissions per mile (conservative)	300	gCO2e/mi	conservative estimate (state average closer to 500)
Daily VMT per capita	25	miles/day	http://www.vitalsigns.mtc.ca.gov/daily-miles-traveled

[redacted]

YELLOWTIN

Accelerating Clean Electrification

Date: August 3rd 2018
Point of Contact: Vishwas Ganesan, Founder & CEO
Organization: YellowTin, Inc
Email: Vishwas.ganesan@yellowtin.com
Phone: 408-250-1099

4.2.2 Description of the project

<u>Objective for PCE residential customers</u>: The project targets residential customer base but can be conceivably scaled to the C&I customer base longer term.

1. Provide education on building and automotive solutions to help them electrify their homes.
2. Empower homeowners with a personalized set of unbiased recommendations based on an analysis of their preferences, their energy-usage data (obtained from PG&E), current technology costs, available incentives, etc.
3. Enable homeowners to easily understand and evaluate quotes from vendors so they can make informed decisions confidently.
4. Accelerate the adoption of electric technologies, including PV, EVs, battery storage, and heat pumps that can help customers save money and reduce the need for fossil fuels.
5. Improve the overall economics of technology adoption by reducing the soft costs (especially customer acquisition costs) of implementation.

<u>Problem</u>: Most homeowner's in PCE territory (and beyond) are faced with rising energy costs. Additionally, an increasing number are recognizing the serious environmental concerns associated with a continued reliance on fossil fuels for heating and transportation.

A variety of clean and cost-effective electric options are available that can address these issues. It is not easy, however, for homeowners to research, analyze, and select the most-appropriate options for their particular situations. Determining the optimal mix of technologies, the best utility rate plan, the available incentives, etc. is a significant inhibitor to all but the most-savvy analysts.

The traditional solution has too often involved approaching the problem one technology at a time -- approaching a solar installer, for example, to put in a solar solution and later approaching an electrician to put in an EV charger, or a plumber to install a HPWH. This piecemeal approach works, but it is far from optimal and often leaves valuable dollar savings and GHG reductions beyond the homeowner's radar screen.

Moreover, many homeowners are reluctant to even approach vendors if they're not armed with at least a basic understanding of the technologies, the costs, and how the technologies can be applied to their situation. Unfortunately, some homeowners have been discouraged by vendors who do not put the homeowner first and, on the contrary, pressure the homeowner to sign a contract before a proper understanding has been reached.

<u>Solution</u>: YellowTin is a web service that educates and empowers homeowners of PCE territory (and beyond) to make informed decisions toward clean & complete electrification by analyzing their energy data. Our automated concierge service will be offered at no cost to homeowners. This translates to significant GHG reductions coupled with a high penetration of renewables and consumer savings.

We accelerate clean electrification of homes through the range of solutions shown below. Our ability to understand and portray the combined economic benefits of a portfolio solution such as

YellowTin
Accelerating Clean Electrification

EV + Solar + Heat pump using real gas and electricity PG&E data is unique and innovative. The water heater and space conditioner would predominately use heat pump technology. Please also note that technically the space heater is a space conditioner as it offers AC in addition to heating.

Solar System | Electric Vehicle | Battery Storage | Water Heater | Space Heater

<u>Value proposition</u>: Homeowners engage with our online platform where they learn the benefits of electrification by understanding the economics and solutions specifically tailored to their needs, based on their detailed gas & electricity data. The ability to do this at their own convenience and in a safe environment empowers them to go past the unknowns and confidently get quotes from vendors and make installation decisions confidently. Our recommendation engine allows them to build a plan to completely electrify their homes in logical steps and at their own pace (generally over multiple years).

<u>Activities:</u> Version 2.0 of the YellowTin platform will be the major product of the pilot project. During the 18-month project period, intermediary software releases will iteratively build value and functionality. Additionally, key learning's and analytics will be obtained about customer preferences, energy-usage patterns, etc. We would like to roll the platform to residential customers in both of the following ways:

- Directly pushed by PCE (white labelled with PCE brand)
- Pushed through the private sector (San Mateo companies) to their homeowner employees via their Corporate Social Responsibility/ Sustainability teams. We have already begun discussions with a few corporates and there is a strong interest to begin pilots by the end of 2018 that will continue into 2019. Specifically Intuit has confirmed rolling out our platform when it is ready later this year.

<u>Current solution (Version 1.0)</u>: Figure 1 shows the platform as it currently operates. This solution first collects the data shown in the yellow blocks (including user preferences) through a user interface. It then analyses the information to facilitate the sizing and pricing of a solar system that includes the consideration of EV usage. This platform is currently being used by few solar installers and about 400 homeowners have engaged with the platform so far. Additional engagements are occurring each day.

<u>Expanded solution (Version 2.0)</u>: Figure 2 shows the platform that will be developed as a part of YellowTin's technology roadmap, as accelerated by this project. We are adding battery storage, electric water heating, and electric space conditioning. We are also developing a personalized Dashboard that offers a cost-effective plan for homeowners interested in saving money and reducing GHGs.

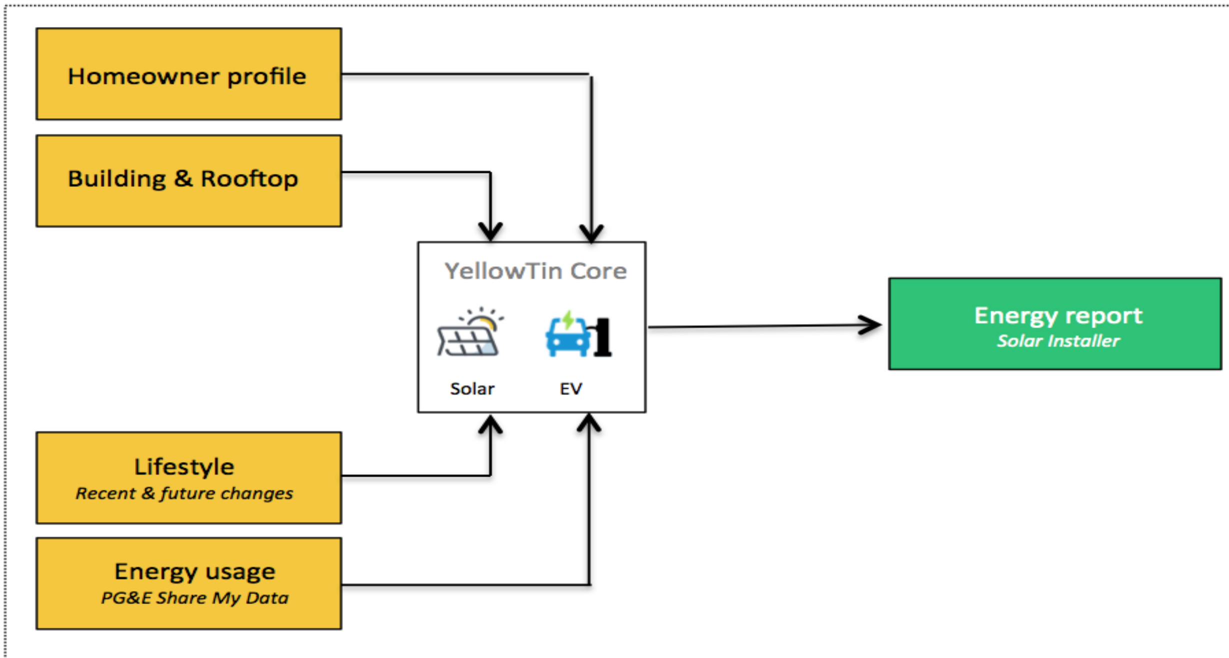


Figure 1. Current Version of the YellowTin Platform

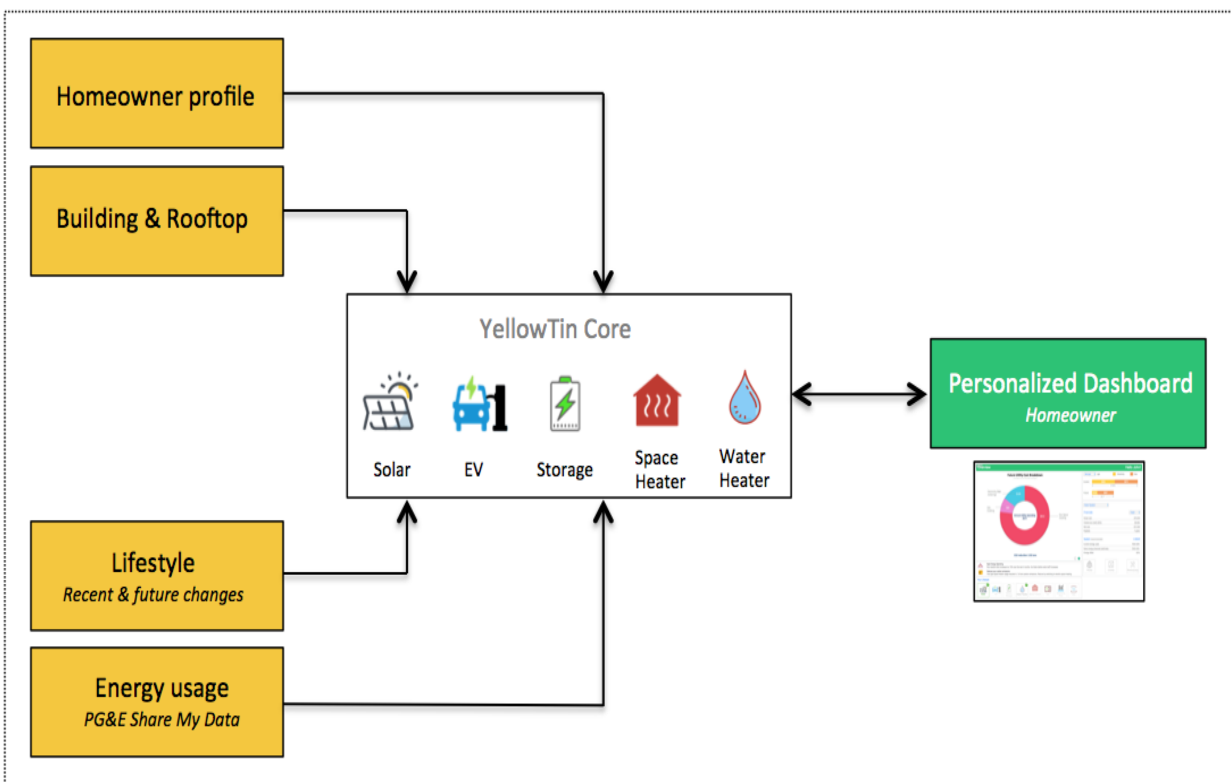
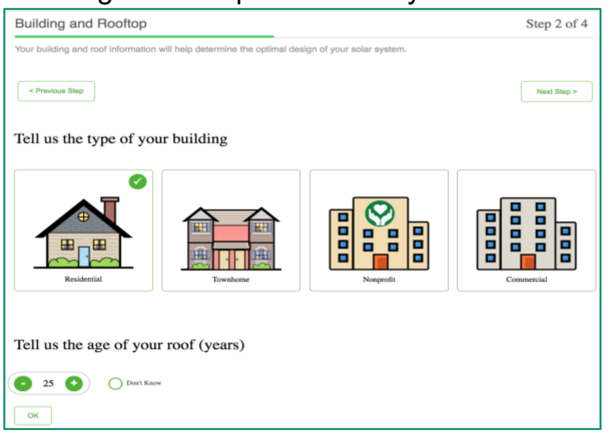


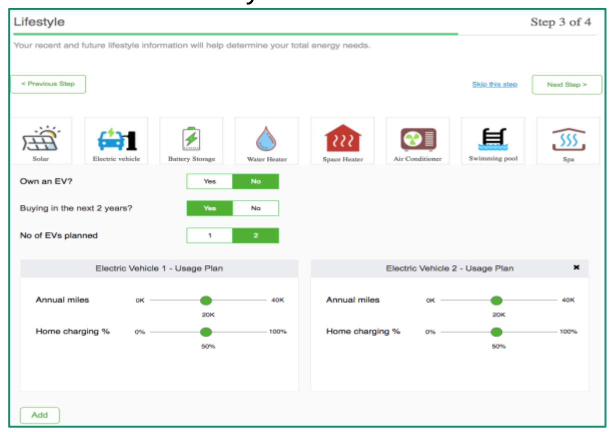
Figure 2. Expanded Version of the YellowTin Platform with Personalized Dashboard

Below are key areas for next steps for the pilot project:

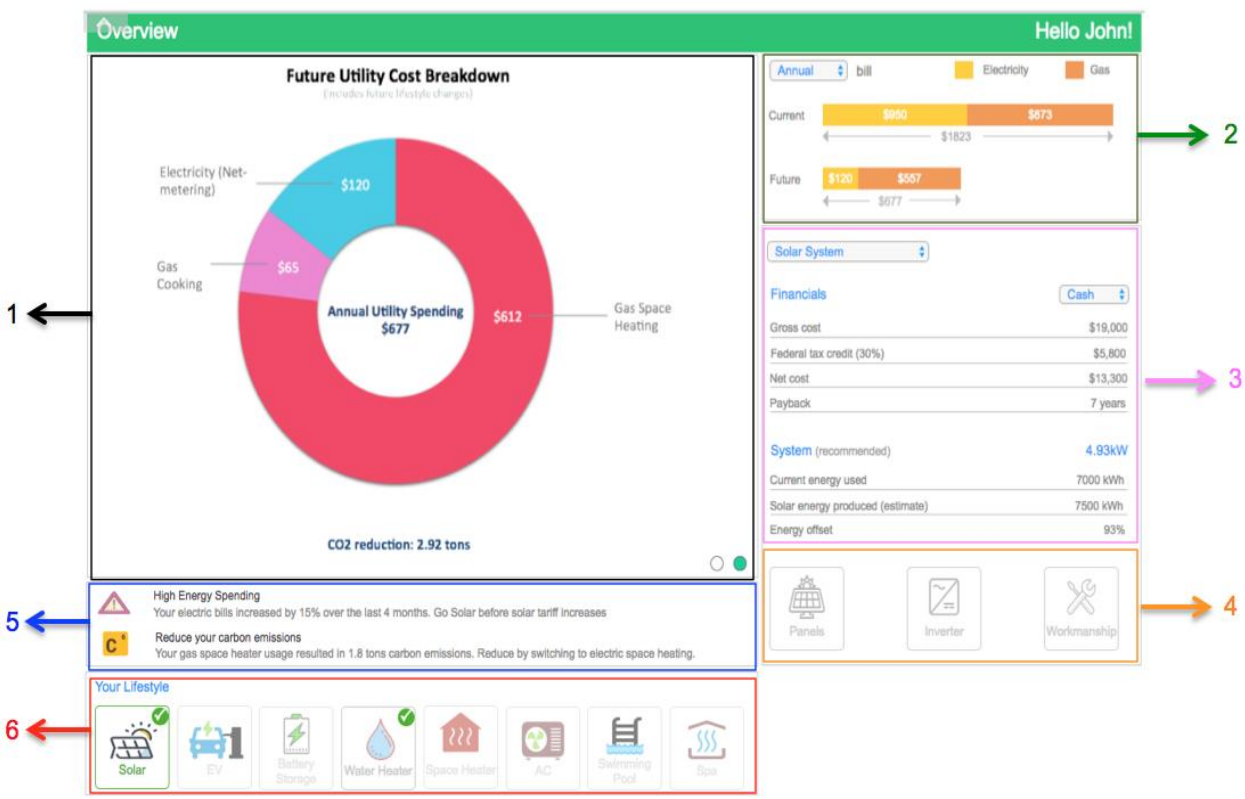
1. Homeowner interviews: We will conduct around 50 interviews to understand homeowner emotions, concerns, goals and why they have not taken action (or if they have, to understand their buying journeys). Customer empathy and product market fit are key to building the right product and we will need to repeat the same process for this project. We conducted the above steps for our Version 1.
2. User experience: The elements noted below are critical if a homeowner is going to embrace and engage with an online interface. The science of taking complex information and showing it to the user in a simple, yet powerful manner requires group sessions to get design feedback on the user interface and will likely require a few iterations.
    a. User flow: What happens when a button is clicked, an icon is selected or the next page is loaded? How should information be collected and presented from a quantitative perspective.
    b. Visual design: How should the icon look? What colors are appealing to our target audience (homeowners)? Should there be a zoom feature?
3. Product development: This includes the effort to develop:
    a. Software: Develop the code, host it, make sure the whole experience is working well with all the right data for different browsers, machines, operating systems, mobile, tablets and desktops.
    b. Logic and algorithms: Develop the back-end intelligence for the solution set. As an example, what is the impact of financial impacts on combining solar with storage mean? It requires sizing the solar system accounting for the panel production, rate plans, shading, azimuth and mapping that information to the actual hourly energy usage of the home along with understanding how a battery charges and discharges based on a specific chemistry and its characteristics such as state of charge, charge time, load capabilities, etc. This requires building equations, running patterns on spreadsheets, testing the same and then translating that to code.
4. Testing: This includes several layers:
    a. Front end: Testing the user interface under different environments.
    b. Back end: Checking if the information is loading properly, if there are any delays, etc.
    c. Logic: Correlation of software with a spreadsheet-developed logic
5. Feature development: Any product (software or hardware) has a roadmap based on customer and market needs, and this requires listening to the customer, understanding their problem and solving it intuitively. It may be a download button request or it may be the ability to view monthly data in addition to annual data. This effort is on-going and the tighter the product market fit, the stronger the value, so we intend to keep doing this continuously during the pilot period.
6. Marketing: This is described in Section 4.2.4. In addition, we will explore the possibility of engaging with students who could encourage their parents to start the online engagement, thereby allowing the students to also get involved and be future sustainable citizens.

Design and functionality: To further define the components and the process found in the Expanded Platform, this section focuses on some of the key blocks shown in Figure 2. The four yellow blocks are the homeowner engagement screens, which then feed data into the YellowTin core engine. The engine houses device-level models for each of the technologies considered, along with algorithms that run computations to optimize and create a plan set that is personalized to the specific homeowner. As examples, these two screenshots show the “Building & Rooftop” and “Lifestyle” sections that determine feasibility of the solutions.



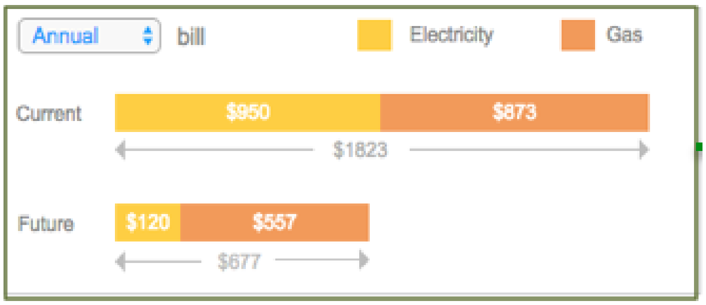


The output of the data-driven calculations performed in the YelllowTin Core are presented as a personalized Dashboard. The Dashboard contains the six sections marked in the screenshot shown below and as described in the section-by-section discussions that follow.

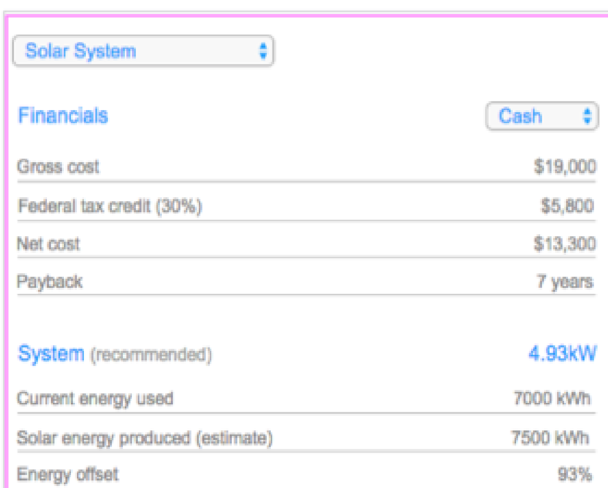


Section 1 - Future disaggregation: Details the future utility cost breakdown based on lifestyle selections. In this example, the homeowner has selected Solar and Heat Pump Water Heater and so the future breakdown shows Gas cooking ($), Gas space heating ($), Electricity (Net metering), CO_2 reduction along with Annual Utility Spending ($).

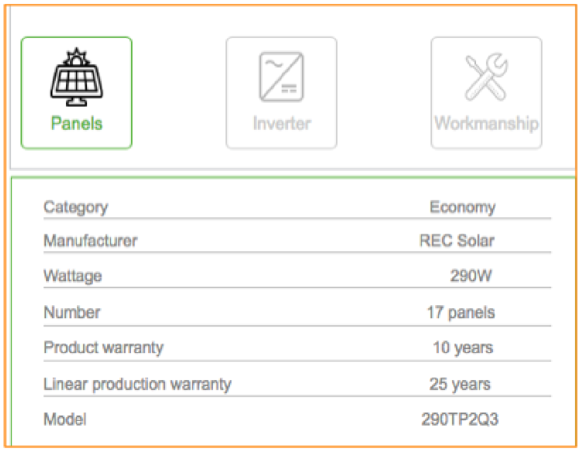
Section 2 - Utility bill breakdown: Breakdown of actual gas & electricity bills for current & future situations. In this example, the future state includes the scenario of switching from a gas water heater to a HPWH and also getting Solar.



Section 3 - System & Financials: The optimal system needed based on homeowner's current and future energy needs is computed accounting for rate plans (Tier & TOU), equipment characterization and simulation data along with specific product datasheet attributes. This would also allow, over time, for comparisons by manufacturer (such as Tesla vs. Nissan for an EV). The analysis will include incentives (such as tax credits or rebates) offered by PCE, PG&E, and at the federal, state & city levels. Here we show a cash option but other options such as Loan, PPA, or PACE can be built in.

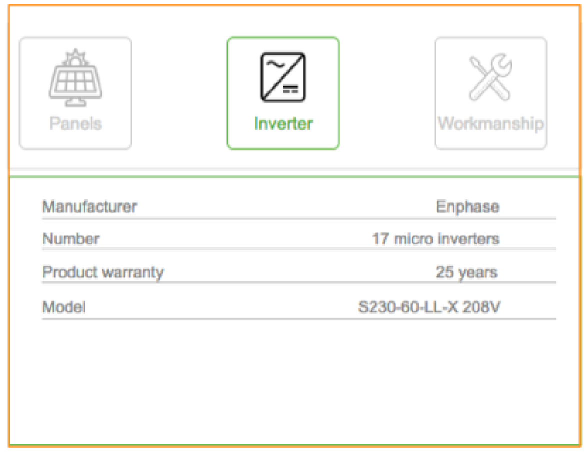


Section 4 - Technical details: The homeowner can drill down into the technical details of specific products including warranty information. Here we show for Solar, where Panels, Inverters and Workmanship information can be seen.



Panels | Inverter | Workmanship

Category	Economy
Manufacturer	REC Solar
Wattage	290W
Number	17 panels
Product warranty	10 years
Linear production warranty	25 years
Model	290TP2Q3



Panels | Inverter | Workmanship

Manufacturer	Enphase
Number	17 micro inverters
Product warranty	25 years
Model	S230-60-LL-X 208V

Section 5 - Recommendations: We analyze the data and provide a list of solutions encompassing the best portfolio, and identifying which ones are best tackled initially and which are better tackled later based on CO_2 emissions and savings. The homeowner can then start doing the “What If” analysis by adding, for example, a space heater (likely a heat pump space conditioned) to the solar selection. This action dynamically updates the dashboard so they can see how the carbon emissions and financials change as solutions are added or removed. By adding a heat pump space conditioned, they would also see that the Solar system now would be increased along with the panel count in order to power the heat pump.

Section 6 - Lifestyle sections: This serves as the control pad for the user to add/ remove a lifestyle choice and then understand how all of the above information changes.

4.2.3 Outcomes

Accelerates GHG reductions and renewables: The majority of PCE’s residential customers live busy lives and seldom have the bandwidth and interest to comprehensively research all the details needed to make an informed decision related to solutions needed to meet PCE’s goals. We are seeing digital transformation happening in all of the major industries starting from hotel booking (Airbnb) to job hunting (LinkedIn) to house hunting (Redfin/Zillow), where platform companies analyze data and provide meaningful recommendations. This simply means consumers want third-party companies to help with the analysis and then suggest personalized options that are available for implementation. Please refer to section 4.2.7 for quantification of GHG reductions and cost effectiveness. Spread sheet “GHG Emissions Reduction and Cost Effectiveness- YellowTin_Calcs“ also is attached in the email response.

This whole experience is simply missing in the energy industry. This project brings a much-needed digital transformation to PCE’s customer base, allowing them to understand the issues and take action more easily. This will deliver results in a cost-effective manner, directly increasing solar, EV, storage, HPWH & HP space conditioning adoption, which support PCE’s procurement goals. As an example, charging an EV in the evening from the battery storage that has been charged from solar would allow various end uses to be fully powered by renewables.

Delivers community benefits*:* The platform has the ability to assist other programs that are designed to encourage solar, energy efficiency, load shaping, etc. in low-income communities. The platform can describe these programs and incorporate incentives such as rebates into the financial section of the Dashboard. The platform is truly scalable, meaning the entire customer base of 262,900 residences across San Mateo County can be served during a full-scale implementation. There is no geographic preference as such. The uptick in installations will increase local vendor activity, resulting in higher profits and expanded economic activity in the region.

Supports PCE’s load serving needs*:* The platform will increase the implementation of solar, battery, and heat pump solutions, creating greater flexibility for the shifting of energy from daytime to evening periods. Additionally, the platform is adaptable such that it will allow PCE to advertise any future demand response programs (as it develops them). As an example, if PCE implemented a program where customers interested in solar with batteries agree to not feed power back to the grid during certain times on weekdays during the month of July, then YellowTin could account for this scenario and display the financials based on each homeowner’s historical usage patterns so they get a forecasted economic savings analysis. This will quantify customers’ benefits and encourage participation.

Additional Benefits*:* Version 1 of the platform (Figure 1) is currently live and supporting solar customers. More than 400 homeowners are onboard so far and detailed data have been collected for each homeowner.

- Learnings: The user interviews have helped shape the user experience and feature set for the product, including the algorithms needed to provide results and recommendations.
- Results: We are constantly running user-driven analytics, including parameters such as clicks, time spent on a page, what features were not preferred, etc. The insights from this analysis have been invaluable as we have built our roadmap.

This platform can be easily expanded because the software is scalable. It will require strategic marketing initiatives for full-scale expansion so homeowners in the service area are well aware of the solution and how to access it. The platform can increase community resilience in few different ways:

- Increased Distributed Energy Resources: A home that has its own solar, EV, and battery will have less dependence on energy infrastructures and will be less impacted by severe weather, storms, etc.
- Inverter manufacturer and feature education: Today only a small fraction of inverters allow solar generation to continue producing power during a power outage and we will see more of these features from product manufacturers. The ability to highlight such inverters and their functionality can be achieved on the customer dashboard.

4.2.4 PCE Implementation Requirements

We would need the IT department of PCE to embed our link on the PCE site so it becomes a gateway for homeowners. We would also like to incorporate the PCE logo onto the platform, white labelling the solution with PCE's brand. Alternatively, we can simply use the YellowTin brand, but the former would be preferred. We would like to ideally create links on the websites of each of the cities in San Mateo County with a button that points to the link in the PCE site for homeowners to begin the engagement. It would be very useful to do some marketing activities around the fact that this online solution is available for homeowners and it could be done through newsletters, brown bag sessions, digital marketing such as Nextdoor, facebook, etc. The YellowTin team is happy to take the lead on this, but we would need the assistance of PCE's team to assist with the basic marketing initiatives described above. We would also be thrilled to benefit from the PCE citizens advisory committee to get inputs on customer success.

4.2.5 Qualifications

We are a start up that incorporated in July 2016 and have a full time team of 6 members. The CEO has 16 years of experience in the power management and energy markets and has worn several hats starting from systems engineer to product management to strategic business development. The VP of engineering comes from a strong background of building B2B2C software cloud applications. Tom Kabat (bio attached in email) serves as an advisor and brings the strength of decades of utility resource planning and integrated resource planning, rate and financial analysis, experience in utilities. YellowTin as explained in Section 4.2.2 (Activities) has a live product with customers with several hundred homeowners onboarded. The project will require ramping of staff and working with consultants on a need to basis. SunWork's board and team has a lot of expertise and they will be our partner who will help us to build our algorithms and user interface designs. We will be beginning a full-scale deployment with Intuit in their Mountain View and San Francisco offices where they host more than 3000 employees. YellowTin was recently selected as a top idea in the Sunnyvale Innovate Climate Challenge.

4.2.6 Evaluation

We will evaluate success in the following way:

1. Analytics: The ability to understand how many homeowners onboard, how far each of them interacts with the platform, how much time they spend, how frequently they came back, which specific solutions interest them – All put together are invaluable and the further we are able to drive uptick in engagement clearly shows we are creating interest to take the next step.
2. Decision analysis: The ability to get feedback from the homeowner if they moved forward with the install or not and if they did not, what the reasons were. As an example, if they did not move forward because it requires them to upgrade their main service panel

which say costs $3000, then we consider that success because we are able to know the exact reasons why. This could motivate PCE to introduce say a rebate if a decent % of people hit the same roadblock. Bucketing the segment of users who installed and those who did not and what topics were barriers.

4.2.7 Metrics and Assumptions

Refer attachment “YellowTin_GHG-Emissions.xls”. It includes all the details. For the short term (end of pilot), our target CO2 savings is 1.4Million lbs for the year and longer term (end of 10 years), our target CO2 savings is 52Million lbs for the year. The cumulative over a 10 year period is assumed to be 250Million lbs based on linear growth.

The project cost is $75,000 and will also involve minimal PCE staff time as described in section 4.2.4. The platform as discussed is designed to scale, so over time with minimal efforts the number of home owners who use the platform increases steadily leading to more installations and hence more CO2 savings.

5 Budget:

We are looking to raise our seed round of up to $500,000 sometime in 2019 and will be looking to leverage the pilot work to apply for other sources of funding as well. Please refer to “YellowTin_Budget.xlsx” for expenses. Our software development team is based in Bangalore, India and we will be looking to add the two software engineers there. Our user experience consultant is based in the Bay Area.

YellowTin Inc
Accelerating Clean Electrification
8/3/18
Community Pilots

REVENUE SOURCES	SOURCE	YEAR 1	TOTAL		STATUS*
Income #1	**Requested from PCE**		**$75,000**	100%	Requested
Income #2			**$0**	0%	
Income #3			**$0**	0%	
Income #4			**$0**	0%	
Income #5			**$0**	0%	
Income #6			**$0**	0%	
Income #7			**$0**	0%	
Income #8			**$0**	0%	
Income #9			**$0**	0%	
Income #10			**$0**	0%	
	Total	**$0**	**$75,000**		

REVENUE SUMMARY		
Total Requested	**$75,000**	100%
Total Pledged	**$0**	0%
Total Received	**$0**	0%
Total Estimated	**$0**	0%
TOTAL PROPOSAL REVENUE	**$75,000**	100%

EXPENSE	DESCRIPTION**	YEAR 1	TOTAL		If the expense request is classified as capital***, what is its anticipated length of service in years?
Expense #1	Software engineer (Back end)]		**$30,000**	40%	
Expense #2	Software engineer (Front end)		**$30,000**	40%	
Expense #3	User interviews, focussed group		**$5,000**	7%	
Expense #4	User experience design consultant		**$10,000**	13%	
Expense #5			**$0**	0%	
Expense #6			**$0**	0%	
Expense #7			**$0**	0%	
Expense #8			**$0**	0%	
Expense #9			**$0**	0%	
Expense #10			**$0**	0%	
TOTAL PROPOSAL EXPENSES		**$0**	**$75,000**	**100%**	

Net Income - Expenses		-	-

* For "Status," choose **"Received"** for all income currently under your organization's control. Choose **"Pledged"** for sources which have been promised to your organization, but not yet received. Choose **"Requested"** for all income sources for which your organization has applied or asked that have not been received or pledged. Choose **"Estimated"** for all income that you are projecting to earn from services provided or event admissions.

** For staff labor, specify the position, loaded rate and hours in the description.

*** The purchase and/or installation of assets that have a useful life of greater than one year and which will be depreciated over time on your books.

	System size (avg)	Annual generation (kWh)		Annual CO2 savings (lbs)	Annual CO2 emissions (lbs)	Assumptions	Comments and links
Solar	5kW	8000		1138.08		Average solar size is 5kW that will offset 100% of the electricity usage.	Table 5 of References provided
	Annual Usage			**Annual CO2 savings (lbs)**	**Annual CO2 emissions (lbs)**	**Assumptions**	**Comments and links**
Gas water heater	193 therms				2258.1		http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-ES.PDF (Table ES3)
Heat pump water heater	800kWh			2258.1	0	Switching from Gas to electric water heater and then power the electric water heater from Solar - So reducing to 0 emissions from water hear.	http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-ES.PDF (Table ES2); Heat Pump water heater efficiency is 3x - So divided the kWh by a factor of 3.
Gasoline car	15000 miles	476 gm of CO2 per mile	1.05 lbs of CO2 per mile		15750		https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/cci_emissionfactordatabase.xlsx?_ga=2.200085870.1992283159.1529530734-504331174.1529443208.
EV	15000 miles			15750		Charged from renenwable either directly from Solar or from battery that was charged from Solar. 3000 EV's will replace gasoline cars.	https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/cci_emissionfactordatabase.xlsx?_ga=2.200085870.1992283159.1529530734-504331174.1529443208.
Gas space heater	144 therms				1684.8		http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-ES.PDF (Table ES3)
Heat pump space heater	642kWh			1684.8	0	Switching from Gas to electric space heater and then power the electric space heater from Solar - So reducing to 0 emissions fromspace hear.	http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-ES.PDF (Table ES2)

Residential customers in San Mateo County			260,000				
Description		Short Term (end of 18 month pilot)					
		%	Actuals	Per-implementation Emission Reduction (lb/yr)	Total emission reduction (Thousand lbs/ year)	%	Actuals
Servicable addressable market	**Short term:** Green conscious homeowners; **Longer term:** Mainstream cost conscious homeowners	**3.8%**	**10,000**			**26.9%**	**70,000**
Onboarded users	Total number of home owners who engage with YellowTin platform	20%	2000			40%	28000
Installed users	Total number of onboarded users who take action to install because of YellowTin platform	20%	400			40%	11200
EV1	Percentage of users who take action that implement this solution	20%	80	15,750	1260	20%	2240
Solar	Percentage of users who take action that implement this solution	25%	100	1,138	114	25%	2800
HP water heater	Percentage of users who take action that implement this solution	5%	20	2258.1	45	15%	1680
HP space conditioner	Percentage of users who take action that implement this solution	1%	4	1684.8	7	5%	560
EV2	Percentage of users who take action that implement this solution	0%	0	15,750	0	5%	560
					1426		

Tom Kabat's PCE grant related Bio

As an environmental engineer with more 35 years in the municipal electric and gas utility field, I help people and institutions make satisfying, economical sustainable energy progress. With both customer facing and utility facing experience, I focus on ways to decarbonize our energy system by bootstrapping renewables and efficient electrification in innovative ways. I help people transition from dangerous, dirty fossil fuels to clean efficient use of renewable electricity. Specifically, I work on analysis, policy and practices while consulting with cities, utilities, community choice energy agencies and the DOE to help make progress on energy and climate goals. I'm a board member of SunWork.org and Carbon Free Silicon Valley as well as an environmental quality commissioner for City of Menlo Park.

I've participated in the installations dozens of solar systems, 3 heat pump water heaters, 3 EV chargers and a mini-split heat pump.

Tom Kabat's general efficiency Bio

As an environmental engineer with 35 years in the municipal utility energy field, I help people and institutions make satisfying sustainable energy progress. I focus on renewable energy implementation and on ways to decarbonize our energy system. I help people transition from dangerous dirty fossil fuel use to clean efficient use of renewable electricity. Specifically, I work on policy and practices while consulting with cities, utilities, community choice energy agencies and the DOE to help make progress on energy and climate goals. I'm a board member of SunWork.org and Carbon Free Silicon Valley as well as an environmental quality commissioner for City of Menlo Park.

Acterra ACTION FOR A HEALTHY PLANET

3921 East Bayshore Road
Palo Alto CA 94303-4326

tel 650.962.9876
fax 650.962.8234

www.acterra.org
info@acterra.org

August 3, 2018

Peninsula Clean Energy
Community Pilot Program Grant Review Team
2075 Woodside Rd.
Redwood City, CA 94061

Dear Review Team:

I am writing on behalf of Acterra in support of YellowTin's application for funding under the Peninsula Clean Energy Community Pilot Program.

YellowTin's proposed development of a homeowner-facing dashboard that helps people create a custom view of their home's energy data and deliver a custom crafted solution for beneficial electrification is extremely valuable. Their system is designed to understand utility rate plans and net metering rules, which are critical as we move to a smarter grid. YellowTin is solving a real problem of customer education and empowerment and we are happy to support them for the Peninsula Clean Energy Community Pilot Program.

Acterra is a nonprofit environmental education and action organization whose mission is to make it faster, easier, and cheaper to take action on climate. Since 1970, we have served cities in Santa Clara and San Mateo counties that want to strengthen the resiliency of their communities and accelerate the transition to clean and renewable energy. Acterra's Green@Home program in Mountain View served 1,800 households, resulting in an average 16.4% reduction in natural gas usage, a 5.5% reduction in electricity use, and eliminated a total of 1,366 metric tons of CO_2e. A similar program is now also underway in Sunnyvale. Today, Acterra is working with the City of Sunnyvale and IDEO to support community outreach for the city's upcoming Climate Action Plan 2.0. Our Climate Resilient Communities Program focuses on environmental justice in low-income communities. We also provide education and programming about the benefits of electric vehicles through our GoEV program. We actively support the benefits of Community Choice Energy programs through our web site and active public outreach, including a successful outreach initiative with Silicon Valley Clean Energy completed in July 2017 and a current campaign to provide outreach to low income communities about the benefits of PCE programs.

Having YellowTin's proposed interface will represent an important opportunity to improve homeowner understanding and empowerment to take control of their home energy profile and help Acterra achieve its goal of reducing our collective carbon emissions. We look forward to supporting both YellowTin and Peninsula Clean Energy in building a more resilient San Mateo County through this grant opportunity.

Sincerely,

Julie Noblitt

Julie Noblitt
Energy & Climate Program Director
Acterra

Letter in Support of Yellowtin Proposal to PCE

Yellowtin is in an excellent position to help home owners understand their options for lowering their carbon footprint. This is particularly true for the modern technologies such as solar photovoltaics, electric vehicles, battery storage and heat pump water and space heating. Their web service has streamlined our interaction with customers by collecting key information including PG&E usage data helping home owners and nonprofit organizations install a solar system more quickly with SunWork.

SunWork is also working with Yellowtin to include customer options for transitioning from natural gas hot water heating to heat pump hot water heating since there is a significant benefit to increasing the solar system size to account for the transition. The Yellowtin software already includes information to help SunWork size a system properly for the addition of an electric vehicle.

We think that an interactive interface for customers allowing them to do “what if” analysis on various options to understand the financial benefits of taking multiple steps to help reduce a home owner’s carbon footprint would be a benefit to our customers. This is very powerful especially when it’s based on actual gas and electricity usage data and rate options.

SunWork has installed over 600 solar systems in the Bay Area and we offer an incentive for homeowners who install a heat pump water heater or a heat pump space heater to benefit from the SunWork nonprofit model for going solar.

Regards,

Mike Balma
SunWork.org
Development Director
Sobrato Center for Nonprofits
477 Valley Way, Milpitas

To: Peninsula Clean Energy Review Tam

Intuit's commitment to environmental sustainability took off in 2007 when our first green teams were formed. We promote sustainability both at our work sites and in communities across the globe. We have achieved carbon neutrality for our worldwide operations since 2015. We're on track for 50 percent carbon reduction by 2025, and 100 percent renewable energy-powered by 2030. Intuit also embraces sustainability outside the workplace. It offered a program for employees to install home solar panels at a reduced price, and provided early adopters $500 toward their system. Within six months, nearly 100 employees began installing solar panels on their homes. In addition, Intuit encourages employees to reduce electrical consumption by installing LEDs in their homes. In San Diego alone, an employee coordinated an event that resulted in the purchase of 1,560 Energy Star LEDs, saving 86,310 kilowatt-hours of electricity.

Our employees who own homes are faced with rising gas and electric bills and there is no easy way for them to understand the right solution choices (such as solar, heat pump, etc.), financial options, payback period and benefits of transitioning from gas powered appliances to electric ones that is personalized for their respective lifestyle requirements. Traditionally homeowners have relied on extensive online research and piecemeal information from vendors to make their decisions. YellowTin solves this problem by educating & empowering our employee homeowners to make informed decisions to transition to clean & complete electrification at their own pace and convenience by personalizing the experience. We support YellowTin in its efforts and will roll out their platform in our Mountain View and San Francisco employees starting late 2018.

Sean Kinghorn

Global Sustainability Leader – Intuit

75725 Torrey Santa Fe Road, San Diego, CA 92129

(858) 472-9355

SILICON VALLEY
CLEAN ENERGY

333 W El Camino Real, Suite 290 | Sunnyvale, CA 94087 | 1-844-474-SVCE (7823) | SVCleanEnergy.org

August 3, 2018

Dear PCE Evaluation Team,

Vishwas Ganesan asked me to write a few words related to my knowledge of his company, Yellow Tin, as part of a proposal he is making to PCE.

Vishwas was introduced to me via a colleague who is an expert in decarbonization policies and programs. We then met at SVCE where Vishwas demonstrated his product. Subsequently, as a judge for Sunnyvale's Open IDEO competition, I also reviewed Yellow Tin's product as Vishwas was a finalist.

I think that the fundamental approach taken by Yellow Tin in providing meaningful information to customers is very valuable. Access to understandable and meaningful data and information is a major barrier to customers adopting cost-effective and environmentally-positive electrification investments.

As we are still in the planning and design stages of our program development at SVCE, we have not entered into any commercial arrangement with Yellow Tin. Entrepreneurial companies such as Yellow Tin is the kind of company that we will encourage to respond to our upcoming request for proposals for services related to programs.

Sincerely,

Girish Balachandran
(408) 721-5301 x1001
Girish@svcleanenergy.org

Contributing to our Community
Since 1986

1013 Pardee Street
Berkeley, CA 94710
(510) 981-7760
Fax 981-0102
www.EBenergy.org
License #751533

August 3, 2018

To Whom it May Concern

CESC is currently working on promoting electric heat pump water heater technology through a program funded through the East Bay Energy Watch (EBEW), a local government partnership between Pacific Gas and Electric Company (PG&E), StopWaste, and the cities within and counties of Alameda and Contra Costa. Low income homeowners can at no-cost replace their existing gas water heater with an ENERGY STAR® HPWH with a Universal Energy Factor (UEF) of 3.17. The program also offer a $1500 rebate for homeowners who do not qualify as low income.

CESC is constantly talking to homeowners, educating them on heat pump technologies, qualifying them for eligibility with the intent to switch out their existing gas storage water heater for an electric heat pump water heater. We see cost and education as key barriers for people to transition to these technologies and YellowTin's ability to show the best possible payback such as coupling solar with heat pump along with a recommended rate plan based on actual PG&E usage data would mean more units installed and lower GHG emissions. We support YellowTin's vision and look forward to working with them when their platform is ready.

Sincerely;

Martin Bond
Executive Director

Sunnyvale

August 3, 2018

Sunnyvale Office Center
505 West Olive Avenue
Sunnyvale, CA 94088-3707
TDD/TYY 408-730-7501
sunnyvale.ca.gov

Vishwas Ganesan, CEO
Yellow Tin
Sunnyvale, CA

Re: Accelerating Clean Electrification (YellowTin)

Dear Mr Ganesan,

Thank you for participating in the City of Sunnyvale's *Innovate Climate Action in Sunnyvale Challenge*. We have been inspired by the community's excitement and engagement in our process to identify new, emerging actions that can accelerate climate action and help move Sunnyvale in the direction of becoming a carbon-neutral community. We saw a diversity of contributors, including nonprofit directors, startup founders, community leaders and young people across Sunnyvale. In total, we received 119 ideas through our on-line challenge platform.

Accelerating Clean Electrification (YellowTin) was selected as one of seven ideas that were showcased at our Innovate Climate Action in Sunnyvale Pitch Event, held on July 30, 2018. It was selected as an emerging idea as it addresses an important area we need to target for climate action, shifting our community energy use from natural gas to clean, carbon-free electricity. The event was a great opportunity for the selected ideas to receive feedback from a panel, consisting of representatives from the City, LinkedIn, Plug 'n Play, and Silicon Valley Clean Energy, as well as Sunnyvale community members.

Thank you for your ongoing participation in our process to update Sunnyvale's Climate Action Plan.

Sincerely,

Elaine Marshall

Elaine Marshall
Environmental Programs Manager

“Direct Engagement of Our Pacific Island Communities”
August 3, 2018

Anamatangi is pleased to apply for a $75,000 local community development “seed grant” from PCE, with Youth Community Service as our fiscal agent. Having partnered before on civic issues with organizations like Acterra and One East Palo Alto, our contributions include providing the individual who translated your PCE flyer into Tongan for Acterra. <u>The goal of this grant is to “develop capacity and agency” within Pacific Islander (“PI”) Communities in San Mateo County to educate ourselves concerning fast-changing environmental issues</u>, and as a result, achieve greater participation in conservation and clean energy programming. The sub-criterion we are filing under is “Developing Local Community Benefits.”

<u>In terms of metrics, it is our specific goal to reach 8,000 Pacific Islanders (out of 11,200 total) in San Mateo County and convert them to the 100% Equal Plus plan</u>—including the 3,200 Pacific Islanders who live within East Palo Alto alone. Our strategy will have three components, each designed to reach Pacific Islanders in ways they can quickly comprehend and embrace. These approaches include: (1) “reaching out to Pacific Islanders in their churches;” (2) “follow up with direct messaging to Pacific Islanders in their homes on a regular, repeated basis with live green energy programming in Tongan, Samoan and Fijian through radio;” and (3) “empowering Pacific Islander, African American and Latino youth and their parents” through training provided by Prof Miguel Guajardo (Guajardo, Guajardo and Casaperalta, 2007) of south Texas in how to do “Community Based Research”—where a community studies its own needs, seeks grants, and then takes action to implement the grant-funded change projects, in this case leading to greater non-carbon energy consumption patterns and a transition to non-carbon energy use that is mutually reinforcing as between families (and thus re-normed). In our communities, this kind of change will involve a “paradigm shift” in the way the communities think, hence the three-part strategy for outreach.

Proposed Budget

Proposed Anamatangi Budget for $75,000 “Seed Grant:”

Community Based Research Workshop—Prof Guajardo honorarium + flyers, food, room	$3,500
Radio Equipment for 5 Days/Week Radio Broadcasting:	
Lap Top with Music and Arts Capacity (to Connect with the Internet)	3,000
Control Panel	600
Multi-Connect Capacity to Bay Area & Hawaii (from there to all other Pacific Islands)	13,000
Women and Manpower:	
Experienced radio voice already known to the PI community (Kitione Mokofisi)	14,000
Outreach and training (Mamadee Uhila and Reverend Dan Taufalele)	14,000
Admin, curriculum, intercultural training, and assessment (Gregory “Kanaka” Tanaka)	7,000
Office Manager	10,000
Supplies, Food, Utilities, Room Rental for Other Events and Outreach	4,900
Translations (into Tongan, Samoan, Fijian)	5,000
In-Kind Contributions by One EPA and Acterra (TBD)	<u>XX,XXX</u>
TOTAL =	$75,000

BIOS

Appollonia Fa'anana Grey Uhila, aka “Mamadee,“ with a passion/love for all Pacific Islander children, is a former Commissioner of Juvenile Justice for San Mateo County. Founder of Anamatangi, she has been performing “parenting counseling” in Tongan and Samoan for a number of years and assisted Pacific Islander youths in schools and in prisons. She specializes in Pacific Islander outreach.

Reverend Dan Taufalele is the minister at Tokaikolo Christian Church in East Palo Alto. He attended college here on the Peninsula and has served as a music teacher, wellness counselor, football coach and advisor to incarcerated youth. His high school student marching bands have won prestigious awards over the years. His particular expertise is in providing social-emotional counseling to PI youth.

Kitione Mokofisi has been a prime time talk show host for over 40 years in the Bay Area and in Tonga. Having attended college in Hawaii and in New Zealand, he is a prominent member of the political elite in Tonga where he has often been asked to serve as the master of ceremony in major festivals and other events. He is presently living in the Bay Area where he is a radio commentator.

Gregory K. Tanaka, executive director of Anamatangi, is a former barrio elementary school teacher and law school acting dean. Designer of the first "intercultural university in the U.S.," he holds an MA in teaching, MBA, JD and PhDs in education and anthropology, has taught applied research methods at USC, UCLA and the University of San Francisco, and raised $50 million in funding for nonprofits.

1. COVER PAGE: Executive Summary

> ***OUR MISSION***: *Leverage energy storage, DER modularity & development expertise to deliver a superior value proposition to host communities, offtakers & project stakeholders.*

The ultimate objective of the *Community-scale Dispatchable Generation Pilot* is to demonstrate that high penetrations of renewable community generation can simultaneously maximize economic value to the host community while offering system value to the load serving entity.
This Community Pilot proposal lays out concrete and quantifiable goals & measures, to be further refined to align with PCE's strategic & tactical priorities, to demonstrate how community distributed renewable energy can be deployed to deliver an superior value proposition to host communities & Load serving entities (with emphasis on economic impact to "vulnerable communities").

The project will consist of 5 MW portfolio of distributed solar with storage generation assets located within the South San Francisco *(District 1/CVI value: 61.2)* & Brisbane *(District 5/CVI value: 46.41)* of PCE's service territory.

FIRM clean energy intends to mobilize PCE pilot funds to supplement the up-front costs associated with early-stage project development, design & procurement activities. The use of PCE funds (Scope of work) is intended to progress enable the project to independently finance the construction & operation of the proposed 5 MW dispatchable renewable pilot project

2. DESCRIPTION OF PROJECT:

The ultimate objective of the *Community-scale Dispatchable Generation Pilot* is to demonstrate that high penetrations of renewable community generation can simultaneously maximize economic value to the host community while offering system value to the load serving entity.

Specifically, the proposed Pilot project will demonstrate a standard methodology to leverage existing distribution infrastructure by deploying a distributed network of turn-key, grid-tied, renewable generation assets optimized with DC-coupled energy-storage for peak dispatchability.

This proposed pilot lays out concrete and quantifiable goals & measures. Successful achievement of these goals (as detailed below) will deliver real-world proof that distributed renewable energy can be cost-competitively deployed at a scale that:

i) Compliments existing grid constraints that have traditionally limited 'community' renewable penetration. (

ii) Satisfies siting constraints that have traditionally been a barrier to deployment of "community" renewable energy assets at scale.

iii) Delivers amplified direct & indirect economic benefits to host communities and all PCC rate-payers alike.

iv) Accelerates reduction of GHG-emissions by simultaneously minimizing net-load during hours of peak GHG intensity and reducing the GHG-profile of ancillary services by minimizing local demand for AS.

FIRM clean energy intends to independently develop, finance, construct & operate a proposed 5 MW dispatchable renewable pilot project located within the <u>South San Francisco *(District 1/CVI value: 61.2)*</u> & Brisbane <u>*(District 5/CVI value: 46.41)*</u> of PCE's service territory.

The proposed project will consist of a 5 MW distributed portfolio of modular solar & storage assets each interconnected directly to PG&E's existing distribution grid at pre-determined points of interconnection via the 'fast-track' interconnection process.

The 5 MW portfolio will consist of between 12-15 unique project sites (nodes) each co-located on existing disturbed lands owned by local municipal, industrial & private landowners secured by the project sponsor via a long-term site lease.

Each project "node' will host a dispatchable solar w/storage platform configured with a DC-coupled ESS to reliably deliver a dispatchable energy product to the grid during peak 'shoulder' hours (0700-1100 & 1700-2100, respectively).

Each node of the portfolio will feature the following components:

- *Generation (PV):* 500 – 1500 kW of ground-mounted solar PV
- *Energy Storage (ESS):* DC-coupled (behind-the-meter) ESS sized equivalent to 50% of the PV generation capacity and configured to deliver a 1x4 capacity to energy ratio.
- *POI & Ancillary Facilities:* Pole-mounted step-up transformer, breaker, meter & associated facilities as defined by the node's WDAT interconnection agreement with PG&E.

The proposed project portfolio will be designed to deliver > 40% of % the annual energy output on a dispatchable basis while approximately 50-60% of the annual output will be delivered on an 'as-available' basis.

The project sponsor plans to enter into long-term contracts to sell the energy and ancillary services at competitive market rates. Aside from supporting the financing and O&M requirements of the proposed project (See PCE *'Implementation Requirements'*), the project sponsor believes that successful closing of long-term PPA's and AS contracts will prove to be the strongest indicator of the proposed pilot's ability to deliver value to PCE rate-payers (See *'Project Outcomes'*).

3. OUTCOMES - Project goals and objectives:

The proposed pilot project will demonstrate that high penetrations of renewable community generation can simultaneously maximize economic value to the host community while offering system value to the load serving entity.
Specifically, the proposed project will aim to achieve the following project goals for the community and utility, respectively.

Community Benefits: i) Economic Benefits (Direct & Indirect); ii) GHG Reduction

a. *Economic Benefits:*
    i. Increase Local Revenue Base via Project Royalty payments
    ii. Increase demand for local services & jobs.
    iii. Reduce energy costs to PCE rate-payers by siting projects to defer T&D costs while delivering cost competitive energy & services.
    iv. Equip & enable vulnerable communities to monetize local renewable resources.
b. *GHG- reduction*
    i. Minimize net-load during shoulder hours with highest carbon intensity.
    ii. Minimize PCE rate-payer carbon-footprint associated with procurement of ancillary services by delivering carbon-free alternatives on existing infrastructure.

Load Serving Benefits: i) PCE Load-Serving Needs; ii) New Local Power (carbon-free).

c. *PCE Load-Serving Needs* System Impacts:
    i. Quantitative System Impacts:
        A) Reduce peak hour net-load
        B) Defer/avoid T&D upgrade costs in PCE territory by leveraging dispatchable generation at priority network locations (POIs).
    ii. Qualitative System Impacts:
        A) Deliver grid support to the local distribution grid (i.e. Ancillary services including capacity; regulation & frequency).
d. *New Power (Carbon Free)*
    i. Accelerate PCE GHG-reduction goal by enabling increased penetrations of cost-competitive local renewable generation on existing infrastructure.
    ii. Standardize project components & project development process to leverage modularity & simplify the interconnection, permitting & financing barriers to adoption.
    iii. Enhance cost-competitiveness of distributed community generation via aggregation of assets into portfolios capable of delivering the scale and standardization required to incentivize competition amongst project finance lenders and investors.

4. PCE IMPLEMENTATION REQUIREMENTS:

FIRM clean energy intends to independently finance the development, origination, financing & construction of the proposed pilot project. Proposed as a self-sufficient entity, the project sponsor believes the proposed pilot project can successfully achieve stated goals without the overt policy intervention or credit support from PCE.

As a self-sufficient commercial entity, the project sponsor will look to PCE to engage in a good-faith effort to negotiate and enter into a competitively priced long-term off-take agreement (PPA) with project sponsor for delivery of the energy and attributes generated by the proposed project.

Aside from the above stated bi-lateral PPA negotiation, the project sponsor strongly believes that close coordination with PCE staff will serve to maximize the ultimate value of the pilot project to PCE rate-payers. Specifically, the following points summarize the types of support and intensity of coordination required to maximize the pilot project's utility to PCE ratepayers.

i) **Project Planning Stage:**
   a. The project sponsor will rely on PCE providing individual points of contact to participate in the planning stages of the project to provide technical feedback to identify & prioritize optimal points of interconnection, as well as commercial feedback to align, refine & quantify the stated project objectives and goals to complement PCE's strategic mandate.

ii) **Execution stage:**
   a. The project sponsor will be pursuing site control agreements with select municipal, industrial and private landowners. As necessary, the project sponsor may ask PCE staff to assist in introductions and provide guidance to identify appropriate contacts.
   b. During permitting & CEQA review process with relevant lead agencies, project sponsor may, from time-to-time, require PCE staff to provide evidence of PCE support for project approvals.

iii) Evaluation Stage:
   a. The project sponsor will rely on PCE's direct involvement to properly measure and quantify the performance of the project relative to the stated objectives defined at the outset.

5. QUALIFICATIONS

***OUR MISSION**: Leverage energy storage, DER modularity & development expertise to deliver a superior value proposition to host communities, offtakers & project stakeholders.*

The FIRM clean energy team brings deep domain experience in renewable project development and a curated network of local partners and domain experts to execute on the proposed plan.

***Please see Appendix A** for detailed summary of FIRM clean energy project development experience & team qualifications.*

1. METRICS & ASSUMPTIONS & EVALUATION

a. ***GHG- reduction***
   i. Demonstrate decreased net-load during shoulder hours with highest carbon intensity.
   ii.

b. ***PCE Load-Serving Needs* System Impacts:**
   i. Demonstrate Reduced PCE system net-load during peak 'shoulder"

c. **Community Benefits:**
   i. Quantify direct economic impact to local communities derived from project royalty payments to host landowners & municipalities.
   ii. Quantify impact of enhanced demand for labor & service from local communities.
   iii. 3rd party Quantification of in-direct economic impacts relative to out-of-territory renewable generation.

d. **Commercial Viability:**
   i. Demonstrate market competitiveness via executed PPA & project financing via equity & debt markets.

APPENDIX A: PROJECT EXPERIENCE & TEAM MEMBER BIO's

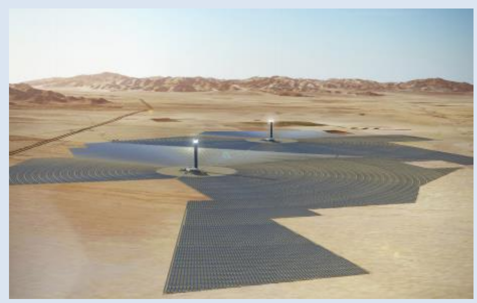
Charles Turlinski – President
15+ years in wind and solar renewable energy market. Developed 800MW of operational projects with Horizon Wind Energy, EDPR & BrightSource Energy. Deep experience with corporate fundraising and project finance. MBA from MIT

Gordon Dash – Project Management
15 years energy industry experience. >1GW of wind energy projects through development & construction with Horizon Wind & TerraGen. Licensed Civil Engineer. Masters from UNC.

Neil Storey – Development
20+ years of technical (GIS, CAD, etc,) expertise and 15 years of development experience. Neil's unique skill-set has been applied to innovating proprietary suites of development intelligence tools for worldclass engineering and development firms.

Scott Galatti – Project Counsel & Permitting
20 years energy development experience with >8 GW of operating assets completed throughout CA with Caithness Energy.

Project	Description	
Marble River Wind Farm Size: 230 MW Technology: Wind Energy Location: Ellenburg, NY COD: 2010 Owner: Horizon Wind Energy	Led the early-stage development of the project through project financing, EPC negotiation and commencement of construction.	
Grand Bahama Dispatchable Hybrid Size: 15 MW Technology: Wind/Solar/Storage Location: Grand Bahama, Bahamas COD: 2019 Owner: Emera	Lead developer of utility-scale solar/wind & storage generator optimized to deliver below-market rate firm energy for Grand Bahama Power Authority.	

CA Solar Portfolio Size: 55 MW Technology: Solar PV Location: CAISO COD: 2016 Owner: EDP Renovaveis	Led the early-stage and mid-stage development process concluding with a commercial transaction with a reputable 3rd party owner operator.	
Ivanpah SEGS Size: 370 MW Solar Technology: Concentrated Solar Thermal Power Tower Location: Ivanpah, CA COD: 2014 Owner: BrightSource Energy	Ivanpah SEGS is the first of its kind utility-scale solar power tower. Ivanpah is currently the largest operating CSP solar facility in the world.	
Palen SEGS Size: 500 MW Solar Technology: Concentrated Solar Thermal Power Tower Location: Riverside County, California COD: 2017 (on-going) Owner: BrightSource Energy	Successfully oversaw the 5 year development process and project financing of the largest proposed solar thermal facility in the world.	
Saipan Solar PV w/Storage Size: 20 MW with integrated storage (ESS) Technology: Solar PV Location: Saipan Commonwealth of Northern Marianas Islands (CNMI) COD: 2017 (delayed) Owner: FIRM clean energy	Led the early-stage development and successful commercial negotiation to achieve 'short-listed' status as a preferred supplier of large-scale solar generation.	

KIUC (Kauai) Solar PV w/ Storage Size: 5 MW PV w/5 MWhrs ESS Technology: Solar PV & integrated Redox flow battery (ESS) Location: Kauai, Hawaii COD: TBD Owner: FIRM clean energy	FIRM clean energy led innovative bid submission and subsequent commercial negotiation with KIUC to develop, own & operate an integrated PV generation and storage facility designed to enable KIUC to shift peak solar generation to supplement evening ramping (as a means to displace evening oil-fired generation with solar energy.	

MUNI CO-LO Distributed Uses

Water Towers	1-7 acres	.2-1 mw
Radio Towers		1-2.5 mw
Transmission RoW	1000 ft linear (@ 12.5 ft per side) = 1/2 acre	500 kW
Railroad & Highway Buffe	1000 ft linear (@ 12.5 ft per side) = 1/2 acre	500 kW

REGULAR MEETING of the Citizens Advisory Committee
of the Peninsula Clean Energy Authority (PCEA)
Thursday, August 16, 2018
MINUTES

2075 Woodside Road, Redwood City, CA 94061
6:30 p.m.

CALL TO ORDER

Meeting was called to order at 6:31 pm.

ROLL CALL

Present:	Michael Closson, Menlo Park, *Chair* Janet Creech, Millbrae Joe Fullerton, Half Moon Bay Emily Leslie, Pacifica Landis Marttila, Works in San Mateo County Walter Melville, San Bruno Jason Mendelson, Redwood City Desiree Thayer, Burlingame
Absent:	Ted Howard, San Mateo, *Vice Chair* Diane Bailey, Belmont Gladwyn D'Souza, Belmont Scott Harmon, Portola Valley Janelle London, Menlo Park Cheryl McGovern, Unincorporated James Ruigomez, San Bruno
Staff:	Kirsten Andrews-Schwind, Communications and Outreach Manager Rafael Reyes, Director of Energy Programs Alejandra Posada, Energy Programs Associate Anne Bartoletti, Board Clerk/Executive Assistant to the CEO Jennifer Stalzer Kraske, Deputy Counsel

A quorum was established.

PUBLIC COMMENT

No public comment.

ACTION TO SET THE AGENDA AND APPROVE CONSENT AGENDA

Motion Made / Seconded: Leslie / Creech

Motion passed 8-0 (Absent: Howard, Bailey, D'Souza, Harmon, London, McGovern, Ruigomez)

REGULAR AGENDA

1. **Chair Report**

   Michael Closson, *Chair*, reported that Rafael Reyes would be one of the speakers in a webinar on DER (Distributed Energy Resources) and Local Programs, being presented by the Center for Climate Protection on August 22, 2018 at 11:00 a.m.

2. **Outreach Report**

   Kirsten Andrews-Schwind, *Communications & Outreach Manager*, reported on upcoming and recent community outreach events, and thanked Citizens Advisory Committee (CAC) members for their participation and support.

3. **Review of Community Pilot Energy Program Abstracts**

   Rafael Reyes, *Director of Energy Programs*, provided an update on the status of Local Programs, and announced the promotion of Alejandra Posada to the position of Energy Programs Associate, and the hiring of Sven Thesen as Clean Energy Programs Manager starting September 24, 2018.

   Rafael presented the Community Pilots Objectives and Submissions, the screening schedule, screening criteria, and proposed criteria for first cut eliminations. CAC members reviewed 37 Community Pilots Proposal Abstracts and discussed the pros and cons of the proposals.

4. **Local Program Outreach Contact Strategy**

   Rafael Reyes asked Committee members to review their community organizations and contacts to identify key local program stakeholders with whom PCE should engage. The Committee plans to discuss this topic further at the October meeting.

5. **Procurement Report**

   Kirsten Andrews-Schwind announced the groundbreaking for the Wright Solar Park project will take place on October 11, 2018, in Los Banos, Merced County.

6. **Regulatory and Legislative Update**

   Kirsten Andrews-Schwind reported that a judge for the docket issued a Proposed Decision (PD) on PCIA (Power Charge Indifference Adjustment), and that one of the Commissioners on the CPUC (California Public Utilities Commission) issued an

Alternate Proposed Decision (APD). Kirsten reported that both the PD and APD are being reviewed by PCE and the other CCAs (Community Choice Aggregator).

7. **Committee Members' Reports**

   Janet Creech reported that she visited Scott Harmon's Boy Scouts Sustainability Camp at TomKat Ranch.

8. **Selection of new Vice Chair**

   Michael Closson reported that Ted Howard has resigned as Vice Chair and has resigned from the CAC. He requested nominations for Vice Chair. Joe Fullerton nominated Emily Leslie, and Emily expressed interest.

<u>Motion Made / Seconded:</u> Fullerton / Marttila

Motion passed 8-0 (Absent: Howard, Bailey, D'Souza, Harmon, London, McGovern, Ruigomez)

9. **Review Draft Board Agenda for August 23, 2018 Meeting**

   Kirsten Andrews-Schwind reported that the draft agenda for the upcoming August 23, 2018, Board of Directors meeting was revised after the CAC Agenda Packet had been sent out. She reported that a new format was being introduced that would move the monthly departmental reports to the Consent Agenda as "Information Only".

ADJOURNMENT

Meeting was adjourned at 8:24 pm.