# DOES GRID ALTERNATIVES CONTRIBUTE TO GREENHOUSE GAS EMISSIONS REDUCTION TARGETS IN CENTRAL COAST CLIMATE ACTION PLANS?

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# ABSTRACT

## Does GRID Alternatives Contribute to Greenhouse Gas Emissions Reduction Targets in Central Coast Climate Action Plans?

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As of March 2016, GRID Alternatives' 179 solar electric system installations on low-income housing contributed 103 metric tons of carbon (MT $CO_2e$) emissions reduction for the climate action plans' *Energy* or *Renewable Energy* c*limate action measures* that pertain to solar electric installations in the cities of: Arroyo Grande, Atascadero, Paso Robles, and San Luis Obispo and San Luis Obispo County.

In 2007, The San Luis Obispo County Air Pollution Control District (APCD) created a team of government agencies to design climate action plans (CAP) that met the emission reduction goals set out by AB 32 and the 2008 Climate Change Scoping Plan (Rincon Consultants, 2014, p. 1-2).

Each CAP outlines its greenhouse gas (GHG) baseline emissions and GHG emissions reduction targets in metric tons of carbon (MT $CO_2e$) and identifies *climate action measures* to reach GHG emissions reduction targets. The *climate action measure* that pertains to *Energy or Renewable Energy,* specifically solar electric system installations, is examined in this study.

GRID Alternatives, a non-profit solar installer that implements its Solar Affordable Housing Program, was selected by the California Public Utilities Commission (CPUC) in 2008, to serve as the statewide program manager for the California Solar Initiative's $108 million incentive program called the Single-family Affordable Solar Homes (SASH) program, which is the country's first dedicated solar rebate program for low-income families (GRID, 2016a, p. 2). In 2010, GRID Alternatives opened its Central Coast office in Atascadero to serve five central coast counties and tracks $CO_2$ emission reductions for each installation.

My objective is to determine the impact that GRID Alternatives' solar electric installations in the cities of Arroyo Grande, Atascadero, Paso Robles, and San Luis Obispo and in San Luis Obispo County have on their respective CAPs' GHG emissions reduction targets for the *Energy* or *Renewable Energy climate action measure* that pertains to solar electric installations.



Keywords: Solar electric installations, low-income, GRID Alternatives, Single family Solar Affordable Home Program (SASH), carbon emission reductions, climate action plans, central coast, California, MT $CO_2e$, energy, AB 32, greenhouse gas emissions (GHG), non-profit solar installer

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## 1. INTRODUCTION

In this study I examine how GRID Alternatives' solar electric installations on low-income housing in the Central Coast impact greenhouse gas (GHG) emissions reductions targets set by local climate action plans. In each climate action plan (CAP) there are *climate action measures* that pertain to the focus area of "Energy" or "Renewable Energy" within each CAP. The c*limate action measures* that discuss solar electric installations have specific corresponding greenhouse gas (GHG) emissions "reduction goals" measured in MT $CO_2e$. This report will determine how the installation of solar electric systems on low-income housing units contributes to the CAPs' GHG emissions reduction goals set by the c*limate action measure* that pertains to solar electric installations in the Cities of Arroyo Grande, Atascadero, Paso Robles, and San Luis Obispo and in San Luis Obispo County. Only these five CAPs will be analyzed because that is where GRID Alternatives has completed installations, however the analysis is scalable for other service areas. As of March 2016, GRID Alternatives has installed 179 solar electric systems in the areas of the Central Coast described in Table 1.

**Table 1. GRID Alternatives' Central Coast Completed Installations as of March 2016**

| Jurisdiction | Number of Completed Installations |
|---|---|
| City of Arroyo Grande | 12 |
| City of Atascadero | 19 |
| City of Paso Robles | 18 |
| City of San Luis Obispo | 14 |
| San Luis Obispo County | 116 |
| **Total** | **179** |

## WHAT IS A CLIMATE ACTION PLAN?

A climate action plan (CAP) is a long-range policy document that identifies how a community can accomplish its greenhouse gas (GHG) emissions reduction targets from community activities and government operations and also prepare for the effects of climate change (San Luis Obispo County, 2016, 1st ¶). It is a document that lays out goals and strategies for achieving GHG emissions reduction targets set by The California Global Warming Solution Act of 2006, also known as AB 32, and the 2008 Climate Action Scoping Plan.

AB 32 required California to reduce its GHG emissions to 1990 levels by 2020 (California Air Resources Board, 2014). AB 32 is an innovative law that addresses global warming and sets the framework to achieve GHG emissions reduction goals. One of the key requirements of AB 32 directed the California Air Resources Board (CARB) to create a Climate Change Scoping Plan (City of San Luis Obispo (with Cal Poly Climate Team and PMC), 2012, p.8). In 2008, CARB acting as the lead agency for implementing AB 32 GHG emissions reduction measures, created a Climate Change Scoping Plan that guided the creation of an inventory of historic GHG emissions, established GHG reporting requirements, and set the 2020 GHG emissions limit. (California Air Resources Board [CARB], 2008, ES-1).

The 2008 Climate Change Scoping Plan (2008 Plan) addresses anthropogenic climate change and highly encourages local government agencies to commit to reducing their GHG emissions to 1990 levels by 2020, consistent

with AB 32 emissions reduction goals (CARB, 2008, ES-1). The 2008 Plan highlights how a policy can motivate local governments to garner community input and begin to positively affect GHG emission reductions.

Climate action plans emissions reduction targets also have numerous community wide co-benefits. For example, CAPs will help communities lower energy costs, reduce air pollution, support local economic development, and improve public health and quality of life (San Luis Obispo County Air Pollution Control District, 2016).

**WHAT IS THE PURPOSE OF A CLIMATE ACTION PLAN?**

Each CAP is designed to meet GHG emissions targets prescribed in AB 32 and the 2008 Climate Change Scoping Plan. Accordingly climate action plans identify a community's sources of emissions, quantifies its emission baseline numbers for 2005 in metric tons of carbon emission (MT $CO_2e$), outlines its business-as-usual and its adjusted business-as-usual GHG emissions forecasts, and develops its corresponding GHG emissions reduction targets (Rincon, 2014, p. 1-2). The CAPs also create a list of *climate action measures* that have *focus areas* designed to meet the GHG emissions reduction targets. Each jurisdiction selects focus areas that are most appropriate for its region and may include government operations, energy, buildings, transportation and land use, off-road, water, solid waste and tree planting, parks and open space (Rincon, 2014, p. 1-2; City of San Luis Obispo (with Cal Poly Climate Team and PMC [City of SLO]), 2012, p. 2). Each CAP also creates adaption measures, implementation actions,

and monitoring procedures, which are consistent with the reduction goals stated in AB 32 to assess and track if their GHG emissions targets are actually being met (Rincon, 2014, p. 1-2).

Climate action plans ultimately identify "strategies to guide the development and implementation" of climate action measures that quantify the emissions reductions resulting from these strategies (City of SLO, 2012, p. 1). These climate action measures improve a jurisdiction's ability to address the potential impacts that climate change has on its residents as well as identify co-benefits beyond just GHG emissions like "quality of life improvements for the community, potential energy cost savings for residents and businesses, and protection of the environment for future generations" (City of SLO, 2012, p. 1).

**WHAT DO CLIMATE ACTION PLANS DO LOCALLY?**

Seven local cities and San Luis Obispo County have created CAPs as listed in Table 2, to meet the GHG emissions reduction goals set out by AB 32 and the 2008 Climate Change Scoping Plan and are currently being implemented (San Luis Obispo County Air Pollution Control District [SLOAPCD], 2016). Locally the CAPs "incorporate best practices with public input to produce a blueprint for achieving greenhouse gas emissions reductions in the unincorporated towns and rural areas of San Luis Obispo County" and its seven cities (San Luis Obispo County, 2016, 1st ¶). The climate action plans create emission reduction *targets* and climate action emission reduction *measures* that can be implemented to reduce the regions' contribution of anthropomorphic

greenhouse gases (GHG) emissions while also supporting economic growth and generating a variety of co-benefits (San Luis Obispo County [SLO County], 2016, 3rd ¶). The climate action plans implement these *targets* and *measures* through a variety of programs and incorporate public input to feature the most effective GHG emissions reductions climate action measures tailored for this region (SLO County, 2016, 3rd and 5th ¶).

The climate action plans also describe three different GHG emission scenarios: (1) a baseline emission scenario, (2) a business-as-usual projection of emissions scenario, and (3) an adjusted business-as-usual forecast of emissions scenario after implementation of the CAP's climate action measures (SLO County, 2016, 4th ¶). They also quantify the GHG emissions reduction targets that will comply with the state recommendation per AB 32 to reduce emissions to 1990 levels by 2020. Each climate action plan concludes with a section on how to adopt, implement and monitor the progress of GHG emissions reduction targets.

Locally, the San Luis Obispo County Air Pollution Control District (APCD) created a team of government agencies that met beginning in 2007 to implement GHG emissions reduction targets (Rincon Consultants, 2014, p. 1-2). As a result of these meetings climate action plans were developed for the seven cities and San Luis Obispo County with assistance from one of the following consultants: Rincon Consultants, Inc., PMC, or the consultant team of the City of San Luis Obispo, Cal Poly Climate Team, and PMC, as listed in Table 2.

**Table 2. Climate Action Plans in San Luis Obispo County by Preparers and Adoption Date**

| Jurisdiction | Prepared by | Adopted | In this Study |
|---|---|---|---|
| City of Arroyo Grande CAP | Rincon Consultants, Inc. | November 26, 2013 | Yes |
| City of Atascadero CAP | Rincon Consultants, Inc. | January 28, 2014 | Yes |
| City of Grover Beach CAP | Rincon Consultants, Inc. | September 15, 2014 | No |
| City of Morro Bay CAP | Rincon Consultants, Inc. | January 14, 2014 | No |
| City of Paso Robles CAP | Rincon Consultants, Inc. | November 19, 2013 | Yes |
| City of Pismo Beach CAP | Rincon Consultants, Inc. | May 2014 | No |
| City of San Luis Obispo CAP | City of San Luis Obispo, Cal Poly Climate Team, and PMC | August 2012 | Yes |
| San Luis Obispo County EnergyWise Plan | PMC | November 2011 | Yes |

Rincon Consultants created a *San Luis Obispo Regional Climate Action Plan* on behalf of the APCD that included the Cities of Arroyo Grande, Atascadero, Grover Beach, Morro Bay, Paso Robles, and Pismo Beach (Rincon Consultants [Rincon], 2014, p. 1-2). Whereas the City of San Luis Obispo created its own climate action plan with the help of PMC and the Cal Poly Climate Team from the City & Regional Planning Department, and San Luis Obispo County created its own plan called the *EnergyWise* Plan with the help of PMC (Rincon, 2014, p. 1-2). Table 2 also identifies which climate action plans are in this study. Some CAPs were not included in this study because GRID Alternatives did not complete installations in all seven cities within San Luis Obispo County.

In the fall of 2010, GRID Alternatives, a non-profit solar installer, opened its Central Coast office in Atascadero to serve five central coast counties: Santa Cruz, Monterey, San Benito, San Luis Obispo, and Santa Barbara Counties. GRID Alternatives tracks several data points for each solar electric installation.

One data point that it measures and calculates is GHG emissions reduction achieved by each installed system. My objective is to determine the impact that GRID Alternatives' low-income housing solar electric installations in the cities of Arroyo Grande, Atascadero, Paso Robles, and San Luis Obispo and in San Luis Obispo County has on their respective *climate action measures'* GHG emissions reduction targets that pertain to solar electric installations. The climate action measures that address potential GHG emissions reduction of solar electric installations can be found in either the *Climate Action Measures, Renewable Energy or Community-Wide GHG Reduction Measures,* chapters of each respective climate action plan.

## 2. WHAT IS GRID ALTERNATIVES?

### FOUNDING GRID ALTERNATIVES: HISTORY AND BACKGROUND

Erica Mackie, P.E., and Tim Sears, P.E. founded GRID Alternatives in 2001. They wanted to peruse an ideal that "free, clean electricity from the sun should be available to everyone" (GRID Alternatives, 2015a). GRID Alternatives, a non-profit solar installer, was born to turn this ideal into a reality. In 2003, they quit their day jobs and began to implement a model called the "Solar Affordable Housing Program, GRID Alternatives' core program" (GRID Alternatives [GRID], 2015a). This core program makes photovoltaic technology practical and accessible for low-income communities.

From their experience as engineers installing solar electric systems in the private sector, Erica and Tim knew that low-income communities were not only the least likely to benefit from this technology, they were also the least likely to have access to it. GRID Alternatives changed this paradigm with the Solar Affordable Housing Program. The Solar Affordable Housing Program means GRID Alternatives is able to "provide low-to-no cost photovoltaic systems to families that qualify as low-income, and installs these systems with teams of volunteers and job trainees that gain hands-on experience they can use to get jobs in the growing solar industry" (GRID, 2015b).

Each installation has a triple impact: energy cost savings; a classroom in the field for job trainees that supports local employment and the growing solar

industry; and a reduction in greenhouse gas emissions that helps local governments reach their climate action plan GHG emissions reduction targets (GRID, 2015b). There are an estimated 20 million low-income, owner-occupied single-family homes in the United States, so there is a known opportunity for these communities to benefit from renewable energy (GRID, 2015b).

## How Does It Work? Solar Affordable Housing Program in San Luis Obispo County

GRID Alternatives implements the Solar Affordable Housing Program through a community outreach process that culminates in the installation of a solar electric system. The California Solar Initiative's Single-family Affordable Solar Homes (SASH) incentive program is modeled after GRID Alternatives Solar Affordable Housing Program. GRID Alternatives is the statewide program manager for the SASH incentive program. The community outreach process discussed in the following paragraphs explains the step-by-step process of how GRID Alternatives implements the SASH incentive program. The process begins with community outreach, then outreach site visits and energy efficiency audits. This is followed by construction site visits and contract site visits that lead into Salesforce data entry and design, which culminates with an installation. Installations occur as a two-day volunteer experience, or a Solarthon one-day long "barn raising" event. All installations are completed with follow-up site visits.

## COMMUNITY OUTREACH

GRID Alternatives staff collaborates with affordable housing partners like People's Self-Help Housing, Habitat for Humanity, the City of San Luis Obispo, the City of Arroyo Grande, the City of Paso Robles, and San Luis Obispo County to identify potential low-income housing clients. Once a low-income housing development or tract of housing is identified, mailers are sent out to announce a GRID Alternatives informational meeting were families are asked to bring a copy of their utility bill (to size their solar electric system), their homeowners insurance declaration page (to verify homeownership), and a copy of their most currently filed taxes (to verify income and household size). The partnership with People's Self-Help Housing for example culminated in wide spread low-income solar installations like the one photographed in Figure 1 and demonstrates how the Solar Affordable Housing Program can provide solar power for an entire single-family home development by implementing SASH. The Templeton, CA People's Self-Help Housing development pictured in Figure 1 powered up with renewable energy during GRID Alternatives' Central Coast first Solarthon in 2011.

**Figure 1. People's Self Help Housing Development in Templeton, CA powers up with the Solar Affordable Housing Program during GRID Alternatives' Central Coast's first Solarthon in 2011. Source, Author.**

Together with low-income housing partners, cities, agencies and San Luis Obispo County, GRID Alternatives has co-hosted informational meetings in town halls, libraries, community centers, and in individual family member's homes for the past five years. This community outreach effort was able to qualify 179 families for the SASH program from 2010 to 2016. I completed the outreach process for 85 of the installations from 2010 to 2012, and the remaining 94 installations were completed over the next four years by 3 other outreach staff.

At outreach meetings GRID Alternatives staff gives a presentation that briefly introduces who GRID Alternatives is, who it serves, what GRID Alternatives does and how it is able to do it, and why GRID Alternatives does the work it does. Then GRID Alternatives staff briefly explains solar technology and how it works, discusses some statistics on climate change and GHGs, and then indentifies the qualifications of the California Solar Initiative's Single-family Affordable Solar Homes (SASH) program.

To qualify for the SASH program a person must be a homeowner that meets the CPUC's "Public Utilities Code Section 2852" definition of low income housing (having a deed restricted property), receive power from one of the participating investor owned utilities (PG&E, SCE, or SDG&E), and prove that their income is 80% area median income (AMI) or below (GRID, 2016a, pp. 1-3). There are several hundred low-income homeowners in San Luis Obispo County however only 179 families qualify for the narrow definition of a deed restricted property as defined by the SASH program. The CPUC created a very strict

definition of what constitutes a low-income single-family residential unit in order to ensure that the solar electric installations completed by GRID Alternatives were made in the low-income housing community and stayed in the low-income housing community. The intention behind this definition was to ensure that low-income families whom are least likely to benefit from solar electric technology now could participate in the nation's first "comprehensive low-income solar program" (GRID, 2016a, p. 2).

### Outreach Site Visits and Energy Efficiency Audit Software

After a community meeting is held, participants that possibly qualify for the SASH program sign up for the first outreach site visit at their home where an energy efficiency audit is conducted. The information collected from the energy efficiency audit is entered into a software program called *Home Energy Saver* created by the Lawrence Berkeley National Laboratory. If the home qualifies for energy efficiency upgrade, then a local low-income weatherization program, like Community Action Partnership of San Luis Obispo County, is notified to service the home. It also provides a time to go over any questions or concerns a family has in a more private setting and allows more time to discuss the importance of energy efficiency despite qualifying for a solar electric system.

### Construction Site Visits

Construction staff then schedules a site visit to take measurements of the individual's home and identify the best location for the design and eventual installation of the solar electric system. Construction staff takes measurements

with a SOLMETRIC SunEye and photo documents the site. Back at the office construction staff sizes the system according to 12-month PG&E usage and designs the system using SketchUp software. Once the system is designed the system components can be ordered and/or prepared for installation.

### CONTRACT SITE VISITS

Once it is confirmed that a family qualifies for the SASH program during the first outreach site visit, a second outreach site visit is scheduled to sign a contract with GRID Alternatives. This is scheduled after the solar electric system design is complete and the construction permit is pulled at the city or county planning department by either outreach or construction staff. The contract site visit is a time to collect any remaining paper work that was not provided during the community meeting or during the first outreach site visit. At this time the results of the energy efficiency audit are also shared with the family and they are notified if they qualify for and energy efficiency upgrade or not. Most often families do qualify for some sort of energy efficiency upgrade, and therefore makes the installation that much more capable of GHG emissions reductions.

### SALESFORCE SOFTWARE

The information collected during the first community meeting and the subsequent outreach site visits is entered into a software program called Salesforce. This software tracks income, household size, system components and size, as well as GHG emissions reductions and savings for the families for

the 25-year system life span.  It allows outreach staff to manage the outreach process and is a platform for the construction staff to tract system components.

### INSTALLATION

Installations are typically a two-day event where, trained volunteers and job trainees gather to install solar electric panels in a barn raising fashion with and for, a homeowner that qualifies for the SASH program. GRID Alternatives construction staff and team leaders (roof team and ground team) guide every step of the installation. In Figure 2, Danny from the Center for Employment Training on the roof team installs solar electric panels in Atascadero, CA.

**Figure 2.  Danny, a job trainee from Center for Employment Training installs solar electric panels in Atascadero, CA, (GRID, 2014).**

All volunteers are encouraged to partake in all aspects of the installation. The homeowner (if they choose/are able), trained volunteers and job trainees have the opportunity to participate in every step of the installation. Anyone can bend and mount conduit, build and cut rails, mount and wirie solar electric

panels, and install the inverter. GRID Alternatives essentially becomes a classroom in the field that gives homeowners, job trainees and community members the chance to touch and feel renewable energy and see the impact of their work immediately.

### FOLLOW-UP SITE VISITS

Outreach staff conducts a third and final outreach site visit after PG&E interconnects with the homeowner. At this meeting outreach staff reviews the operation and maintenance of the solar electric system and discusses the warranties of the panels, inverter and of the work performed by GRID Alternatives. PG&E's TrueUp bill is also explained in detail so that the homeowner can determine if they would prefer the energy credit or cash out credit for the renewable power they generate.

### SOLARTHON

Once a year, each regional office hosts a Solarthon. Solarthon is GRID Alternatives' flagship community installation one-day long event. It is a fundraiser and solar block party that brings together individual fundraisers, corporate sponsors, job trainees, community leaders and the homeowners themselves, to install multiple solar electric systems in one neighborhood, in one day (GRID, 2016c). Several solar electric systems in Templeton, Oceano and Atascadero were installed using a Solarthon model. Figure 3 is the group photograph of GRID Alternatives' Central Coast Solarthon 2012, in Oceano, CA that brought together Peoples Self-Help Housing homeowners (in green shirts), job trainees

from Center for Employment Training, corporate sponsors like Wells Fargo, and the support of local and state government officials like State Assemblyman Katcho Achadjian (first person in second row on the right) and Congresswoman Lois Caps (not pictured) (GRID, 2012a).


**Figure 3. GRID Alternatives' Central Coast Solarthon 2012 in Oceano, CA brought together job trainees, corporate sponsors and the support of local and state government officials (GRID, 2012a).**

Sponsoring and participating in Solarthon helps GRID Alternatives meet its mission to provide clean, affordable energy and hands-on solar installation experience to families and job trainees that need it most. Participants and volunteers get hands-on experience installing solar electric systems for local families, and at the same time have the opportunity to network with other solar enthusiasts and solar installation companies. It is a venue that is educational, inspirational, and fun.

Solarthon likewise is a venue that showcases how government policies can generate multifaceted positive impacts and provides opportunities for government officials to demonstrate their support of policies that benefit their constituents. In Figure 4, Congresswoman Lois Capps meets with the Gomez

family whose installation is sponsored by SunRun at GRID Alternatives Central Coast Solarthon 2015.


**Figure 4. Congresswoman Lois Capps (first row, far right) visits the Gomez family (first row in green shirts) while Corporate Sponsor, Sun Run (on roof top), installs a solar electric system during GRID Alternatives' Central Coast Solarthon 2015 (GRID, 2015h).**

For corporate sponsors the event is an opportunity to demonstrate their commitment to environmental and community sustainability. It provides corporations with a non-traditional form of team building, while also contributing to local GHG emission reductions and learning a new skill. Solarthon is a one-day long event where everyone involved makes difference in their community.

## FUNDING: HOW IS GRID ALTERNATIVES FUNDED?

GRID Alternatives is funded by the Single-family Affordable Solar Homes (SASH) incentive program, a third party ownership model, Cap and Trade

revenue, and other sources of funding that range from corporate sponsorships to individual donors.

### SASH 1.0, SASH 2.0 AND TPO

After five years of fine-tuning the Solar Affordable Housing Program, GRID Alternatives was selected by the California Public Utilities Commission (CPUC) in 2008, to serve as the statewide program manager for its $108 million SASH incentive program, the country's first dedicated solar rebate program for low-income families (GRID, 2016a, p. 2). The SASH Program originated with California Assembly Bill 2723, which directed that a minimum of 10% of California Solar Initiative (CSI) funds be set aside for programs assisting low-income households in accessing solar technology (GRID, 2016a, p. 2).

SASH, one of two targeted low-income incentive programs that resulted from the CSI, provides significant rebates on solar electric systems to qualifying single-family homeowners in the Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E) service territories (GRID, 2016a, p. 2). Over eighteen thousand low-income California homeowners have gone solar with the help of GRID Alternatives under this groundbreaking initiative in partnership with these California utilities, while also integrating workforce development into every installation by training over twenty-six thousand volunteers (GRID, 2016a, p. 2).

Assembly Bill 217 (Bradford, 2013) extended the SASH Program and its sister program, the Multi-family Affordable Solar Housing (MASH) Program, from

their scheduled sunsets in 2016 (GRID, 2016a, p. 3). The original SASH allocation of $108 million is referred to as “SASH 1.0” and the reauthorized SASH program with $54 million in additional funding is referred to as “SASH 2.0” and “will operate either until December 31, 2021, or when all funds available from the program’s incentive budget have been encumbered, whichever event occurs first” (GRID, 2016a, p. 3).

“Resolution E-4719, approved June 25th, 2015 by the [CPUC], allows for a unique third-party ownership (TPO) model in SASH 2.0 under AB 217’s funding” (GRID, 2016a, p. 3). The TPO model was “deliberately designed to maximize household savings and include consumer protection measures” (GRID, 2016a, p. 3). Spruce, GRID Alternatives’ third-party ownership provider, allows GRID Alternatives to “bring Federal Investment Tax Credit (ITC) financing to SASH 2.0 projects, and participating families receive a performance guarantee, monitoring and a 20 year warranty coverage” (GRID, 2016a, p. 7).

### CAP AND TRADE

California Department of Community Services and Development (CSD) works with “community partners statewide to install rooftop solar photovoltaic systems and solar water heaters on low-income households and buildings in disadvantaged communities to reduce GHGs and save energy,” and provides these services through the CSD's “Low Income Weatherization Program” (California Department of Community Services, 2015).

Authorized by AB 32, the Cap and Trade program is one of many programs used in California to reduce GHG emissions (California Department of Community Services [CSD], 2015). Funds received from the program are deposited into the Greenhouse Gas Reduction Fund (GGRF) and appropriated by the Legislature and "must be used for programs that further reduce emissions of greenhouse gases" (CSD, 2015). GGRFs are administered by state and local agencies for a variety of GHG emissions reduction programs. "Guidelines written by the Air Resources Board help these agencies develop programs that meet statutory requirements for reducing emissions while maximizing the benefits to disadvantaged communities" (CSD, 2015).

California's 2015-16 State Budget provided $78 million in proceeds from the Cap and Trade auctions conducted quarterly by the CARB and maintained in the GGRF for the CSD's Low Income Weatherization Program (CSD, 2015).

> "In 2012, the Legislature passed Senate Bill 535 (De León) directing that, in addition to reducing greenhouse gas emissions, a quarter of the proceeds from the Greenhouse Gas Reduction Fund must also go to projects that provide a benefit to disadvantaged communities. A minimum of 10% the funds must be for projects located within those communities. The legislation gives the CalEPA responsibility for identifying those communities" (CSD, 2015).

In October 2014, following a series of public workshops, CalEPA released its list of disadvantaged communities and relied on the California Communities Environmental Health Screening Tool (CalEnvrioScreen 2.0) to assesses all census tracts in California and identify areas disproportionately burdened by and vulnerable to multiple sources of pollution (CSD, 2015).

GRID Alternative's Central Coast San Luis Obispo County clients do not qualify for this Cap and Trade funding because Central Coast air quality is relatively good and this region is not listed as a disadvantaged community per the requirements in SB 535.

**OTHER SOURCES OF FUNDING**

In addition to the resent SASH 2.0 incentive program, GRID Alternatives is also funded by contributions from local government agencies, foundations, corporate sponsorships, in kind donations and individuals. Homeowners also "pay" in the form of sweat equity for the installations. In Figure 5 Oceano, CA homeowner Marco Figueroa said, "Today is a very special day for me, my family, and the environment," at GRID Alternatives' Central Coast Solarthon 2012.

**Figure 5. Homeowner Marco Figueroa at GRID Alternatives' Central Coast Solarthon 2012 (GRID, 2012b).**

Marco Figueroa concluded, "I don't have words to express how grateful I am for this opportunity" (GRID, 2012b). Homeowners participate with the actual installation of their system in whatever way possible, from providing meals for the volunteers and job trainees during the installation, to getting up on their own roof and running wire and laying down rail. Some families even become "solar champions" and help with the outreach process by hosting informational meetings in their homes or become a point of contact for the community that keeps their neighbors abreast of GRID Alternatives progress in their neighborhood.

Also if there is a funding gap for a project GRID Alternatives helps low-income homeowners with additional community based fundraising to make the installation possible. By the end of an installation a family not only understands how their system works, but they are also reinvesting in their community and revive their neighborhood connections.

**WHERE WILL GRID ALTERNATIVES GO NEXT? EXPANSION**

GRID Alternatives core program, Solar Affordable Housing Program, has scaled to a both national and international level. Since 2010 GRID Alternatives has also worked with tribal nations in Arizona, South Dakota and California (GRID, 2015c). In 2012, GRID Alternatives launched a national expansion with support from Wells Fargo. In fall 2012, the Colorado office was opened in Denver and is piloting the first community solar project exclusively dedicate to subscribers that qualify as low-income that will serve 6 to 10 families and

generate 25kW from a ground mounted array (GRID, 2015d). In 2013, the New York Tri State office was opened in Bronx, New York as GRID Alternatives' first east coast affiliate office and serves families in New York, New Jersey and Connecticut (GRID, 2015e).

In February 2014, Power to the People's founder Jean Smith merged with GRID Alternatives to become Director of GRID Alternatives International Program. Power to the People as has installed photovoltaic systems in Nicaragua since 2008 using a volun-tourism model (GRID, 2015f). "GRID Alternatives' long-term goal is to bring solar to underserved communities all over the world and joining forces with Power to the People is a concrete step in that direction" (GRID, 2015f).

In the fall of 2014, the GRID Alternatives' Mid-Atlantic office was opened in Washington, D.C. as a part of a five-year, $2 million commitment from the Wells Fargo Foundation to help GRID Alternatives continue to expand nationally (GRID, 2015g).

GRID Alternatives is a gateway to large-scale solar adoption nationwide. It has created a real-world solution to a real-world economic problem in low-income communities and turns an environmental good into a three-pronged solution.

# 3. REVIEW OF CITIES AND COUNTY CLIMATE ACTION PLANS

## BACKGROUND

The cities of Atascadero, Arroyo Grande, Grover Beach, Morro Bay, Paso Robles, Pismo Beach and San Luis Obispo and San Luis Obispo County gathered beginning in 2007, to discuss climate change with the guidance of the San Luis Obispo County Air Pollution Control District (APCD) (Rincon Consultants, 2014, pp.1-2). During this convening the following topics were discussed: science, policy, funding, mitigation, adaptation and public engagement (Rincon Consultants [Rincon], 2014, pp.1-2). "The APCD coordinated the GHG emission inventories for each of the jurisdictions" enabling them to begin the process of preparing their respective climate action plans (CAP) (Rincon, 2014, pp.1-2).

After securing federal stimulus funds to develop their climate action plans, San Luis Obispo County adopted its "*EnergyWise* Plan" in November of 2011, and the city of San Luis Obispo adopted its CAP in July of 2012 (Rincon, 2014, pp.1-3). The remaining cities collaborated with the APCD to fund their six individual CAPs through APCD's mitigation grant funding, Pacific Gas & Electric Company (PG&E) Green Communities Program (City of Paso Robles was funded this way), and Southern California Gas Company (SoCalGas) (Rincon, 2014, pp.1-3).

City and County staff, consultants, Cal Poly City and Regional Planning professors and graduate students, elected officials, and members of the community participated in extensive public outreach program, community workshops, Planning Commission meetings, City Council meetings, Board of Supervisor meetings, as well as a virtual town hall meeting to gather public comment, input and ideas regarding the respective CAPs (Rincon, 2014, pp.1-3).

All CAPs reference the science behind global climate change, its causes, and its implications. They also discuss a list of several state regulatory legislation and policies, as well as outline GHG emissions and reduction targets by identifying GHG emission sources, and quantifying GHG emission baseline numbers. Each CAP also discusses *climate action measures* as focus areas like *energy* (Rincon, 2014, pp.1-2). All CAPs conclude with adaption measures, implementation actions and monitoring procedures that are consistent with the reduction goals stated in AB 32 (Rincon, 2014, p.1-2).

Only the CAPs for the cities of Arroyo Grande, Atascadero, Paso Robles, San Luis Obispo and San Luis Obispo County were analyzed in this report because this is where GRID Alternatives has completed solar electric installations. I reviewed each CAPs' chapter titled *Climate Action Measures*, *Renewable Energy, or Community-Wide GHG Reduction Measures* and identified the specific *energy* related *climate action measure* that corresponds to GHG emissions reductions made by collaborating with GRID Alternatives or a GRID Alternatives compatible policy (facilitating the permit process for solar

electric installations). I also identified how many metric tons of $CO_2e$ (MT $CO_2e$) emissions reduction the *energy* related *climate action measure* claims to achieve.

**CITY OF ARROYO GRANDE**

Rincon Consultants, Inc. prepared the climate action plan for the City of Arroyo Grande as part of the *San Luis Obispo Regional Climate Action Plan*. The CAP was adopted by the City Council November 26, 2013, Resolution 4557. The City of Arroyo Grande's 2005 baseline emissions are 84,399 MT $CO_2e$, while its 2020 adjusted business-as-usual emission forecast is 75,653 MT $CO_2e$ (Rincon, 2013b, p. ES-4). The city's overall GHG emissions reduction target is 71,739 MT $CO_2e$, therefore in order to meet this target Arroyo Grande will need to reduce its GHG emissions by 3,914 MT $CO_2e$ (Rincon, 2013b, p. ES-4) in order to comply with the GHG emissions reduction target of 1990 levels by 2020 as stated in AB 32.

In order to achieve the GHG emissions reduction target the CAP identifies *climate action measures* that are organized by focus areas including: "city government operations, energy, transportation and land use, off-road, solid waste, and tree planting" (Rincon, 2013b, p. ES-4). These focus areas were selected based on:

> "… careful consideration of the emission reductions needed to achieve the target, the distribution of emissions in the GHG Emissions Inventory, existing priorities and resources, strategies of neighboring jurisdictions and regional agencies, and the potential costs and benefits of each measure" (Rincon, 2013b, p. ES-4).

The focus areas were fully unpacked in chapter three of Arroyo Grande's CAP, entitled: *Climate Action Measures.* The focus area that pertains to this study is *energy* and specifically, "Energy Measure E-8: Income-Qualified Solar PV Program" (Rincon, 2013b, p. 3-10). *Energy Measure E-8* states that the City of Arroyo Grande will:

> "Facilitate the installation of small-scale on-site solar PV systems on and solar hot water heaters in income-qualified housing units by promoting existing programs offers through the California Solar Initiative and New Solar Homes Partnership and by collaborating with organizations, such as Grid Alternatives, on outreach and eligibility" (Rincon, 2013b, p. 3-10).

**The corresponding GHG Emissions Reduction Potential 2020 Goal for this specific measure is 139 MT $CO_2e$ (Rincon, 2013b, p. 3-6).**

The *Existing and/or Completed Efforts in Support of this Measure* states that: "The City has collaborated with (GRID) Alternatives to provide targeted education and outreach to developers and homeowners about incentives offered through the Single Family Affordable Solar Homes (SASH) Program" (Rincon, 2013b, p. 3-10).

The *Implementation Action E-8.1* states the following: "Collaborate with GRID Alternatives and other community organizations to provide targeted education and outreach to developers and homeowners about incentives offered through the Multifamily Affordable Solar Homes (MASH) program" (Rincon, 2013b, p. 3-10).

The City of Arroyo Grande's CAP mentions that GRID Alternatives is program manager for the MASH program, however GRID Alternatives is only the

program manager for the SASH program. This is misinformation should be corrected. Arroyo Grande's CAP does however clearly state that GRID Alternatives does help the city achieve part of its GHG emissions reduction target.

**CITY OF ATASCADERO**

Rincon Consultants, Inc. prepared the climate action plan for the City of Atascadero as part of the *San Luis Obispo Regional Climate Action Plan*. The CAP was adopted by the City Council January 28, 2014. The City of Atascadero's 2005 baseline emissions are 141,428 MT $CO_2e$, while its 2020 adjusted business-as-usual emission forecast is 138,951 MT $CO_2e$ (Rincon, 2014, p. ES-4). Its overall GHG emissions reduction target is 120,214 MT $CO_2e$, therefore in order to meet this target, Atascadero will need to reduce its GHG emissions by 18,737 MT $CO_2e$ (Rincon, 2014, p. ES-4) in order to comply with the GHG emissions reduction target of 1990 levels by 2020 as stated in AB 32.

In order to achieve the GHG emissions reduction target the CAP identifies *climate action measures* that are organized by focus areas including: "City government operations, energy, transportation and land use, off-road, water, solid waste, and trees and vegetation" (Rincon, 2014, p. ES-5). These focus areas were selected based on:

> " … careful consideration of the emission reductions needed to achieve the target, the distribution of emissions revealed in the GHG Emissions Inventory, goals and policies identified in the City's General Plan, existing priorities and resources, policies and strategies of neighboring jurisdictions and regional agencies, and the potential costs and benefits of each measure" (Rincon, 2014, p. ES-5).

The focus areas were fully unpacked in chapter three of Atascadero's CAP, entitled: *Climate Action Measures.* The focus area that pertains to this study is *energy* and specifically, "Energy Measure E-6: Income-Qualified Solar PV Program" (Rincon, 2014, p. 3-11). *Energy Measure E-6* states that the City of Atascadero will:

> "Facilitate the installation of small-scale on-site solar PV systems on and solar hot water heaters in income-qualified housing units by promoting existing programs offers through the California Solar Initiative and New Solar Homes Partnership and by collaborating with organizations, such as Grid Alternatives, on outreach and eligibility" (Rincon, 2014, p. 3-11).

**The corresponding GHG Emissions Reduction Potential 2020 Goal for this specific measure is 87 MT $CO_2e$ (Rincon, 2014, p. 3-11).**

The *Existing and/or Completed Efforts in Support of this Measure* states that:

> "The Single Family Affordable Solar Homes (SASH) Program will be installing solar PV systems on 24 new affordable housing units which are currently under construction by People's Self-Help Housing (and that the) City (will) collaborate with Grid Alternatives on outreach and eligibility" (Rincon, 2014, p. 3-11).

The *Implementation Action E-6.1* (Rincon, 2014, p. 3-11) states the following:

> "Continue to collaborate with GRID Alternatives and/or other community organizations to provide targeted education and outreach to developers and homeowners about incentives offered through the SASH Program and the Multifamily Affordable Solar Homes (MASH) Program" (Rincon, 2014, p. 3-11).

The *Implementation Action of E-6.2* states the City of Atascadero will:

"Provide targeted outreach regarding solar incentives offered through the

California Solar Initiative, including the SASH and MASH Programs" (Rincon, 2014, p. 3-11).

Atascadero's CAP clearly mentions that GRID Alternatives does help the city achieve part of its GHG emissions reduction target.

**CITY OF PASO ROBLES**

Rincon Consultants, Inc. prepared the climate action plan for the City of Paso Robles as part of the *San Luis Obispo Regional Climate Action Plan*. The CAP was adopted by the City Council November 19, 2013, Resolution 13-153. The City of Paso Robles' 2005 baseline emissions are 169,557 MT $CO_2e$, while its 2020 adjusted business-as-usual emission forecast is 163,975 MT $CO_2e$ (Rincon, 2013a, p. ES-4). Its overall GHG emissions reduction target is 144,123 MT $CO_2e$, therefore in order to meet this target Paso Robles will need to reduce its GHG emissions by 19,852 MT $CO_2e$ (Rincon, 2013a, p. ES-4) in order to comply with the GHG emissions reduction target of 1990 levels by 2020 as stated in AB 32.

In order to achieve the GHG emissions reduction target the CAP identifies *climate action measures* that are organized by focus areas including: "City government operations, energy, transportation and land use, off-road, water, solid waste, and tree planting" (Rincon, 2013a, p. ES-4). These focus areas were selected based on:

> " … careful consideration of the emission reductions needed to achieve the target, the distribution of emissions revealed in the GHG Emissions Inventory, goals and policies identified in the City's General Plan, existing priorities and resources, policies and strategies of neighboring jurisdictions

and regional agencies, and the potential costs and benefits of each measure" (Rincon, 2013a, p. ES-4).

The focus areas were fully unpacked in chapter three of Paso Robles' CAP, entitled: *Climate Action Measures.* The focus area that pertains to this study is *energy* and specifically, "Energy Measure E-7: Income-Qualified Solar PV Program" (Rincon, 2013a, p. 3-10). *Energy Measure E-7* states that the City of Paso Robles will:

> "Facilitate the installation of small-scale on-site solar PV systems on and solar hot water heaters in income-qualified housing units by promoting existing programs offers through the California Solar Initiative and New Solar Homes Partnership and by collaborating with organizations, such as Grid Alternatives, on outreach and eligibility" (Rincon, 2013a, p. 3-10).

**The corresponding GHG Emissions Reduction Potential 2020 Goal for this specific measure is 183 MT $CO_2e$ (Rincon, 2013a, p. 3-10).**

The *Implementation Action E-7.1* states the following:

> "Collaborate with Grid Alternatives and/or other community organizations to provide targeted education and outreach to developers and homeowners about incentives offered through the Single Family Affordable Solar Homes (SASH) Program and the Multifamily Affordable Solar Homes Program (MASH)" (Rincon, 2013a, p. 3-10).

Paso Robles' CAP clearly acknowledges that GRID Alternatives does help the city achieve part of its GHG emissions reduction target.

**CITY OF SAN LUIS OBISPO**

San Luis Obispo City Council, City staff, the Planning Commission, and the Cal Poly Climate Team with the help of PMC prepared the City of San Luis Obispo's climate action plan. The CAP was adopted by the City Council in

August 2012, Resolution 10388. "In 2008, the City of San Luis Obispo joined ICLEI-Local Governments for Sustainability's Cities for Climate Protection campaign" and completed the first step of the five milestone climate protection process which was to conduct a baseline emissions inventory (City of San Luis Obispo (with Cal Poly Climate Team and PMC), 2012, p. i). San Luis Obispo's climate action plan marks completion of the second and third milestones of "…adopting a GHG emissions reduction target consistent with AB 32 and developing a plan to achieve that target…" and the fourth and fifth milestones are implementation and monitoring the developed plan (City of San Luis Obispo (with Cal Poly Climate Team and PMC) [City of SLO], 2012, p. i).

San Luis Obispo's total 2005 baseline emissions are 264,240 MT $CO_2e$, while its total 2020 adjusted business-as-usual emission forecast is 244,630 MT $CO_2e$ (City of SLO, 2012, p. 11). Its total overall GHG emissions reduction target is 224,600 MT $CO_2e$, therefore in order to meet this target San Luis Obispo will need to reduce its GHG emissions by a total of 20,030 MT $CO_2e$ (City of SLO, 2012, p. 11) in order to comply with the GHG emissions reduction target of 1990 levels by 2020 as stated in AB 32.

In order to achieve the GHG emissions reduction target the CAP identifies seven *climate action measures* (which are called GHG reduction measures in their CAP) that are organized by *Community Strategies*: "(1) Buildings, (2) Renewable Energy, (3) Transportation & Land Use, (4) Water, (5) Solid Waste, and (6) Parks & Open Space, and (7) Government Operations" (City of SLO,

2012, p. ii). These focus areas were selected based on plan development research, a policy audit that served as a basis for emissions reduction strategy development, community outreach and input from City Staff (City of SLO, 2012, p. ii).

The CAP's focus area that is most relevant to this study is the chapter titled: *Renewable Energy* that has three sections. The section that pertains to this study is "RE 2: Renewable Energy Implementation" (City of SLO, 2012, p. 24). The *RE 2: Renewable Energy Implementation* section states that San Luis Obispo will: "Incentivize renewable energy generation in new and existing developments." (City of SLO, 2012, p. 24). **The corresponding GHG Emissions Reduction Potential 2020 Goal for this specific measure is 140 MT $CO_2e$ (City of SLO, 2012, p. 24).**

The *RE 2: Renewable Energy Implementation* section has three *Implementation Measures* and the one that is relevant to this report and income qualified solar electric systems is *Implementation Measure RE 2.1* which states:

> "Incentivize renewable energy generation by streamlining review processes, reducing permit costs, and/or allowing modest density bonuses for construction projects with renewable energy installations" (City of SLO, 2012, p. 24).

While *Implementation Measure RE 2.1* does not mention GRID Alternatives or the Single-Family Affordable Solar Homes (SASH) program it still correlates to this study because all solar electric systems installations require pulling a construction permit. It is considered a GRID Alternatives compatible

policy since all solar electric installations would benefit from the goals described in this measure as well as contributes to its GHG reduction potential 2020 goal.

Though income qualified solar electric systems had been installed by GRID Alternatives when San Luis Obispo's climate action plan was written, they were not considered as a contributing factor to reduce the City's GHG emissions. In fact the *Renewable Energy* chapter of San Luis Obispo's CAP fails to mention the SASH program or the New Solar Homes Partnership and only generally mentions the California Solar Initiative on page 23, which seems odd since this chapter is devoted to renewable energy and its implementation.

However the CAP's *Introduction* chapter (under the section of *State Polices to Reduce GHG Emissions* section) does mention the California Solar Initiative (CSI) and all three CSI programs: the Single-family Affordable Solar Housing (SASH) Program, the Multi-family Affordable Solar Housing (MASH) Program, and the Solar Hot Water Program (City of SLO, 2012, p. 11). This section even attributes 1,490 MT $CO_2e$ GHG emissions reduction to CSI program as a whole (City of SLO, 2012, p. 11). However the CAP fails to mention that GRID Alternatives' solar electric installations contribution to GHG emission reductions in the *Renewable Energy* chapter of the San Luis Obispo's CAP. This omission could be corrected.

**SAN LUIS OBISPO COUNTY**

PMC prepared the climate action plan for San Luis Obispo County with assistance from San Luis Obispo County staff Green Team, EnergyWise Stakeholder Focus Groups, and San Luis Obispo County residents and business owners (San Luis Obispo County (with PMC), 2011, title page). San Luis Obispo County Board of Supervisors adopted the *EnergyWise* Plan on November 22, 2011, Resolution 2011-381 (San Luis Obispo County (with PMC) [SLO County], 2011, title page).

San Luis Obispo County's climate action plan is called the *EnergyWise* Plan (Plan). "The name of this Plan highlights the County's focus on energy as a key sector to addressing local greenhouse gas emissions" (SLO County, 2011, 1-1).

> "In 2009, the County was awarded an Energy Efficiency and Conservation Block Grant (EECBG) from the United States Department of Energy (DOE). The County developed an Energy Efficiency and Conservation Strategy (EECS) to determine how the EECBG funds would be used to reduce energy use. As part of the EECS, the County dedicated a portion of its EECBG funds to prepare this Plan as a key implementation program of the County's Conservation and Open Space Element of the General Plan" (SLO County, 2011, p. 1-5).

San Luis Obispo County's 2006 total baseline emissions are 917,700 MT $CO_2e$, while its total 2020 adjusted business-as-usual emission forecast is 899,780 MT $CO_2e$ (SLO County, 2011, p. 4-11-12). Its overall GHG emissions reduction target is 780,050 MT $CO_2e$, therefore in order to meet this target San Luis Obispo County will need to reduce its GHG emissions by 119,730 MT $CO_2e$

(SLO County, 2011, p. 4-11-12) in order to comply with the GHG emissions reduction target of 1990 levels by 2020 as stated in AB 32.

In order to achieve the GHG emissions reduction target the Plan identifies *climate action measures* (which the Plan calls "reduction measures") that are organized by focus areas (which the Plan calls "reduction measure topics") including: "Energy Conservation, Renewable energy, Solid waste, Land use and transportation, Water conservation, and Agriculture" (SLO County, 2011, 5-1). These focus areas were selected to align with the climate action measures "source of GHG emissions as presented in the GHG Inventory (Chapter 3) of the Plan" (SLO County, 2011, 5-1).

The Plan's focus area that is most relevant to this study is chapter five titled: *Community-Wide GHG Reduction Measures* (SLO County, 2011, 5-1). The section in this chapter that pertains to this study is "Renewable Energy" (SLO County, 2011, 5-19). The *Renewable Energy* section states that San Luis Obispo County will: "Increase the production of renewable energy from small-scale and commercial-scale renewable energy installation to account for 10% of total local energy use by 2020" (SLO County, 2011, 5-19).

This *Renewable Energy* section has four measures and the one that best correlates with GRID Alternatives is climate action measure *#11 Small-Scale Renewable Energy*, which states that San Luis Obispo County will: "Implement a financing program to provide property owners with low-interest loans for the installation of renewable energy resources" (SLO County, 2011, 5-24).

**The corresponding GHG Emissions Reduction Potential 2020 Goal for this specific measure is 19,850 MT $CO_2e$. (SLO County, 2011, p. 5-24).**

San Luis Obispo County would be able to achieve this goal with six *Supporting Actions* however only the following two are relevant to this report:

> (1) "Promote the development of sustainable energy sources and renewable energy projects through streamlined planning and development rules, codes, processing, and other incentives," (SLO County, 2011, 5-24) and;
>
> (2) "Collaborate with stakeholder groups, including business and property owners, wineries, and other agricultural operations, to increase awareness of renewable energy systems, to streamline the permitting process, and to identify incentives" (SLO County, 2011, 5-24).

While climate action measure *#11 Small-Scale Renewable Energy* does not mention GRID Alternatives or the Single-Family Affordable Solar Homes (SASH) program it still correlates to this study because all solar electric systems installations require pulling a construction permit. It is considered a GRID Alternatives compatible policy since all solar electric installations would benefit from the goals described in this measure as well as contributes to its GHG reduction potential 2020 goal.

Though income qualified solar electric systems had been installed by GRID Alternatives when San Luis Obispo County's climate action plan was written, they were not considered as a contributing factor to reduce the County's GHG emissions. The *Renewable Energy* section of chapter five, *Community-Wide GHG Reduction Measures*, does mention the California Solar Initiative (CSI) on page 5-19, but refers the reader to chapter four. In chapter four,

*Greenhouse Gas Emissions Forecast and Reduction Targets,* all three California Solar Initiative programs are mentioned on page 4-8: the Single-family Affordable Solar Housing (SASH) Program, the Multi-family Affordable Solar Housing (MASH) Program, and the Solar Hot Water Program. Also on page 4-4, 1,180 MT $CO_2e$ GHG emissions reduction is attributed to CSI program as a whole. However neither chapter four or five of the Plan mention GRID Alternatives' solar electric installations contribution to GHG emissions reduction, which seems odd since these chapters discuss renewable energy and GHG emissions reduction. This is omission of a program like GRID Alternatives, which currently produces measureable GHG emissions reduction in the *Renewable Energy* section of chapter five could be corrected.

**SUMMARY**

In each climate action plan, *climate action measures* that pertained to *energy* or *renewable energy* were analyzed. Each CAP uses the terminology of "GHG Emissions Reduction Potential 2020 Goal" and for the purposes of clarity "GHG emissions reduction targets" will be used for the remainder of this study to mean the same thing. The CAPs for Arroyo Grande, Atascadero, and Paso Robles all explicitly mention how collaborating with GRID Alternatives will help them achieve their respective GHG emissions reduction targets. However the City of San Luis Obispo and San Luis Obispo County do not mention how GRID Alternatives helps them achieve their respective GHG emissions reduction targets. Now that all the climate action plans have been analyzed it is possible to

identify how the installation of solar electric systems by GRID Alternatives on low-income housing units compares to the MT $CO_2e$ emissions reduction targets listed in Table 3. Table 3 summarizes the *energy* or *renewable Energy* GHG emissions reduction target of each CAPs' climate action measure that correlates to GRID Alternatives low-income solar electric installations and the SASH program, or has a GRID Alternatives compatible policy.

**Table 3. Summary of Energy or Renewable Energy GHG Emissions Reduction Targets for CAPs' Climate Action Measures that Correlates to GRID Alternatives or has a GRID Alternatives Compatible Policy**

| **Jurisdiction** | **Total GHG emissions reduction needed to comply with 1990 levels by 2020 (MT $CO_2e$)** | ***Energy* or *Renewable Energy* Climate Action Measure** | **GHG Emissions Reduction Target per specific climate action measure** | **Policy Type: GRID Alternatives/ SASH or GRID Alternatives Compatible** |
|---|---|---|---|---|
| City of Arroyo Grande | 3,914 | Energy Measure, E-8: Income Qualified Solar PV Program | 139 | GRID Alternatives/ SASH |
| City of Atascadero | 18,737 | Energy Measure, E-6: Income Qualified Solar PV Program | 87 | GRID Alternatives/ SASH |
| City of Paso Robles | 19,852 | Energy Measure, E-7: Income Qualified Solar PV Program | 183 | GRID Alternatives/ SASH |
| City of San Luis Obispo | 20,030 | Renewable Energy Measure, RE 2: Renewable Energy Implementation | 140 | GRID Alternatives Compatible |
| San Luis Obispo County | 121,550 | Renewable Energy Measure #11: Small Scale Renewable Energy | 19,850 | GRID Alternatives Compatible |
| *Total* | *184,038* | | | |

Since GRID Alternatives inventories data regarding each solar electric installation it was possible to make this comparison. One data piece GRID Alternatives tracks is “expected annual output in kWh/yr” that uses the EPA’s emission factor to estimate GHG reductions. For the final analysis of the GHG emissions reduction targets, the expected annual output in kWh/yr collected by GRID Alternatives was converted to MWh/yr, and then multiplied by the PG&E emissions factor in order to correlate with the GHG emissions reduction targets of the CAPs that were analyzed. The Methods chapter of this report will further explain the discrepancies in calculating the GHG emissions reduction targets.

# 4. METHODS

## OVERVIEW

Data was collected for each GRID Alternatives solar electric installation and input into Salesforce software. In this study a Salesforce report (Appendix A) was generated to create a summary of all installed projects within San Luis Obispo County, and organized by city and unincorporated areas between 2010 and 2016. A Salesforce summary report can also included several data points such as: specific location, system size, savings, usage, interconnection date, installation date, and lifetime production (kWh). For this study the two Salesforce data points analyzed are: 1) *expected annual output in kilowatt/year* (kWh/yr), and 2) *lifetime emission reduction (25 years) in metric tons of $CO_2$/kWh* for each installation within San Luis Obispo County (Appendix B).

When these two GRID Alternatives' data points were compared to the climate action plans for the cities of Arroyo Grande, Atascadero, Paso Robles, and San Luis Obispo and San Luis Obispo County, there were three discrepancies that surfaced. The first is that climate action plans' GHG emissions reduction targets are for 2020, a singular year, and not an accumulation lifetime emissions reduction of 25 years like noted by GRID Alternatives. The second discrepancy is that the climate action plans use PG&E's emission factor in megawatt hours (MWh), not kilowatt-hours (kWh) like noted by GRID Alternatives. The third discrepancy is that the climate action plans account for

GHG emissions reduction targets in metric tons of $CO_2$ equivalents ($CO_2e$) that includes all GHG gases, and GRID Alternatives accounts for GHG emissions reduction in metric tons of just $CO_2$.

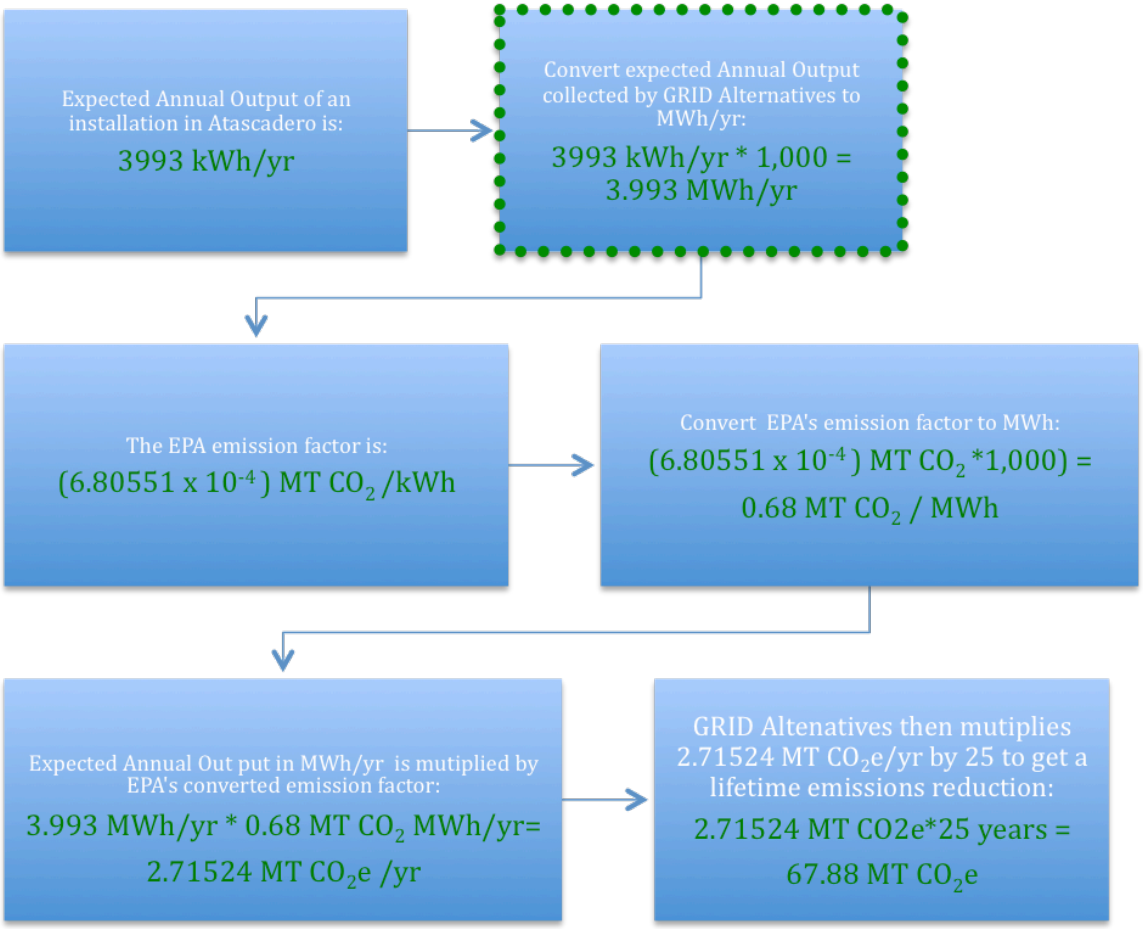
In order to be able to the compare GRID Alternatives' *expected annual output in kWh/yr* of each system with the CAPs GHG emissions reduction targets, several conversions had to be made.

For instance GRID Alternatives calculates its 25-year $CO_2$ emission reduction in the following manner. Take for example an Atascadero project's expected annual output of 3993 kWh/yr and multiply it by 1,000 to get 3.993 MWh/yr. Then multiply the EPA's emission factor of $6.89551 \times 10^{-4}$ MT $CO_2e$/ kWh by 1,000 to get the megawatt hour equivalent of, 0.68 MT $CO_2e$/ MWh.

Next GRID Alternatives takes the expected annual output in megawatts of, 3.993 MWh/yr and multiplies it by the converted EPA's emission factor of 0.68 MT $CO_2e$/ MWh, to get a yearly emissions factor of, 2.71524 MT $CO_2e$/yr. Then GRID Alternatives multiplies the value of 2.71524 MT $CO_2e$/yr, by 25 years, to get 67.88 MT $CO_2e$, for its lifetime carbon emissions reduction.

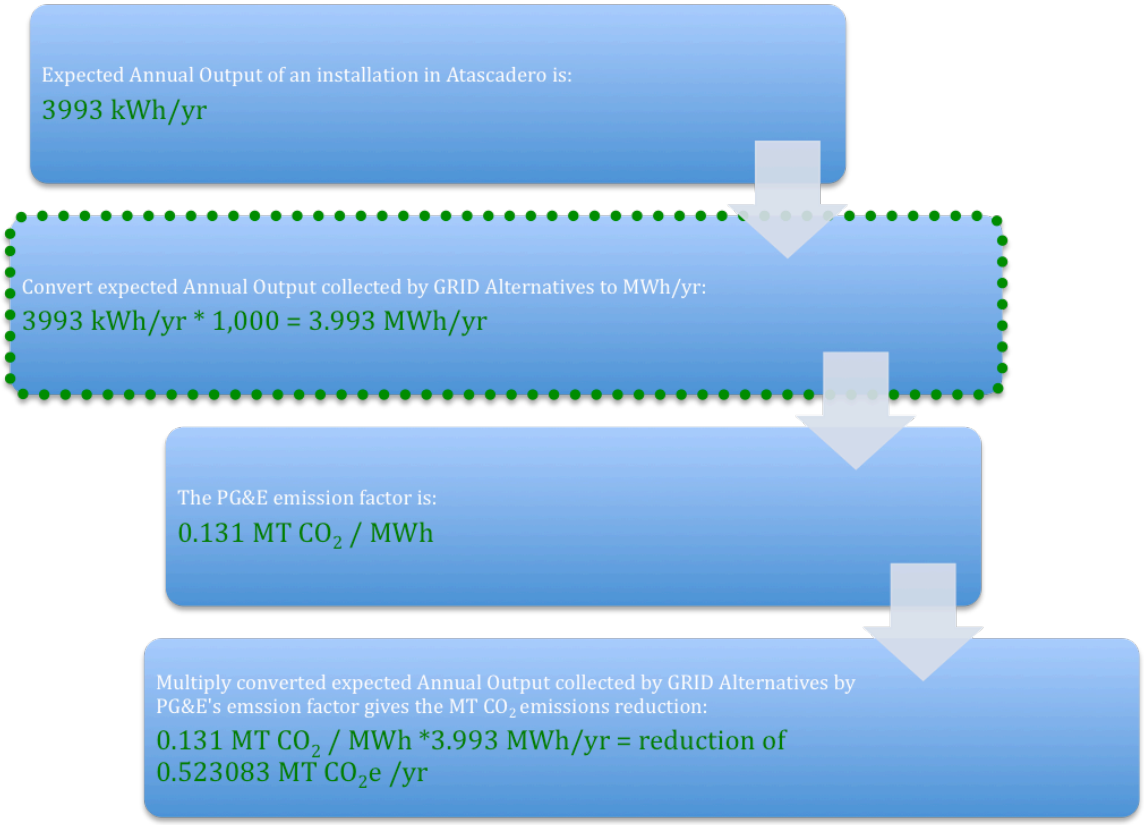
GRID Alternatives lifetime emissions calculations use the EPA emission factor of $6.89551 \times 10^{-4}$ MT $CO_2e$/ kWh. Table 4 explains the mathematics of this result.

**Table 4. GRID Alternatives Calculation of 25-year (system life) Carbon Emissions Reduction in Metric Tons**




Therefore, in order to covert this GRID Alternatives lifetime carbon emissions reduction number into one is consistent with the CAPs' accounting of $CO_2e$ emissions reductions, the expected annual output number collected by GRID Alternatives, once converted to MWh/yr, was multiplied by PG&E's emission factor of 0.131 $MTCO_2e/MWh$ for the year 2020 (PG&E, 2015). Table 5 explains the results of this calculation using the same Atascadero installation as an example.

**Table 5. GRID Alternatives Converted Emissions Reductions Multiplied by PG&E's 2020 Emissions Factor of 0.131 MT $CO_2e$/MWh**




## DISCREPANCIES BETWEEN EMISSION FACTOR VALUES

A GHG emission factor is "a measure of the pounds of carbon dioxide ($CO_2$) emitted per megawatt-hour of electricity or per therm of natural gas" (PG&E, 2015). For example, "electricity generated from fossil fuels like natural gas or coal emits $CO_2$, while other sources of electricity are considered to be carbon-free like hydropower, wind, solar, and nuclear power" (PG&E, 2015).

### PG&E EMISSION FACTOR USED BY CAPS (MEGAWATT-HOURS)

This report uses PG&E's emissions factor of **0.131 MTC$CO_2e$/MWh** for the year 2020, since all the installations being accounted for are all in PG&E service territory. This emissions factor is based on the California Public Utility

Commission GHG Calculator published in 2010 and is publicly available (PG&E, 2015). This calculator provides an independent forecast of PG&E's emission factors as part of a model on how the electricity sector would reduce emissions under AB 32 (PG&E, 2015).

The electricity that PG&E delivers to customers comes from "a mix of generation sources and PG&E's emission factor for delivered electricity incorporates the annual energy and associated emissions from each generation source (fossil fuels, hydropower, wind, solar and nuclear power) for the given year" (PG&E, 2015). "Variance in PG&E's mix of electricity sources largely account for changes in PG&E's GHG emission factor from year to year" (PG&E, 2015). Also, "the multiple sources of power used in the course of a year and the rigorous process PG&E follows to have its emissions independently verified by a third party, means that emission factor for delivered electricity lags by a year" (PG&E, 2015).

**EPA EMISSIONS FACTOR USED BY GRID ALTERNATIVES (KILOWATT-HOURS)**

GRID Alternatives uses the EPA emissions factor of **$6.89551 \times 10^{-4}$ $MTCO_2e$ /kWh** (eGRID, U.S. annual non-baseload $CO_2$ output emission rate, year 2010 data) which is does not include any GHGs other than $CO_2$ and it does not include line losses (EPA, 2014). It is generated with the Greenhouse Gas Equivalency Calculator. This Calculator uses the "Emissions Generation Resource Integrated Database (eGRID) U.S. annual non-baseloaded $CO_2$ output emission rate to convert reductions of kilowatt-hours into avoided units of carbon

dioxide emissions" (EPA, 2014). This Calculator uses a "non-baseloaded rate because most people want to know how energy efficiency or renewable energy programs affect emissions reductions, and these programs typically to not affect baseloaded emissions, like that of a power plant that runs constantly, but rather on non-baseload generation, like that of power plants that are brought online to meet demand" (EPA, 2014).

**SUMMARY**

In conclusion, the *Expected Annual Output kWh/yr* data collected by GRID Alternatives was converted from kWh/yr to MWh/yr and then multiplied by PG&E emissions factor of **0.131 $MTCO_2e/MWh$** (for the year 2020, which based on 2010 data from the California Public Utility Commission) to determine the annual emissions reduction of each system installed (PG&E, 2015). PG&E's emissions factor was used because it is available, more accurate for California emissions and consistent with the climate actions plans for the cties of Arroyo Grande, Atascadero, Paso Robles, and San Luis Obispo and San Luis Obispo County.

GRID Alternatives uses an emission factor from the EPA of **$6.89551 \times 10^{-4}$ $MTCO_2e/kWh$** (eGRID, U.S. annual non-baseload $CO_2$ output emission rate, year 2010 data) to track its emission reduction goals over the 25-year life span of each system (EPA, 2014). Since GRID Alternatives is a national program it makes sense for it to use this number as an organization. However, the emission factor provided by PG&E is more accurate for this region and for this report and is consistent with the cities and county GHG emissions reduction accounting.

## 5. FINDINGS

The installation of solar electric systems on low-income housing has a favorable impact on the CAPs GHG emission reduction targets for specific climate action measures in the cities of Arroyo Grande, Atascadero, Paso Robles, San Luis Obispo or in San Luis Obispo County. In total, the 179 solar electric systems installed by GRID Alternatives achieved 103 MT $CO_2e$ emissions reduction and positively impact the GHG emissions reduction targets for the county as a whole as summarized in Table 8.

The 12 solar electric systems installed in the City of Arroyo Grande achieved 6 MT $CO_2e$ emissions reductions and meet 4.25% of its CAP *Energy Measure, E-8: Income Qualified Solar PV Program* GHG emissions reduction target of 139 MT $CO_2e$.

The 19 solar electric systems installed in the City of Atascadero achieved 11 MT $CO_2e$ emissions reductions and meet 12.84% of its CAP *Energy Measure, E-6: Income Qualified Solar PV Program* GHG emissions reduction target of 87 MT $CO_2e$.

The 18 solar electric systems installed in the City of Paso Robles achieved 12 MT $CO_2e$ emissions reductions and meet 6.29% of its CAP *Energy Measure, E-7: Income Qualified Solar PV Program* GHG emissions reduction target of 183 MT $CO_2e$.

The 14 solar electric systems installed in the City of San Luis Obispo achieved 8 MT $CO_2e$ emissions reduction and meet 5.53% of its CAP *Renewable Energy Measure, RE 2: Renewable Energy Implementation* GHG emissions reduction target of 140 MT $CO_2e$.

The 116 solar electric systems installed in San Luis Obispo County achieved 67 MT $CO_2e$ emissions reduction and meet 0.34% of its CAP *Renewable Energy Measure #11: Small Scale Renewable Energy* GHG emissions reduction target of 19,850 MT $CO_2e$.

**Table 6. Summary of Findings**

| Jurisdiction | Number of Solar Electric Installations installed as of March 2016 | Climate Action Measure | GHG Emission Reductions ACHEIVED (MT $CO_2e$) for specific climate action measure | GHG Emission Reduction TARGETS (MT $CO_2e$) for specific climate action measure | GRID Alternatives Effect (%) on GHG Emission Reduction TARGETS for specific climate action measure |
|---|---|---|---|---|---|
| City of Arroyo Grande | 12 | Energy Measure, E-8: Income Qualified Solar PV Program | 6 | 139 | 4.25% |
| City of Atascadero | 19 | Energy Measure, E-6: Income Qualified Solar PV Program | 11 | 87 | 12.84% |
| City of Paso Robles | 18 | Energy Measure, E-7: Income Qualified Solar PV Program | 12 | 183 | 6.29% |
| City of San Luis Obispo | 14 | Renewable Energy Measure, RE 2: Renewable Energy Implementation | 8 | 140 | 5.53% |
| San Luis Obispo County | 116 | Renewable Energy Measure #11: Small Scale Renewable Energy | 67 | 19,850 | 0.34% |
| *Total* | *179* | | *103* | | |

**FORECAST**

GRID Central Coast region is projected to install 26 systems in 2016, 23 systems in 2017, and 24 systems in 2018, 2019 and 2020, which totals 121 potential installations. Assuming that each system will generate 4.4 MWh/yr (which is the average production of all currently installed projects in Atascadero) then the expected annual emissions reductions is 0.588 MT $CO_2$/MWh per installation. Therefore, 0.588 MT $CO_2$/MWh x 121 solar eclectic systems = 71 MT $CO_2$/MWh emission reductions. Where exactly these projects will be installed is yet to be determined but most likely would be in the unincorporated areas of the San Luis Obispo County.

## 6. CONCLUSIONS

Overall the analysis shows that GRID Alternatives can help jurisdictions reach their GHG emissions reduction targets as set out in their *energy* and *renewable energy climate action measures*. As of March 2016, GRID Alternatives has installed 179 solar electric systems in San Luis Obispo County and they are cumulatively reducing 103 MT $CO_2e$ emissions right now and will continue to do so for the coming decades. This is a worthy and measurable accomplishment.

The data likewise shows that the impact GRID Alternatives has on a jurisdiction's climate action measure's GHG emissions reduction target is relative to the number of installations completed and its unique GHG emissions reduction target. GRID Alternative's impact was greater in the cities where the GHG emission reduction targets were not as high as San Luis Obispo County's.

To realize more impact from GRID Alternatives efforts, more installations need to be completed countywide. One way to accomplish this would be to expand the Single-Family Affordable Solar Homes (SASH) program so that it includes workforce income. The SASH program could also be expanded to include all residential housing, not just low-income housing units. Another way to have a greater impact would be to expand the awareness of the SASH program and explicitly include it in each jurisdiction's climate action plan.

The City of San Luis Obispo and San Luis Obispo County have clearly missed an opportunity to implement a policy for reducing GHG emissions by

failing to mention GRID Alternatives in their CAPs' climate action measures. GRID Alternatives and the SASH program should be explicitly mentioned in the City of San Luis Obispo and San Luis Obispo County climate action plans since it is an actual program currently generating positive measureable results in cities within the county.

Though beyond the scope of this study it is also important to recognize GRID Alternatives' co-benefits. The jurisdictional co-benefits of collaborating with GRID Alternatives are greater than just the measurement of GHG emissions reduction targets and include: workforce, environmental justice, technological access, and economics.

Training volunteers and job trainees on how to install solar electric systems means GRID Alternatives becomes a green energy vocational school that prepares future green collar workers. Empowering low-income communities with a technology and energy that they otherwise would have not had access to means that GRID Alternatives addresses environmental justice by bringing these communities inclusion and access to a renewable energy future.

The immeasurable co-benefit of GRID Alternatives installations such as sitting at the kitchen table of a farm worker and going over simple math to explain how the savings from a PG&E true up bill can be put into money market account and used for improving her family is impactful. Conversations about finances are happening in communities that were unaware of money market accounts, or even

how compounding interest from savings can mean opportunities for their children that they never dreamed of having themselves.

Clearly, GRID Alternatives is creating a movement of access to solar technology for all with both measurable and immeasurable factors. GRID Alternatives has made significant impacts on GHG emissions reduction targets for Central Coast communities. Jurisdictions could help increase GRID Alternatives impacts on reducing GHG emissions by including GRID Alternatives and the SASH program in their climate action plans. Furthermore SASH's reach should go beyond just low-income communities. In addition to lowering GHG emissions, the co-benefits GRID Alternatives provides could have significant social and economic impacts on communities. Further study to quantify these impacts would provide a more complete picture of the total effect GRID Alternatives has on these communities. GRID Alternatives' influence is beyond just metrics. GRID Alternatives it is an organization implementing a program that can potentially change communities from its roots to its rooftops.

# BIBLIOGRAPHY

California Air Resources Board. (2008, December). Climate change scoping plan. A framework for change pursuant to AB 32 the California global warming solutions act of 2006. In *Executive Summary*. Retrieved November 21, 2014 from, http://www.arb.ca.gov/cc/ab32/ab32.htm

California Air Resources Board. (2014, August 15). Assembly Bill 32 Overview. Retrieved November 21, 2014 from, http://www.arb.ca.gov/cc/ab32/ab32.htm

California Department of Community Services. (2015). Solar Programs. In Background. Retrieved April 15, 2016 from, http://www.csd.ca.gov/Services/LowincomeWeatherizationProgram.aspx

City of San Luis Obispo (with Cal Poly Climate Team and PMC). (2012, August). City of San Luis Obispo climate action plan. Retrieved June 22, 2015 from, http://www.slocity.org/home/showdocument?id=4086

GRID Alternatives. (2012a, October 20). GRID Alternatives's Central Coast Solarthon 2012 in Oceano, CA- Group Shot. Retrieved May 21, 2016 from, http://www.gridalternatives.org/sites/default/files/styles/landing_regional_home_page/public/planetcc.jpg?itok=FYFN2Y2T

GRID Alternatives. (2012b, Octorber 20). Solarthon gives Oceano homeonwers a break. Retrieved May 21, 2016 from, http://www.gridalternatives.org/sites/default/files/styles/425wide/public/Solarthon_blog.JPG?itok=nER8IPBL

GRID Alternatives. (2104, October 4). Solathon 2014 CET Installation. Retrieved May 21, 2016, from, https://www.flickr.com/photos/gridalternatives/15372518657/in/album-72157648825560255/

GRID Alternatives. (2015a). Mission and History. Retrieved December 5, 2015 from, http://www.gridalternatives.org/about/about-grid

GRID Alternatives. (2015b). Solar Affordable Housing Program. Retrieved December 5, 2015 from, http://www.gridalternatives.org/programs/solar-affordable-housing-program

GRID Alternatives. (2015c). Tribal Program. Retrieved December 5, 2015 from, http://gridalternatives.org/programs/tribal-program

GRID Alternatives. (2015d). Colorado. Retrieved December 5, 2015 from, http://gridalternatives.org/regions/colorado/about

GRID Alternatives. (2015e). New York Tri-State. Retrieved December 5, 2015 from, http://gridalternatives.org/regions/new-york-tri-state/about

GRID Alternatives. (2015f). International Program. Retrieved December 5, 2015 from, http://gridalternatives.org/programs/international-program

GRID Alternatives. (2015g). MidAtlantic. Retrieved December 5, 2015 from, http://gridalternatives.org/regions/midatlantic/about

GRID Alternatives. (2015h, October 17). Sun Run Sponsored Installation. Retrieved May 21, 2016 from,

https://www.flickr.com/photos/gridalternatives/21931558593/in/album-72157660392543436/

GRID Alternatives. (2016a, January). Single-family Affordable Solar Homes (SASH) program semi-annual program status report. Retrieved April 15, 2016 from, http://gridalternatives.org/sites/default/files/Semi_annual_SASH_Program_Status_Report_January%202016.pdf

GRID Alternatives. (2016b). Low-income weatherization program. Retrieved April 15, 2016 from, http://www.gridalternatives.org/programs/solar-affordable-housing-program/low-income-weatherization-program

GRID Alternatives. (2016c). Solarthon. Retrieved April 15, 2016 from,http://www.gridalternatives.org/volunteer/solarthon

PG&E. (2015, November). Greenhouse Gas Emission Factors: Guidance for PG&E Customers. In PE&E Emissions Factor Summary. Retrieved April 5, 2016 from, https://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf

Rincon Consultants. (2013a, November 19). City of Paso Robles Climate Action. Retrieved February 16, 2015, from, http://www.slocleanair.org/images/cms/upload/files/Paso_CAP_Web.pdf

Rincon Consultants. (2013b, November 26). City of Arroyo Grande climate action plan. Retrieved January 29, 2015 from, http://www.slocleanair.org/images/cms/upload/files/AG_CAP_Web.pdf

Rincon Consultants. (2014, January 28). City of Atascadero climate action plan. Retrieved October 29, 2014, from, http://www.atascadero.org/files/CD/Climate%20Action%20Plan/1.%20Final%20Atascadero%20CAP%201.28.14.pdf

San Luis Obispo County. (2016). San Luis Obispo County EnergyWise plan. Designing energy and climate solutions for the future (main web page for CAP). Retrieved May 28, 2016, from http://www.slocounty.ca.gov/planning/CAP.htm

San Luis Obispo County (with PMC). (2011, November). San Luis Obispo County EnergyWise Plan. Designing energy and climate solutions for the future. Retrieved August 18, 2015 from, http://www.slocounty.ca.gov/Assets/PL/CAP-LUCE/final/5-SLOCoCAP_Ch5.pdf

San Luis Obispo County Air Pollution Control District. (2016). Climate Change, Local Activities, Local Government Climate Action Plans. Retrieved May 25, 2016 from, http://www.slocleanair.org/rulesregulations/climatechange.php

US Environmental Protection Agency. (2014). GHG equivalencies calculator – calculations and references. In Electricity Reductions (kilowatt-hours),

Emissions Factor. Retrieved April 5, 2016 from, https://www.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references

# APPENDICES

APPENDIX A. Summary of Salesforce Data: March 2016

| **SUMMARY OF FINDINGS** | | | | | |
|---|---|---|---|---|---|
| | **Jurisdiction** | **Number of Projects Installed** | **Expected Annual Output (MWh/yr) * PG&E emissions factor MTCO2e (2020 0.131)** | **Climate Action Measure GHG Reduction Goals in MT CO2e** | **% of GRID projects effect on climate action measure** |
| | City of Arroyo Grande | 12 | 6 | 139 | 4.25% |
| | City of Atascadero | 19 | 11 | 87 | 12.84% |
| | City of Paso Robles | 18 | 12 | 183 | 6.29% |
| | City of San Luis Obispo | 14 | 8 | 140 | 5.53% |
| | San Luis Obispo County | 116 | 67 | 19,850 | 0.34% |
| | Total | 179 | 103 | | |

APPENDIX B. Complete Salesforce Data: March 2016

| | Jurisdiction | Expected Annual Output (kWh/yr) | Expected Annual Output (MWh/yr) | Expected Annual Output (MWh/yr) * PG&E emissions factor MTCO2e (2020 0.131) | Carbon Reduced Over System Life (Tons) | Lifetime kWh production |
|---|---|---|---|---|---|---|
| **CITY OF ARROYO GRANDE** | | | | | | |
| 1 | Arroyo Grande | 4902 | 4.902 | 0.0642162 | 67.46 | 144610.6963 |
| 2 | Arroyo Grande | 4076 | 4.076 | 0.533956 | 64.5 | 138272.0583 |
| 3 | Arroyo Grande | 3938 | 3.938 | 0.515878 | 64.71 | 138720.8114 |
| 4 | Arroyo Grande | 2932 | 2.932 | 0.384092 | 40.87 | 87619.0487 |
| 5 | Arroyo Grande | 3672 | 3.672 | 0.481032 | 51.08 | 109495.7638 |
| 6 | Arroyo Grande | 3820 | 3.82 | 0.50042 | 61.97 | 132830.9266 |
| 7 | Arroyo Grande | 4721 | 4.721 | 0.618451 | 64.48 | 138215.9641 |
| 8 | Arroyo Grande | 4904 | 4.904 | 0.642424 | 79.08 | 169516.495 |
| 9 | Arroyo Grande | 4351 | 4.351 | 0.569981 | 68.35 | 146517.8971 |
| 10 | Arroyo Grande | 3481 | 3.481 | 0.456011 | 54.27 | 116339.249 |
| 11 | Arroyo Grande | 3999 | 3.999 | 0.523869 | 56.78 | 121724.2866 |
| 12 | Arroyo Grande | 4683 | 4.683 | 0.613473 | 66.81 | 143208.3427 |
| Total | | 49479 | 49.479 | 5.9038032 | 740.36 | 1587071.54 |
| | | | Climate Action Measure GHG reduction in MTCO2e | **139** | | |
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| | Jurisdiction | Expected Annual Output (kWh/yr) | Expected Annual Output (MWh/yr) | Expected Annual Output (MWh/yr) * PG&E emissions factor MTCO2e (2020 0.131) | Carbon Reduced Over System Life (Tons) | Lifetime kWh production |
|---|---|---|---|---|---|---|
| **CITY OF ATASCADERO** | | | | | | |
| 1 | Atascadero | 3993 | 3.993 | 0.523083 | 66.81 | 143208.3427 |
| 2 | Atascadero | 4140 | 4.14 | 0.54234 | 61.23 | 131260.2906 |
| 3 | Atascadero | 6099 | 6.099 | 0.798969 | 87.19 | 186905.6788 |
| 4 | Atascadero | 3036 | 3.036 | 0.397716 | 42.55 | 91209.07374 |
| 5 | Atascadero | 6056 | 6.056 | 0.793336 | 92.82 | 198965.9192 |
| 6 | Atascadero | 4596 | 4.596 | 0.602076 | 66.81 | 143208.3427 |
| 7 | Atascadero | 4538 | 4.538 | 0.594478 | 77.93 | 167048.3528 |
| 8 | Atascadero | 5540 | 5.54 | 0.72574 | 80.18 | 171872.4489 |
| 9 | Atascadero | 4929 | 4.929 | 0.645699 | 71.7 | 153697.9471 |
| 10 | Atascadero | 3440 | 3.44 | 0.45064 | 40.62 | 103101.0317 |
| 11 | Atascadero | 4587 | 4.587 | 0.600897 | 71.7 | 153697.9471 |
| 12 | Atascadero | 4885 | 4.885 | 0.639935 | 71.7 | 153697.9471 |
| 13 | Atascadero | 4464 | 4.464 | 0.584784 | 64.14 | 137486.7403 |
| 14 | Atascadero | 4539 | 4.539 | 0.594609 | 71.7 | 153697.9471 |
| 15 | Atascadero | 4710 | 4.71 | 0.61701 | 56.5 | 143432.7193 |
| 16 | Atascadero | 4033 | 4.033 | 0.528323 | 51.51 | 130755.4434 |
| 17 | Atascadero | 4672 | 4.672 | 0.612032 | 56.7 | 143937.5666 |
| 18 | Atascadero | 2891 | 2.891 | 0.378721 | 37.81 | 95977.07575 |
| 19 | Atascadero | 4135 | 4.135 | 0.541685 | 51.51 | 130755.4434 |
| Total | | 85283 | 85.283 | 11.172073 | 1221.11 | 2733916.258 |
| | | | Climate Action Measure GHG reduction in MTCO2e | **87** | | |
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| | Jurisdiction | Expected Annual Output (kWh/yr) | Expected Annual Output (MWh/yr) | Expected Annual Output (MWh/yr) * PG&E emissions factor MTCO2e (2020 0.131) | Carbon Reduced Over System Life (Tons) | Lifetime kWh production |
|---|---|---|---|---|---|---|
| **CITY OF PASO ROBLES** | | | | | | |
| 1 | Paso Robles | 5488 | 5.488 | 0.718928 | 88.24 | 189149.4444 |
| 2 | Paso Robles | 6492 | 6.492 | 0.850452 | 88.24 | 189149.4444 |
| 3 | Paso Robles | 5657 | 5.657 | 0.741067 | 88.24 | 189149.4444 |
| 4 | Paso Robles | 5064 | 5.064 | 0.663384 | 77.85 | 166880.0703 |
| 5 | Paso Robles | 3254 | 3.254 | 0.426274 | 45.01 | 96481.92302 |
| 6 | Paso Robles | 5484 | 5.484 | 0.718404 | 88.24 | 189149.4444 |
| 7 | Paso Robles | 4915 | 4.915 | 0.643865 | 73.27 | 157063.5956 |
| 8 | Paso Robles | 5385 | 5.385 | 0.705435 | 72.67 | 155773.4304 |
| 9 | Paso Robles | 2829 | 2.829 | 0.370599 | 40.01 | 85767.94204 |
| 10 | Paso Robles | 3379 | 3.379 | 0.442649 | 46.71 | 100128.0422 |
| 11 | Paso Robles | 5199 | 5.199 | 0.681069 | 75.68 | 162224.2566 |
| 12 | Paso Robles | 4375 | 4.375 | 0.573125 | 58.04 | 124416.8054 |
| 13 | Paso Robles | 4999 | 4.999 | 0.654869 | 74.16 | 158970.7964 |
| 14 | Paso Robles | 5759 | 5.759 | 0.754429 | 91.14 | 195375.8941 |
| 15 | Paso Robles | 5094 | 5.094 | 0.667314 | 66.16 | 167945.859 |
| 16 | Paso Robles | 3937 | 3.937 | 0.515747 | 45.72 | 116058.7783 |
| 17 | Paso Robles | 5885 | 5.885 | 0.770935 | 82.43 | 209231.147 |
| 18 | Paso Robles | 4688 | 4.688 | 0.614128 | 66.98 | 170021.3423 |
| Total | | 87883 | 87.883 | 11.512673 | 1268.79 | 2822937.661 |
| | | | Climate Action Measure GHG reduction in MTCO2e | **183** | | |
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| | Jurisdiction | Expected Annual Output (kWh/yr) | Expected Annual Output (MWh/yr) | Expected Annual Output (MWh/yr) * PG&E emissions factor MTCO2e (2020 0.131) | Carbon Reduced Over System Life (Tons) | Lifetime kWh production |
|---|---|---|---|---|---|---|
| **CITY OF SAN LUIS OBISPO** | | | | | | |
| 1 | San Luis Obispo | 4554 | 4.554 | 0.596574 | 77.85 | 166880.0703 |
| 2 | San Luis Obispo | 3689 | 3.689 | 0.483259 | 51.58 | 110561.5525 |
| 3 | San Luis Obispo | 3728 | 3.728 | 0.488368 | 53.98 | 115722.2135 |
| 4 | San Luis Obispo | 3223 | 3.223 | 0.422213 | 49.33 | 105737.4563 |
| 5 | San Luis Obispo | 7115 | 7.115 | 0.932065 | 103.81 | 222525.4585 |
| 6 | San Luis Obispo | 3296 | 3.296 | 0.431776 | 51.86 | 111178.588 |
| 7 | San Luis Obispo | 4360 | 4.36 | 0.57116 | 63.8 | 136757.5165 |
| 8 | San Luis Obispo | 4545 | 4.545 | 0.595395 | 66.78 | 143152.2486 |
| 9 | San Luis Obispo | 2683 | 2.683 | 0.351473 | 40.43 | 86665.4483 |
| 10 | San Luis Obispo | 4158 | 4.158 | 0.544698 | 61.23 | 131260.2906 |
| 11 | San Luis Obispo | 3780 | 3.78 | 0.49518 | 55.66 | 119312.2385 |
| 12 | San Luis Obispo | 3780 | 3.78 | 0.49518 | 55.66 | 119312.2385 |
| 13 | San Luis Obispo | 4431 | 4.431 | 0.580461 | 54.16 | 137486.7403 |
| 14 | San Luis Obispo | 5717 | 5.717 | 0.748927 | 75.33 | 191224.9277 |
| Total | | 59059 | 59.059 | 7.736729 | 861.46 | 1897776.988 |
| | | | Climate Action Measure GHG reduction in MTCO2e | 140 | | |
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| | Jurisdiction | Expected Annual Output (kWh/yr) | Expected Annual Output (MWh/yr) | Expected Annual Output (MWh/yr) * PG&E emissions factor MTCO2e (2020 0.131) | Carbon Reduced Over System Life (Tons) | Lifetime kWh production |
|---|---|---|---|---|---|---|
| **SAN LUIS OBISPO COUNTY** | | | | | | |
| 1 | Cambria | 2855 | 2.855 | 0.374005 | 45.61 | 97772.08827 |
| 2 | Los Osos | 2620 | 2.62 | 0.34322 | 38.96 | 83524.17639 |
| 3 | Nipomo | 3751 | 3.751 | 0.491381 | 54.27 | 116339.249 |
| 4 | Nipomo | 2964 | 2.964 | 0.388284 | 44.41 | 95191.75778 |
| 5 | Nipomo | 3292 | 3.292 | 0.431252 | 46.47 | 99623.19494 |
| 6 | Nipomo | 2029 | 2.029 | 0.265799 | 29.44 | 63105.90896 |
| 7 | Nipomo | 2355 | 2.355 | 0.308505 | 34.36 | 73651.60752 |
| 8 | Nipomo | 2378 | 2.378 | 0.311518 | 34.36 | 73651.60752 |
| 9 | Nipomo | 4275 | 4.275 | 0.560025 | 64.01 | 137206.2696 |
| 10 | Nipomo | 4988 | 4.988 | 0.653428 | 74.66 | 160036.5851 |
| 11 | Nipomo | 4238 | 4.238 | 0.555178 | 64.01 | 137206.2696 |
| 12 | Nipomo | 4561 | 4.561 | 0.597491 | 67.46 | 144610.6963 |
| 13 | Nipomo | 5244 | 5.244 | 0.686964 | 77.93 | 167048.3528 |
| 14 | Nipomo | 4675 | 4.675 | 0.612425 | 67.46 | 144610.6963 |
| 15 | Nipomo | 4561 | 4.561 | 0.597491 | 67.46 | 144610.6963 |
| 16 | Nipomo | 4516 | 4.516 | 0.591596 | 64.01 | 137206.2696 |
| 17 | Nipomo | 4444 | 4.444 | 0.582164 | 66.49 | 142535.213 |
| 18 | Nipomo | 4311 | 4.311 | 0.564741 | 64.01 | 137206.2696 |
| 19 | Nipomo | 4311 | 4.311 | 0.564741 | 67.46 | 144610.6963 |
| 20 | Nipomo | 5205 | 5.205 | 0.681855 | 74.66 | 160036.5851 |
| 21 | Nipomo | 5155 | 5.155 | 0.675305 | 74.66 | 160036.5851 |
| 22 | Nipomo | 4806 | 4.806 | 0.629586 | 67.46 | 144610.6963 |
| 23 | Nipomo | 4526 | 4.526 | 0.592906 | 64.01 | 137206.2696 |

| | Jurisdiction | Expected Annual Output (kWh/yr) | Expected Annual Output (MWh/yr) | Expected Annual Output (MWh/yr) * PG&E emissions factor MTCO2e (2020 0.131) | Carbon Reduced Over System Life (Tons) | Lifetime kWh production |
|---|---|---|---|---|---|---|
| 24 | Nipomo | 4505 | 4.505 | 0.590155 | 64.01 | 137206.2696 |
| 25 | Nipomo | 4526 | 4.526 | 0.592906 | 64.01 | 137206.2696 |
| 26 | Nipomo | 5338 | 5.338 | 0.699278 | 74.66 | 160036.5851 |
| 27 | Nipomo | 5198 | 5.198 | 0.680938 | 74.66 | 160036.5851 |
| 28 | Nipomo | 4516 | 4.516 | 0.591596 | 64.01 | 137206.2696 |
| 29 | Nipomo | 4476 | 4.476 | 0.586356 | 64.01 | 137206.2696 |
| 30 | Nipomo | 5595 | 5.595 | 0.732945 | 77.85 | 166880.0703 |
| 31 | Nipomo | 4988 | 4.988 | 0.653428 | 74.66 | 160036.5851 |
| 32 | Nipomo | 4275 | 4.275 | 0.560025 | 64.01 | 137206.2696 |
| 33 | Nipomo | 4374 | 4.374 | 0.572994 | 65.08 | 139506.1294 |
| 34 | Nipomo | 4311 | 4.311 | 0.564741 | 64.01 | 137206.2696 |
| 35 | Nipomo | 4444 | 4.444 | 0.582164 | 66.49 | 142535.213 |
| 36 | Nipomo | 4444 | 4.444 | 0.582164 | 66.49 | 142535.213 |
| 37 | Nipomo | 4526 | 4.526 | 0.592906 | 64.01 | 137206.2696 |
| 38 | Nipomo | 4571 | 4.571 | 0.598801 | 64.01 | 137206.2696 |
| 39 | Nipomo | 4526 | 4.526 | 0.592906 | 64.01 | 137206.2696 |
| 40 | Nipomo | 4561 | 4.561 | 0.597491 | 67.46 | 144610.6963 |
| 41 | Nipomo | 4444 | 4.444 | 0.582164 | 66.49 | 142535.213 |
| 42 | Nipomo | 4311 | 4.311 | 0.564741 | 64.01 | 137206.2696 |
| 43 | Nipomo | 5352 | 5.352 | 0.701112 | 67.91 | 172377.2962 |
| 44 | Nipomo | 5506 | 5.506 | 0.721286 | 71.44 | 181352.3588 |
| 45 | Nipomo | 5647 | 5.647 | 0.739757 | 70.71 | 179501.2521 |
| 46 | Oceano | 5015 | 5.015 | 0.656965 | 80 | 171479.7899 |
| 47 | Oceano | 2018 | 2.018 | 0.264358 | 32 | 68603.1348 |

| | Jurisdiction | Expected Annual Output (kWh/yr) | Expected Annual Output (MWh/yr) | Expected Annual Output (MWh/yr) * PG&E emissions factor MTCO2e (2020 0.131) | Carbon Reduced Over System Life (Tons) | Lifetime kWh production |
|---|---|---|---|---|---|---|
| 48 | Oceano | 3115 | 3.115 | 0.408065 | 46.71 | 100128.0422 |
| 49 | Oceano | 2898 | 2.898 | 0.379638 | 41.53 | 89021.40223 |
| 50 | Oceano | 2793 | 2.793 | 0.365883 | 41.11 | 88123.89597 |
| 51 | Oceano | 4052 | 4.052 | 0.530812 | 62.99 | 135018.5981 |
| 52 | Oceano | 4820 | 4.82 | 0.63142 | 69.34 | 148649.4744 |
| 53 | Oceano | 3198 | 3.198 | 0.418938 | 46.24 | 99118.34767 |
| 54 | Oceano | 4971 | 4.971 | 0.651201 | 72.72 | 155885.6187 |
| 55 | Oceano | 4828 | 4.828 | 0.632468 | 85.33 | 182922.9948 |
| 56 | Oceano | 4581 | 4.581 | 0.600111 | 64.32 | 137879.3993 |
| 57 | Oceano | 3394 | 3.394 | 0.444614 | 48.25 | 103437.5965 |
| 58 | Oceano | 4581 | 4.581 | 0.600111 | 64.32 | 137879.3993 |
| 59 | Oceano | 4581 | 4.581 | 0.600111 | 64.32 | 137879.3993 |
| 60 | San Miguel | 7189 | 7.189 | 0.941759 | 113.59 | 243504.6674 |
| 61 | San Miguel | 4698 | 4.698 | 0.615438 | 67.46 | 144610.6963 |
| 62 | San Miguel | 3575 | 3.575 | 0.468325 | 56.78 | 121724.2866 |
| 63 | San Miguel | 6980 | 6.98 | 0.91438 | 113.59 | 243504.6674 |
| 64 | San Miguel | 3984 | 3.984 | 0.521904 | 56.78 | 121724.2866 |
| 65 | San Miguel | 6063 | 6.063 | 0.794253 | 87.32 | 187186.1495 |
| 66 | San Miguel | 4227 | 4.227 | 0.553737 | 67.46 | 144610.6963 |
| 67 | San Miguel | 2869 | 2.869 | 0.375839 | 40.87 | 87619.0487 |
| 68 | San Miguel | 3647 | 3.647 | 0.477757 | 51.63 | 110673.7408 |
| 69 | San Miguel | 4351 | 4.351 | 0.569981 | 62.28 | 133504.0563 |
| 70 | San Miguel | 6533 | 6.533 | 0.855823 | 103.81 | 222525.4585 |
| 71 | San Miguel | 4311 | 4.311 | 0.564741 | 67.46 | 144610.6963 |

| | Jurisdiction | Expected Annual Output (kWh/yr) | Expected Annual Output (MWh/yr) | Expected Annual Output (MWh/yr) * PG&E emissions factor MTCO2e (2020 0.131) | Carbon Reduced Over System Life (Tons) | Lifetime kWh production |
|---|---|---|---|---|---|---|
| 72 | San Miguel | 4912 | 4.912 | 0.643472 | 77.85 | 166880.0703 |
| 73 | San Miguel | 4643 | 4.643 | 0.608233 | 72.67 | 155773.4304 |
| 74 | San Miguel | 3261 | 3.261 | 0.427191 | 51.63 | 110673.7408 |
| 75 | San Miguel | 4821 | 4.821 | 0.631551 | 77.85 | 166880.0703 |
| 76 | San Miguel | 3561 | 3.561 | 0.466491 | 56.21 | 120490.2155 |
| 77 | San Miguel | 6428 | 6.428 | 0.842068 | 106.37 | 228022.6844 |
| 78 | San Miguel | 4780 | 4.78 | 0.62618 | 67.88 | 145508.2025 |
| 79 | San Miguel | 4132 | 4.132 | 0.541292 | 64.32 | 137879.3993 |
| 80 | San Miguel | 4431 | 4.431 | 0.580461 | 62.75 | 134513.7508 |
| 81 | San Miguel | 7598 | 7.598 | 0.995338 | 108.41 | 232398.0274 |
| 82 | San Miguel | 5894 | 5.894 | 0.772114 | 95.12 | 203902.2036 |
| 83 | Templeton | 4152 | 4.152 | 0.543912 | 56.78 | 121724.2866 |
| 84 | Templeton | 5295 | 5.295 | 0.693645 | 72.67 | 155773.4304 |
| 85 | Templeton | 4138 | 4.138 | 0.542078 | 56.78 | 121724.2866 |
| 86 | Templeton | 4244 | 4.244 | 0.555964 | 57.39 | 123014.4519 |
| 87 | Templeton | 4576 | 4.576 | 0.599456 | 62.28 | 133504.0563 |
| 88 | Templeton | 4538 | 4.538 | 0.594478 | 62.28 | 133504.0563 |
| 89 | Templeton | 5295 | 5.295 | 0.693645 | 72.67 | 155773.4304 |
| 90 | Templeton | 4115 | 4.115 | 0.539065 | 56.78 | 121724.2866 |
| 91 | Templeton | 4576 | 4.576 | 0.599456 | 62.28 | 133504.0563 |
| 92 | Templeton | 4605 | 4.605 | 0.603255 | 62.28 | 133504.0563 |
| 93 | Templeton | 4146 | 4.146 | 0.543126 | 56.78 | 121724.2866 |
| 94 | Templeton | 4538 | 4.538 | 0.594478 | 62.28 | 133504.0563 |
| 95 | Templeton | 5339 | 5.339 | 0.699409 | 72.67 | 155773.4304 |

| | Jurisdiction | Expected Annual Output (kWh/yr) | Expected Annual Output (MWh/yr) | Expected Annual Output (MWh/yr) * PG&E emissions factor MTCO2e (2020 0.131) | Carbon Reduced Over System Life (Tons) | Lifetime kWh production |
|---|---|---|---|---|---|---|
| 96 | Templeton | 0 | 0 | 0 | 62.28 | 133504.0563 |
| 97 | Templeton | 4538 | 4.538 | 0.594478 | 62.28 | 133504.0563 |
| 98 | Templeton | 4138 | 4.138 | 0.542078 | 56.78 | 121724.2866 |
| 99 | Templeton | 5339 | 5.339 | 0.699409 | 72.67 | 155773.4304 |
| 100 | Templeton | 4533 | 4.533 | 0.593823 | 62.28 | 133504.0563 |
| 101 | Templeton | 3739 | 3.739 | 0.489809 | 56.78 | 121724.2866 |
| 102 | Templeton | 4576 | 4.576 | 0.599456 | 62.28 | 133504.0563 |
| 103 | Templeton | 4605 | 4.605 | 0.603255 | 62.28 | 133504.0563 |
| 104 | Templeton | 5373 | 5.373 | 0.703863 | 62.28 | 133504.0563 |
| 105 | Templeton | 4538 | 4.538 | 0.594478 | 62.28 | 133504.0563 |
| 106 | Templeton | 4199 | 4.199 | 0.550069 | 56.78 | 121724.2866 |
| 107 | Templeton | 4102 | 4.102 | 0.537362 | 56.78 | 121724.2866 |
| 108 | Templeton | 5339 | 5.339 | 0.699409 | 72.67 | 155773.4304 |
| 109 | Templeton | 4173 | 4.173 | 0.546663 | 56.78 | 121724.2866 |
| 110 | Templeton | 5275 | 5.275 | 0.691025 | 72.67 | 155773.4304 |
| 111 | Templeton | 3893 | 3.893 | 0.509983 | 56.78 | 121724.2866 |
| 112 | Templeton | 3697 | 3.697 | 0.484307 | 56.78 | 121724.2866 |
| 113 | Templeton | 4199 | 4.199 | 0.550069 | 56.78 | 121724.2866 |
| 114 | Templeton | 4173 | 4.173 | 0.546663 | 56.78 | 121724.2866 |
| 115 | Templeton | 2734 | 2.734 | 0.358154 | 41.53 | 89021.40223 |
| 116 | Templeton | 5036 | 5.036 | 0.659716 | 67.46 | 144610.6963 |
| Total | | 511983 | 511.983 | 67.069773 | 7474.8 | 16106142.51 |
| | | | Climate Action Measure GHG reduction in MTCO2e | **19,850** | | |