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Evaluating Viable Models for Community Solar Projects in the State of California

Bren School of Environmental Science & Management
University of California, Santa Barbara

A group project submitted in partial satisfaction of the degree requirements for the Master of Environmental Science & Management

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As authors of this Group Project report, we are proud to archive this report on the Bren School's website such that the results of our research are available for all to read. Our signatures on the document signify our joint responsibility to fulfill the archiving standards set by the Bren School of Environmental Science & Management.

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The mission of the Bren School of Environmental Science & Management is to produce professionals with unrivaled training in environmental science and management who will devote their unique skills to the diagnosis, assessment, mitigation, prevention, and remedy of the environmental problems of today and the future. A guiding principle of the School is that the analysis of environmental problems requires quantitative training in more than one discipline and an awareness of the physical, biological, social, political, and economic consequences that arise from scientific or technological decisions.

The Group Project is required of all students in the Master's of Environmental Science and Management (MESM) Program. It is a three-quarter activity in which small groups of students conduct focused, interdisciplinary research on the scientific, management, and policy dimensions of a specific environmental issue. This Final Group Project Report is authored by MESM students and has been reviewed and approved by

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ABSTRACT

The development of decentralized community-scale solar projects is an efficient approach to replacing the consumption of fossil-fuel based electricity in the state of California. Community solar projects can encourage individual homeowners

to replace their grid energy use by solar electricity, especially when they do not have the resources to install solar photovoltaics (PV) on their rooftops. This model enables groups of homeowners to amass their physical and economic resources to utilize the benefits of solar powered electricity. We studied the present policy, regulations, financing and technological options available for interested communities to help develop a project of this nature. This report also includes a spatial analysis that has been conducted on three counties in California to identify the prospective locations for developing community solar projects. A local community of homeowners located in a community called Rancho Embarcadero has been chosen as a subject for case study. We studied this community and developed business models to fit their needs and constraints. Finally, this study provides policy makers and interested communities recommendations regarding factors that would make community solar a viable option to be widely implemented in California.

EXECUTIVE SUMMARY

BACKGROUND

Currently there are two common and quite limiting paradigms concerning solar electricity installations. At one end of the spectrum is the individual owner or small business installation of several kilowatts of photovoltaics (PV). At the other end are installations owned and operated by large utilities and corporations producing tens of megawatts and occupying square miles of previously undisturbed land, necessitating transmission line corridors to deliver the energy where needed. An intermediate option, the community solar model, would occupy the middle ground of this spectrum making use of existing structures and disturbed land. This option is limited mainly by regulatory issues, which define communities as utilities, thereby subjecting these installations to onerous regulations and restrictions that are inappropriate given their small scale.

The primary research objectives of this group project include:

- Examining energy policies and regulations as they pertain to community solar in California.
- Examining the financial aspect of community solar installations.
- Investigating community solar business models.
- Examining the prospect of a community solar installation for Rancho Embarcadero Community in Goleta, CA.
- Providing insight regarding solar development in California through a spatial analysis of suitable community solar areas in Santa Barbara, San Luis Obispo, and Ventura Counties.

POLICY DRIVERS

There have been numerous legislative mandates at the state level in California that are directed at moving the state towards developing its renewable energy potential. It is currently mandated by California law that 20 percent of the state's electricity be generated by renewables by 2010. Recently,governor Jerry Brown signed legislation in April 2011 that requires California to now obtain 33 percent of its energy from renewables by 2020. Serious attention was also directed towards renewables in California through the passing of the Global Warming Solutions Act of 2006, or AB 32, which sets a cap on the state's greenhouse gas emissions at 1990 levels by 2020. These mandates, along with the numerous federal tax incentives for renewable energy investment, have focused attention on the merits and potential of renewable energy, particularly solar.

METHODOLOGY

1. Solar Electricity Demand Scenarios
   a. Reviewed national, state and local policies and programs needed to understand the key drivers for the present and future development of the community solar projects.

2. Spatial Analysis
   a. Conducted using ESRI's *ArcGIS* software and was limited to three counties – San Luis Obispo, Santa Barbara and Ventura counties in California.
   b. Identified and removed all areas of land not suitable for developing community solar projects. All federal, military and state park land were removed.
   c. According to NREL Solar Suitability data sets all the land covered by the three counties was 'Good', 'Great' or 'Excellent'.
   d. Calculated population densities for the three counties individually and selected 20%-80% of the densities for the analysis.

3. Survey Analysis
   a. Identified key attributes that make community ideal for a community solar installation.
   b. Talked to and gained permission from community association for community analysis.
   c. Surveyed community twice regarding energy usage, attitudes towards renewables, and support for a community solar project

4. Interviews
   a. The group individually conducted many interviews with industry experts, academics and owners of community solar projects in the U.S.
   b. The complete list of all the interviewees can be found in Appendix B.

5. Financial Modeling based on Business and Array Structure
   a. System Advisor Model (S.A.M.) is an open source online tool developed for policy makers, solar service providers, and other industry professionals by by NREL.
   b. The team used it for assessing and quantifying business model scenarios for EMID.
   c. The results can be found in the Appendix A.

KEY FINDINGS

1. Solar Electricity Demand Scenarios
    a. Presently California policies pose a barrier for the implementation of community solar projects owned solely by community members.
    b. Lois Volk's California Senate Bill 843 will greatly facilitate and encourage implementation of these projects. This bill will provide community generation and ownership with a legal framework within which to function effectively.

2. Survey Analysis
    a. Amount of energy usage can be met by a community solar installation.
    b. Community's backing of community solar is promising based on survey results but 81 percent of community chose not to participate in survey.

3. Spatial Analysis

a. The total area suitable for community solar projects is 599356 acres for the three counties together. Approximately 10 per cent of the total area in these counties has suitable land for community solar projects.

CONCLUSIONS AND RECOMMENDATIONS

Many significant hurdles remain for the implementation of a true community solar project in California. These will be addressed with the passage of Senate Bill 843. We think that SB 843 will also make way for many more solar developers to enter into this upcoming market.

Our key recommendations for all stakeholders include:

1. Sensitizing community members on solar energy and shared solar generation facilities.
2. Paying close attention to the economics and financial aspects to render projects of this nature viable as it seems to be the biggest concern for consumers.
3. Community solar members also need to take land or rooftop space procurement costs into account while building a business model.
4. The investor-owned model should not be underestimated as it provides equal amount of ecological benefits as the complete community ownership model.

INTRODUCTION

Due to concerns about climate change, California has mandated by law that it will attempt to draw 33% of its energy consumption from renewables by 2020. This is a challenging goal, but which can be met with various technologies available on the market today. By far the most likely candidate is solar cell technology. Wind technology is available but difficult for small scale use, since towers need to be high enough to clear surrounding vegetation and any turbulence generated by surrounding residences. Assuming neighbors are tolerant of the associated noise and visual impacts of a wind turbine, the horizontal axis wind turbines have a reputation for killing birds because of the difficulty birds have discerning the spinning blades. Bird strikes have generated considerable controversy over siting of turbines, and while there are methods of mitigation for farms, it may not be reasonable in an urban setting.

Large installations of many hundreds of megawatts, while attractive to utilities for their ease of construction, salability, and relative ease of grid connection, can be damaging to the environment. Examples of these can be found in the Mojave Desert where large tracts of land have scraped clean of all vegetation and life for ease of panel installation and future maintenance.

Larger wind turbine farms, where the turbines have capacities around one to two megawatts, occupy a great deal of land. Environmental impact reports, site monitoring for weather conditions, leasing or purchasing the land, the visual impacts, bird strikes, all make wind technology a harder sell especially near inhabited areas. The wind farm industry in Texas has seen exponential growth but this is in large part due to a streamlined application process and a guarantee of consistent winds over a relatively large area.

Ocean technologies, which seem especially apt for California's needs, are still a long way from producing a reliable energy supply. This is partly due to the technology itself and the harsh ocean environment, and also because of issues regarding permitting, regulations, and power distribution.

Community solar installations, those whose capacity ranges from a quarter to five megawatts, are likely to meet the least resistance to adoption. They can be strategically located to blend into the local terrain, placed on commercial rooftops which are often hidden behind facades, placed on industrial rooftops where aesthetics are less of a concern, mounted over brown-fields, parking structures, and other disturbed or constructed lands. Solar panels are also a low environmental impact when deployed in an environmentally sensitive manner.

PROBLEM STATEMENT

Presently, solar-powered electricity is utilized by individuals either through the installation of solar panels on commercial and residential rooftops or through utility-owned solar farms that generate hundreds of Megawatts of electricity. While these two options have their own set of benefits, they also have several drawbacks. Solar arrays mounted on residential and commercial rooftops have at times been perceived to be too costly, aesthetically undesirable, or structurally unstable. With regard to utility-scale solar farms, the areas in which they are placed are often undisturbed or environmentally sensitive and thereby generate community-wide resistance. In light of these issues, an intermediate option of generating and supplying solar-powered electricity at the community scale may prove expedient. Such a project could occupy less space, encourage community participation, lower transmission costs, and decentralized power distribution. Even though there are a few installations based on variations of this idea in existence today, they often don't meet their objectives of providing clean, environmentally friendly energy that is affordable for the community stakeholders (Farrell 2010).

We define community solar project as a solar PV array installed and at least 50% owned by a community of home-owners or renters on rooftops or a communal piece of land. The costs and benefits of the project will be distributed proportionally amongst all the participants. The benefits of participating in such a project include:

- Powering individual homes with a reliable and clean source of power at a steady price unlike the volatile prices of fossil fuel based generation.
- Enabling residents with shaded rooftops to participate in generating solar energy for their individual homes

Within Southern California there are many open spaces, roofs, and easements in urban and semi-rural areas that are not exploited for solar generation. However, the reasons why such a model of decentralized power distribution hasn't been adopted within the state are unclear and require further exploration. A study by the National Renewable Energy Laboratory (NREL) reports that only 22 to 27% of residential rooftop area is suitable for installation of solar PV (Denholm and Margolis 2008). These values were adjusted for structural, shading, or ownership issues. The issues that dictate the establishment of community solar models or require further analysis are as follows:

- Access to federal tax incentives if the participants are taxpaying entities.
- Regulations that govern the implementation of community solar projects.

- The effects of lease or ownership-related issues on the costs of a community solar business model.
- Guidelines for interconnection, transmission and storage for a community solar project.
- Long term financial viability of a community solar program without counting the various federal and state incentives programs in the business model.
- Federal regulations and fast-tracking for installations less than 5 MW of capacity.
- Creative land-use/financing options available for small-scale power generation

Researching the issues stated above would aid in developing multiple business models of varying scope and goals for different communities. Based on these studies, recommendations are made that would highlight the best models which will theoretically offer a wide array of benefits due to the distributed ownership amongst a community of homeowners at a local scale. Such projects would allow for a much more rapid adoption of solar power in California and potentially the rest of the United States.

OBJECTIVES

There are fewer permitting problems associated with installing solar on a smaller scale. In most cases there are no moving parts, and existing structures may be used for mounting the panels. Transmission also ceases to be a problem since energy is consumed at the site of generation or when on-site storage is used at night when solar power is not an option (Denholm et al. 2010).

The primary gains derived from a community solar model are the speed of integration into existing structures and the resulting increase in installed/deployed solar generating capacity. Along with investment tax credits and other supporting financial structures, net metering, and favorable interconnection standards, we might see an increase from about 5,000 MW of solar installed to 25,000 MW installed (Paidipati et al. 2008).

Several options are available to community solar:

- Installation on commercial, municipal, or industrial rooftops: The critical issue is what kind of agreement will need to be reached with the hosting interest, and how best to tie into the grid to distribute power.
- Installation on available land owned by a community: If the land available to use for solar electricity generation is community owned and all parties are agreeable to its use, then the issue is what kind of agreement needs to be set in place to distribute the electricity. A tie into the grid is an option as long as the capacity is less than 5MW, but another alternative, which avoids that transaction, is the development of onsite storage.
- Installation on rooftops of homeowners in a community: In the case where land is not available for solar arrays and/or storage, but there is sufficient rooftop area with good exposure, virtual net metering may be an option. This allows members of a community to divide the generated electricity between them in proportion with investment into the arrays, even though their house may, or may not, have solar panels fixed on the roof.
- Installation on apartment buildings and developments in urban areas: A land lord or developer may decide to install solar panels on the structure if there is some incentive to do so. One incentive would be to effectively become the local utility for the apartment block and either sell electricity or have tenants lease as part of the rental agreement

SIGNIFICANCE

At the most basic level, community solar projects are significant because they allow for the creation of electricity from a renewable energy source: the sun. The generation of solar-powered electricity prevents the rapid depletion of current energy reserves, contributes to national energy security, and lessens the national dependence on fossil fuels whose emissions contribute to air pollution and global climate change. At a residential level, solar installations can reduce household electricity bills while also boosting property values.

The installation of residential solar arrays greatly contributes to the proliferation of solar energy systems across the country. Community solar installations can further the adoption of solar energy because of the various advantages they have over conventional residential solar installations. Community solar installations allow homeowners to pool their resources and reap the benefits of solar-power electricity without having to pay for individual solar systems. Such installations also provide distributed generation with minimal transmission requirements and system reliability.

Community solar projects continue to hold great promise but have their own set of challenges that require further study and analysis. This group project will analyze the various barriers that have prevented the wide-scale adoption of community solar within California. By understanding how issues such as interconnection, feed-in tariffs, federal and state incentives, ground mount vs. roof mounted, PV cost, and net metering affect the feasibility of community solar, strategies can be developed for its implementation.

ENERGY POLICY AND REGULATIONS

REGULATORY AGENCIES

CALIFORNIA ENERGY COMMISSION (CEC)

The California Energy Commission is the state's primary energy policy and planning agency. The Agency was created in 1974 and duties and services include the following;

- Forecasting future energy needs and keeping historical energy data.
- Licensing thermal power plants 50 megawatts or larger.
- Promoting energy efficiency by setting the state's appliance and building efficiency standards and working with local government to enforce those standards.
- Supporting public interest energy research that advances energy science and technology through research, development, and demonstration programs.
- Supporting renewable energy by providing market support to existing, new, and emerging renewable technologies; providing incentives for small wind and fuel cell electricity systems; and providing incentives for solar electricity systems in new home construction.
- Developing and implementing the state Alternative and Renewable Fuel and Vehicle Technology Program to reduce the state's petroleum dependency and help attain the state climate change policies.

- Administering more than $300 million in American Reinvestment and Recovery Act funding through the state energy program, the energy efficiency conservation and block grant program; the energy efficiency appliance rebate program and the energy assurance and emergency program.
  Planning for and directing state response to energy emergencies.

CALIFORNIA INDEPENDENT SERVICE OPERATOR (CAISO)

The California ISO is tasked with overseeing the regular operation of the State's wholesale electrical grid and transmission assets. The Operator must also plan for future expansion and incorporation of renewable energy sources. According to their 2012 Strategic Plan, CAISO is expecting wind and solar to quadruple by 2020.

Regulatory authority over these considerations is shared by several state and federal entities with separate and sometimes overlapping responsibilities. The ISO is federally regulated and must simultaneously answer to the Federal Energy Regulatory Commission and state policy makers that oversee, among other things, utility resource procurement, infrastructure permitting and ratemaking.

THE CALIFORNIA PUBLIC UTILITIES COMMISSION (CPUC)

The CPUC regulates privately owned electric, natural gas, telecommunications, water, railroad, rail transit, and passenger transportation companies. The CPUC is tasked with serving the public interest by protecting consumers and ensuring the provision of safe, reliable utility service and infrastructure at reasonable rates, with a commitment to environmental enhancement and a healthy California economy. The CPUC regulates utility services, stimulates innovation, and promotes competitive markets, where possible.

Additionally, the CPUC promotes the California Solar Initiatives (CSI) plan which has a goal of producing around 2000 MW of installed rooftop solar by 2017. They are also responsible for several incentive programs associated with the CSI program such as the Single-Family Affordable Solar Housing (SASH) program, the Multi-Family Affordable Solar Housing (MASH) program, and the Research, Development, Demonstration & Deployment (RD&D) program.

INVESTOR OWNED UTILITY (IOU) – SCE

The IOU is concerned with the distribution of electricity across its local distribution grid and the maintenance of that grid. Additionally, the utility will also need to be aware of forecasts issued by CAISO regarding likely expansions in the renewable market as well as its obligations to meet the California State Governments goals as set forth under AB 2.

In the case study area, the IOU is Southern California Edison with territory covering 50,000 square miles and 14 million people. The utility follows legislation put forward by the Federal Energy Regulatory Commission (FERC), the CEC, and the CPUC.

SB 843 – COMMUNITY-BASED RENEWABLE SELF-GENERATION PROGRAM

Lois Volk's Community-based renewable energy self-generation program is aimed at filling in the gaps in solar generation at the community level. Currently, there is believed to exist significant opportunities to add hundreds, if not thousands of megawatts of solar to the State's energy portfolio. Governor Brown has stated that reaching 12,000 megawatts of decentralized solar is a goal for California to help it reach the 2020 goal of 33% renewables. This alone suggests that the State and other interested parties will likely work together to help achieve this goal.

As previously noted, NREL believes that only around 24% of the total rooftop area in the U.S. is viable for solar installations under current laws and policies. The other 75% or so of rooftops fall into those owned by renters and those which may be too old to support a solar array, located in vegetated areas or, otherwise shaded. There are however many open spaces, and viable rooftops if the assumption that they can only be used by owners is removed. If instead, a focus on community generation were to emerge, the benefits of solar ownership could be more equitably distributed.

The SB-843 was based on a concept first applied in Davis, California as a result of a policy of tree planting to help ease the heat experienced in the city. Although the trees work wonders for reducing the impact of the intense summer sun, it had the unintended consequence of preventing residents from installing solar panels on their rooftops. Clean Path Ventures teamed up with the City of Davis to install an array which fed power directly into the grid to help offset the City's energy needs (Buczinski 2011).

However, it was realized that if more people were to be included in community solar power they would need to not only expand the array significantly, they would also need to provide a legal framework for the City to provide access to the array for those interested in solar but unable due to shading problems. This led to the push for new legislation to allow the sale of power generated by the 'owners' to the grid for a credit against their bill. This effectively allows community members to fund their own renewable energy generation with the help of experienced solar service providers. The bill has since gone before the Senate where it garnered support with amendments in March, 2011. Later it was reviewed by the Senate Energy Committee where it was passed 8-2 also in March. It is expected to once again go before the Senate in July/August of this year.

The language from the original form of the bill indicates that REC's will be the property of the utility and that the energy credit rates would likely be at a wholesale rate. Under this regime, it would be difficult for community members to make this work financially. If the community could access the REC's they would likely see a benefit of two to three cents a kilowatt hour (kWh) (need source), while the credited rate at wholesale would run around six or seven cents per kWh compared to a more suitable retail rate around fifteen or sixteen cents per kWh. Similar to the Feed-in-Tariff proposed by the CPUC, this wholesale rate really only makes sense for the largest producers of solar power who are able to negotiate favorable PPA's and would effectively make operations less than two or three megawatts non-viable.

However these concerns could be addressed with a retail rate applied to power generated by a community facility and REC's distributed according to proportion of participation. This then would be a far more enticing scenario for outside investors, community investors, and community participants to share in.

DRIVERS OF COMMUNITY SOLAR PROJECTS

Community solar is primarily driven by the desire of communities to develop energy independence with the added benefits of consistent pricing. With the correct legislation it will also be cost effective compared to the cost of utilities building their own renewable generation, complete with transmission lines and Environmental Impact Statements (EIS) that go with that scale of development. These costs are passed on to consumers in rates hikes or incentives which are also taxpayer funded.

Communities interested in developing their own generation are also aware to a certain extent that top-down policy change is slow and hampered by states which are heavily invested in fossil fuels such as coal or oil. As a result of these realizations communities are developing a ground up strategy for creating a decentralized generation grid and taking advantage of the enormous infill opportunities available to this scale of development. Currently Many companies specialize in large solar project development and are uninterested in projects under a megawatt. However, with the likely passage of new legislation and an increasing push by community members to achieve what high-level policy makers cannot, it is likely that companies will begin to realize the potential for this niche.

FEDERAL INCENTIVES

1. BUSINESS ENERGY INVESTMENT TAX CREDIT (ITC)

Program Overview	
Name	Business Energy Investment Tax Credit (ITC)
Incentive Type	Corporate Tax Credit
Amount	30% for Solar
Maximum Limit	No limit (for Solar projects)
Application Deadline	December 31st 2016

Table i Commercial ITC. Source: DSIRE Website

The Business Energy Investment Tax Credit or the Commercial ITC, is a incentive based program available for renewable energy technologies, especially solar energy. It allows the owner of the qualifying project to take a one-time tax credit equivalent to 30% on the installed costs. The owner of the system should be of commercial, utility or industrial nature. The credits under this program can be claimed only by eligible projects which have been placed in service on or before

31st December 2016. The unused credits can be carried over for up to 20 years. According to the DSIRE website, the taxpayer must either construct the system or begin the original use of the array. Therefore, the use of a third party to finance this kind of community solar project will be beneficial, especially if that third party has a good tax appetite. The credit received from this program can be used to offset different types of taxes such as regular and alternative minimum tax (AMT) (Coughlin et al. 2010). For further information, please see the DSIRE website.

2. MODIFIED ACCELERATED COST RECOVERY SYSTEM (MACRS)

Program Overview	
Name	Modified Accelerated Cost Recovery System
Incentive Type	Corporate Depreciation
Application Deadline	31ST December 2012 (50% bonus depreciation)

Table ii Modified Accelerated Cost-Recovery System. Source: DSIRE Website

Depreciation is a financial concept where various assets of a business lose value over time for example, equipments and such. They will eventually need replacement. Many businesses usually keep a record of these expenses over time to account for this reduction in asset value. According to many, for eligible solar projects, this period is usually five years (Coughlin et al. 2010). If the community solar project is funded or designed to be handled by a 'business' entity, this federal tax policy will allow this business to depreciate its investments on an accelerated basis.

According to the DSIRE website, If the project also applies for Commercial ITC, the depreciable basis must be reduced by half the value of the ITC.

STATE INCENTIVES

1. MULTIFAMILY AFFORDABLE SOLAR HOUSING (MASH)

Program Overview	
Name	Multifamily Affordable Solar Housing
Incentive Type	Fixed, upfront capacity-based incentive
Amount	$3.30 to $4 per Watt

Table iii Multifamily Affordable Solar Housing. Source: California Public Utilities Commission

California's Multifamily Affordable Solar Housing (MASH) Program under the California Solar Initiative was established in 2008 and it aims to provide solar incentives on qualifying affordable multifamily dwellings. Under this program, residents of multifamily complexes are permitted to obtain bill credits from a single on site PV system. The building owner is responsible for allocating net metering credits to individual tenants and a building's general load (Coughlin et al. 2010). California Public Utilities Commission has indicated on their website that there is $32.9 million which is reserved for pending projects.

2. PROPERTY TAX EXCLUSION FOR SOLAR ENERGY SYSTEMS

Program Overview	
Name	Property Tax Exclusion for Solar Energy Systems
Incentive Type	Property Tax Incentive
Amount	100% of system value

Table iv Property Tax Exclusion for Solar Energy Systems Source: DSIRE website

Section 73 of the California Revenue and Taxation Code has a provision for property tax exclusion for certain types of solar energy systems. These systems must be installed between January 1, 1999, and December 31, 2016. Please check the California State Board of Equalization website for further information.

3. CALIFORNIA FEED-IN TARIFF

Program Overview

Name	California Feed-In Tariff
Incentive Type	Performance-Based Incentive
Amount	Tariff is based on the CPUC market price referent which is adjusted by time-of-use factors which are between 8am to 6pm.

Table v California Feed-In Tariff. Source: DSIRE website

The California feed-in tariff program allows a qualified customer who generates renewable-energy based energy to sell electricity by entering into a 10-20 year standard contracts with their respective utilities. The electricity is sold at market-based prices which will be as per the CPUC's market price referent (MPR) table which can be checked on the CPUC Resolution E-4137 (Coughlin et al. 2010). A customer-generator who sells power to the utility under this tariff is not allowed to participate in other state incentive programs.Please refer to the CPUC website for details about the current program and for updated information about their efforts to implement the program changes.

UPCOMING NATIONAWIDE AND LOCAL INCENTIVE PROGRAMS:

1. PROPERTY ASSESSED CLEAN ENERGY (PACE)

The PACE program is a voluntary program which is community based and not mandated by a federal party. The program provides long term funding from private investment markets at low cost and does not involve government subsidies. Interested home owners can opt-in to the program to receive financing for improvements on their property. This will be paid back through an assessment on their property taxes for up to 20 years. Presently, this program has run into hurdles put up by Federal Housing Finance Agency (FHFA). For more updates on this program, please look into the following websites.

PACE NOW - http://pacenow.org/blog/

DSIRE SOLAR - http://dsireusa.org/solar/solarpolicyguide/?id=26

2. SOLARIZE SANTA BARBARA – COMMUNITY ENVIRONMENTAL COUNCIL SANTA BARBARA (CECSB)

Solarize Santa Barbara is a pilot project that was carried out for a limited time period only running from May 1 to July 31, 2011. The program is being assessed right now and the CECSB intends to bring the project back to the public. To qualify for the program, the interested parties should live in the service territory (south Santa Barbara County) and own a suitable home for solar installation. In the pilot project, approximately 28 homeowners had signed contracts. For updates on this program please visit the CECSB website at the following address - http://www.cecsb.org/solarize-santa-barbara.

SECURITIES REGULATIONS

FEDERAL SECURITIES LAWS

Prior to 1933 when the Securities Act became law, the market was largely unregulated and many investors were attracted to companies offering huge profits while demonstrating little of substance to back up those claims. The stock market crash of 1929 changed the way securities changed hands and also led to the enactment of the Exchange Act in 1934.

SECURITIES ACT

This act requires companies to provide full disclosure of material facts regarding their investments for the purpose of aiding investors with financial decisions regarding buying shares in that companies stock. The SEC does not determine the quality of the information or whether the securities are good investments, merely that they follow the SEC's disclosure rules.

EXCHANGE ACT

The Exchange Act drives the disclosure of business management and financial decision-making so that the investor can make fully informed decisions regarding the quarterly performance of the company offering the securities. Directors and others related to financial operations must disclose relevant data, sometimes directly to the investors.

The SB-843 Bill is essential to operation of the community model because currently, there are a great many restrictions on people trying to form a company to manage their own assets in the form of community solar arrays. It is assumed from the business models currently available to community solar array purchasers that an LLC will provide the greatest benefit because it allows for the group to take advantage of the ITC (Investment Tax Credit) and the accelerated depreciation credit.

While there are several Federal and State exemptions (Rule 504-5-6) to the U.S. Federal Securities and Exchange Commission Laws and the California Securities Act of 1968 regarding shares trading for small businesses, they do require that investors be accredited (have a personal net worth of one million dollars or more) and that under certain conditions they may be 'sophisticated' investors, which is a less restrictive version of the accredited investor. Typically, an LLC must only sell shares with accredited investors due to the limited liability associated with its incorporation. This restriction severely limits the participation of those with limited assets.

If SB-843 opens up the number of participants beyond the current 35 'sophisticated' investors, it may mean a greater likelihood of financing these community arrays. At the moment it is not all certain that individual investors can find the necessary investment amount to cover a set number of panels in a particular array. If they can simply buy into a percent share and enjoy the benefits from that investment funding of community arrays is made less dependent on attracting the typical 'investment capital' which requires larger returns on investment.

FINANCING

RENEWABLE ENERGY CREDITS

Electricity generated from any renewable energy (i.e. solar, wind, geothermal, etc.) facility produces what are known as renewable energy credits, or RECs. A community solar installation will generate a certain amount of RECs, depending on the amount of energy the installation produces. It is important for anyone associated with a community solar project to understand the value of RECs and how they influence the cost of electricity production from the solar facility.

RECs are a product of all renewable energy generation and represent the environmental and other non-power aspects of renewable energy creation. Typically, RECs are measured in single-megawatt hour increments (1 REC= 1000

KWh = 1 MWh) and based on the megawatts produced by a renewable energy facility. In addition to documenting the amount of energy produced by a renewable energy facility, Renewable energy certificates usually specify the type of generation resource, the location of the renewable generator, when the generation occurred, vintage of the generator, eligibility for certification, and any associated greenhouse gas emissions produced by the generator (U.S EPA 2008).

In addition to the environmental benefits denoted by RECs, the certificates also have monetary value and can be bought and sold between multiple parties. As a "currency" of renewable energy, RECs allow owners to claim that renewable energy was created to meet their electricity demand. RECs are becoming increasingly popular as a way for federal, state, and local governments to meet renewable energy production goals. Often, utilities are allowed by state governments to use RECs in order to satisfy state renewable portfolio standards. Companies and individuals have also been utilizing RECs to meet a wide variety of goals, such as avoiding CO_2 emissions from fossil fuel generation, reducing air pollution, hedging against energy price spikes, brand differentiation, creating positive publicity, demonstrating civic leadership, and instilling company-wide and consumer loyalty.

The novelty of RECs lies in their ability to convey the attributes of electricity generated from renewable sources to buyers. When electricity is produced by a renewable generator, the electricity or electrons are fed into the electric grid and become non-differentiable from electricity produced by other generators, renewable and non-renewable. Therefore, it becomes impossible for consumers to know what kind of generator produced the electricity they are consuming. RECs help address this problem by allowing individuals to directly "consume" a product generated by a renewable energy source. RECs are also monitored and counted, certifying that the energy produced on behalf of REC buyers is differentiable and generated from a renewable source. One important note about RECs is that any generator owner wishing to make an environmental claim about the use of renewable energy from the generator must own the associated RECs to do so. Once the RECs are sold off, the facility owner cannot claim they are using renewable power despite still using the electricity from the renewable generator (U.S EPA 2008).

PRICE OF RECS

Stakeholders of a community solar project wishing to lower the effective cost of the electricity generated by the solar photovoltaic (PV) facility can sell the RECs created by their facility. The price of the RECs generally depends on the technology associated with the generator, the vintage of the generator, the volume of RECs purchased, the region where the generator is located, the eligibility for REC certification, the price of other generation sources, and if the RECs are bought for compliance or voluntary reasons (DOE 2011). RECs bought for compliance obligations must be sourced within the appropriate geographic location to be eligible for renewable portfolio standard (RPS) compliance, while voluntary RECs can be sourced regionally or nationally. REC prices can be difficult to determine and often require the assistance of a broker to determine price and handle transactions. RECs in voluntary markets often sell at a premium if they are competing with RECs used for RPS demand or are coming from regions with limited renewable resource. Solar usually commands the highest premium of all renewables at around $20/REC (SMU 2007). It would be advantageous for community solar stakeholders to hire a broker or consultant to help determine the price of their facility's RECs and to sell them on the market.

FORMING A LIMITED LIABILITY COMPANY (LLC)

An LLC is similar to a limited partnership but includes the legal protections of personal assets that a corporation allows without onerous formalities, fees, and paperwork (The Wall Street Journal). Members of an LLC are not personally liable for their liabilities and debts and can be taxed for their profits only once.

LLC can be managed by either by its members or one or more managers. If an LLC is managed by its members, the owners are directly responsible with running the company, creating a "member-managed LLC." If a manager (or managers) is chosen by the members to manage the LLC, then manager's role becomes similar to that of a director of a corporation. A manager may or may not be an actual member of the LLC. If a manager runs an LLC, then the members are not directly responsible for running the company and thus there is a risk that the non-managing member's interest will be deemed a security. Ownership in an LLC can be determined by percentage or by membership units, which are analogous to shares of stocks in a corporation. Both cases allow for the right to vote the right to share in profits (Coughlin et al. 2010).

The main advantage of forming an LLC for a community-scale solar project is that the company is not liable for debts and liabilities of the LLC. LLCs can also use the cash method of accounting, where income is not taxed until it is received. An LLC can be taxed as either a pass-through entity or as a regular corporation. A regular corporation pays a corporate tax on income and then the stakeholders pay income taxes on the dividends. The pass-through entity nature of the LLC allows profits to be passed on to the owners who pay taxes at their individual tax rates. This is advantageous because members can deduct operating losses against their regular income as allowed by the law, which is useful if losses are projected for the first few years of the operations (Coughlin et al. 2010).

There are a couple of disadvantages associated with an LLC. LLC have only been around for about 30 years and small banks are usually reluctant to lend to LLCs. Also, many legal issues associated with the format of an LLC have not been finalized because of its short history. Although LLCs are attractive because of their ability to relive members of liability, a member can still be liable for LLC debts if the member personally guarantees debt, if personal funds are used in conjunction with LLC funds, if the LLC has minimal insurance, or the members do not contribute enough funds to the LLC when it is formed. To ensure that members are protected under an LLC, owners should keep separate records and not mix personal affairs with the business of the LLC. Most importantly, LLC money should not be mixed with personal money. While an LLC has fewer formalities than a corporation, there is more paperwork need than for a sole proprietorship or partnership. LLC agreements are important in outlining the relationship of the members, financial structure, and the regulation of membership. If an LLC agreement does not exist, the state's LLC laws are applied to the LLC (Coughlin et al. 2010).

CREATING AN LLC IN CALIFORNIA

The first step in creating an LLC is to create a "business name" that will represent the company. The name should not be the same or blatantly similar to any other California LLC or foreign LLC registered to do business within the state. Although not required, it may be useful to register the name as a state and/or federal trademark. Next, all new LLCs must file an "articles of organization" with their secretary of state's office. Such a form can be obtained from the California Secretary of state website and the filing fee is $70 dollars. California also requires an operating agreement to be created in order to form an LLC. The operating agreement may outline how meetings are conducted, how the company is managed, capital contributions of the company members, and profit and losses allocation. It is not necessary to file the agreement with the state. A lawyer is not required to create an LLC but it may be advantageous to have one look over agreements.

The next step is to file a statement of information with the secretary of state within 90 days of filing the articles of organization. The filling fee is $20. A statement of information must be filled every two years after the original statement is filed, with a $20 filing fee being paid each time. After the statement of information is filled, it is imperative that any local licenses required for the business are obtained.

If the LLC for the community solar project requires the hiring of employees, there are certain guidelines that must be followed. A free employee identification number should be obtained from the IRS. If an amount equal to or above $100 is paid to an employee, then the LLC is subject to employment taxes and must register for a California employer account number within 15 days of paying $100. When an employee is hired in California the IRS and the state of California must be informed. The LLC must also carry workers compensation insurance if there are employees in California.

California imposes an $800 minimum franchise tax on LLC's doing business in the state. It may be necessary to open a banking account for the business to keep the business's finances away from personal accounts (Citizens Media Law Project 2010).

SITING ISSUES

LAND USE

The parcel[1] of land chosen for the case study for EMID is set aside by a deed[2] with a condition limiting its use to non-commercial purposes. The condition reserves the right for future housing construction, but severely limits the type of commercial enterprise that might be performed on the parcel. EMID holds the deed with the condition attached and would be responsible for granting permission to use it for the purpose of solar generation for the use of the community.

The County of Santa Barbara South Coast Zone for unincorporated areas zones the Parcel as Ag-II-100[3], meaning it is not prime agricultural land, details can be found in the Santa Barbara County Coastal Plan (2009). Additionally, the parcel falls within the coastal zone[4] as described by the California Coastal Act of 1976 and is administered by the California Coastal Commission. We initiated a discussion with the Ventura office of the Coastal Commission and learned that, depending on the

[1] APN Map 07926 (appendix)
[2] See deed (xxxx) located in appendix
[3] See Zoning Map inset (appendix)
[4] See Excerpt from Co. Santa Barbara Zoning Map

scale of the array, we could likely get a conditional use permit depending on confirmation of our assertions below.

Conditional Use Permits allow limited development on the conditions that the project does not significantly affect the view-shed for the public using state highways and recreational areas, does not interfere with a habitat corridor, is not on prime agricultural land, and does not take away or interfere with endangered species habitat. As the land is bordered by roads on all sides and abuts the 101 freeway, we believe that it is not a corridor for any species. The parcel is also mowed regularly to reduce fire risk, is crossed by paths used by residents for walking dogs and riding mountain bikes and for these reasons we believe the parcel is not likely an endangered species habitat.

The parcel receives limited use as a recreational area by the residents and for this reason we should be conscious of the area required to build the array. With this is in mind it is worth considering the advantages of mono-crystalline panels since this is the most energy dense option and therefore requires the least amount of land per kilo-watt of generation. However, other options are available which largely depend on the cost of the land, and the value of the land for recreational use versus energy generation for the community

Figure 1 View eastwards across proposed site of community solar array

Figure 2 SCE Interconnection Map - Red suggests poor siting with increased interconnect costs likely

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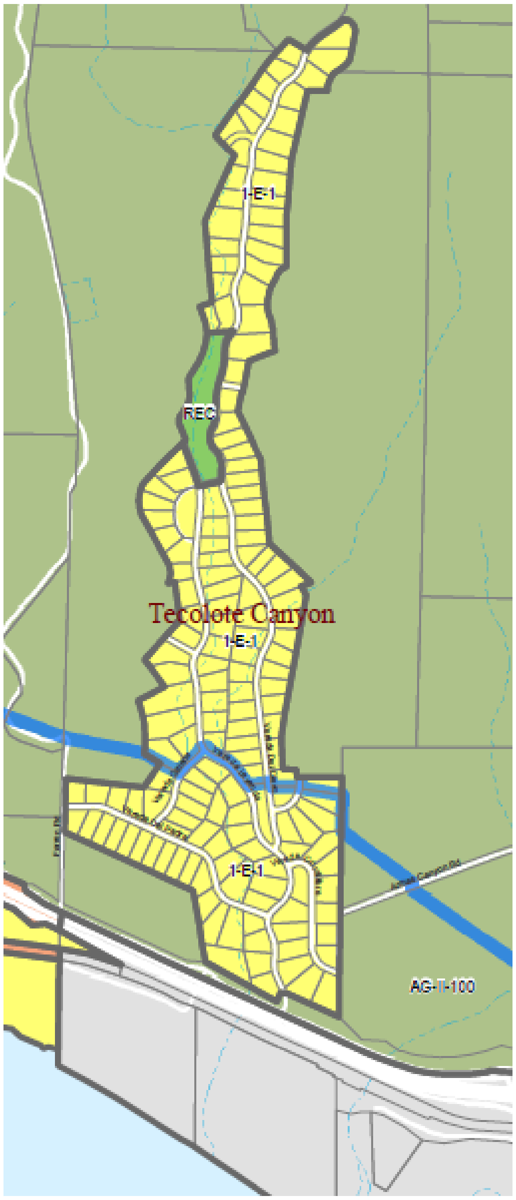


Figure 3: Zoning view showing Coastal Zone (Blue Line)

ROOFTOP USE

TRANSMISSION AND INTERCONNECTION

Transmission and Interconnection of electricity is an important aspect of any electricity generating system. Specifically, in the context of community solar projects in California it becomes an important aspect to take into consideration. This is because the current legislation of the state requires the generated electricity to be transmitted to the utility to claim the applicable credits.

The electricity received by consumers are distributed by utility companies which are either municipal utilities or investor owned utilities (IOUs) (IEP 2012). Sacramento Municipal Utility District (SMUD) and Los Angeles Department of Water and power are some examples of municipal utilities, PG&E and Southern California Edison are some examples of IOUs.

Transmission of electricity in this context refers to the manner in which the power generated is transmitted to the end users. It is reported that utilities in California receive their wholesale supply of electricity from a network of high voltage transmission wires which are connected to 11 western states, 2 Canadian provinces and Mexico (IEP 2012). California Independent System Operator (CAISO), a non-profit entity operated this network. Federal Energy Regulatory Commission (FERC) which is an independent federal agency, regulates all the Independent System Operators (ISOs) like CAISO are regulated by the (IEP 2012).

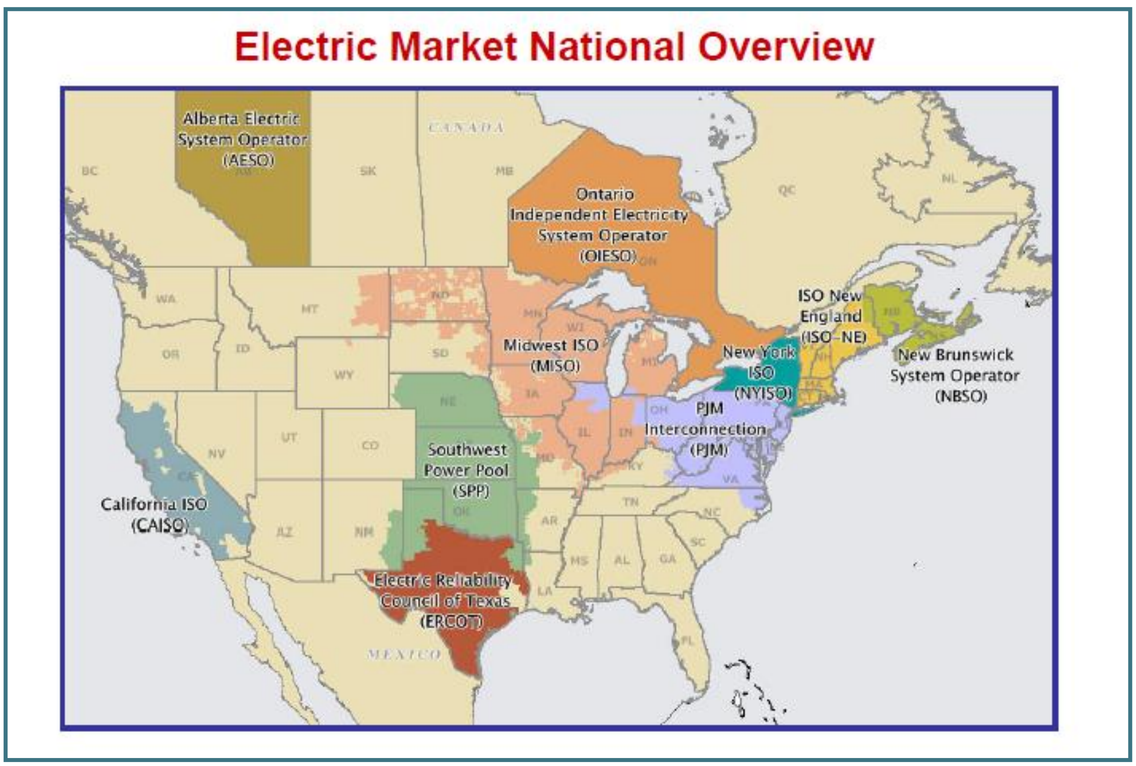


Figure 4: FERC's Electric Market Overview. Source - www.ferc.gov/oversight

Figure 3 shows all the ISOs regulated by the FERC.

Assuming that most community solar projects will be around the capacity of 2 MW or lower, the project owners could apply for a 'Fast Track' process (nwcommunitynergy.org). This process will help get a project online with the local grid. According to FERC, the steps involved are flexible, but at the discretion of the corresponding utility. They are:

1. Submit Interconnection Request to Transmission Provider
2. Scoping Meeting with Utility
3. Feasibility Study
4. System Impact Study
5. Facilities Study
6. Interconnection Agreement

To accommodate an extra electricity load, an existing utility grid might need network upgrades. These upgrades need installation of complex technical machinery which is usually expensive. The project group conducted an informational interview with an official from Southern California Edison. It was learnt that assuming a system of this size has standard transmission lines at close proximity and does not need any network upgrades; it will be inexpensive to get a project online the SCE grid. A security deposit of around $5000 will be charged and will be returned once the project is connected to the grid.

TECHNOLOGIES

MONO CRYSTALLINE SI

Mono-crystalline was invented in 1955 and is considered the first PV technology to be developed. The single crystal modules of monocrystalline panels are made up of cells cut from a piece of continuous crystal ingot. The ingot is created by heating silicon dioxide of crushed quartz or either quartzite gravel in an electric arc furnace. The silicon rod that is produced is then passed through a heated zone several times in order to sequester impurities at one end of the rod for removal. This pure silicon seed crystal rod is then put into a Czochralski growth apparatus and dipped into melted polycrystalline silicon. A small amount of boron is added and the seed crystal is withdrawn, forming a cylinder ingot of very pure silicon. The ingot is then sliced into very thin circular wafers. The wafers can be fully round or trimmed into other circular shapes in order to minimize waste. The cells have a uniform color of dark blue or black because they are cut from a single crystal (Wholesale Solar). The wafers are placed back to back and put in a furnace to be heated to 1,410 degrees Celsius, a temperature close to the melting point of silicon. Phosphorous gas is present in the furnace and the phosphorous atoms enter the porous, almost liquefied silicon (Solar Facts and Advice 2010). The addition of boron and phosphorous to the silicon crystal is known as "doping" and the silicon to conduct more electricity (Process Specialties Inc).

There are numerous advantages associated with monocrystalline panels relative to other types of PV solar technologies. Generally, monocrystalline is more efficient yet more expensive than the newer and cheaper polycrystalline and thin-film PV panel technologies. The most efficient monocrystalline panels can have an efficiency of 24.2 %, which is more efficient than any other commercially produced solar panels available. Monocrystalline panels also have a higher longevity compared to other types of solar panels with some monocrystalline systems lasting up to 50 years. However, the longevity comes at the expense of efficiency since panels tend to lose a certain amount of efficiency every year there are in service. Monocrystalline panels may also be more environmentally friendly than other types, particularly thin film, because they do not use toxic components like cadmium telluride (CdTe). Monocrystalline solar modules also tend to have higher heat resistance than polycrystalline cells. Finally, monocrystalline panels seem to have a higher "bankability" than other types of panels in area, such as Germany, where they have a proven track record or performance (Solar Facts and Advice 2010).

While monocrystalline have many clear advantages over other types of solar panels, they do have a few disadvantages. Like most solar panels, monocrystalline have a high initial cost, especially since the silicon feedstock to manufacture the panels is expensive. However, the payback period associated with monocrystalline is usually better than for other solar panel technologies. Another disadvantage associated with monocrystalline panels is their fragility. Most solar panels are quite fragile and can be damaged or broken by falling debris even though they are often protected by a layer of glass (Discover Solar 2011).

POLYCRYSTALLINE SI

Polycrystalline cells are produced from silicon material similar to that used for monocrystalline panels except that the cells are not formed from a single crystal. Instead, the cells are melted and poured into a mold that forms a square block from which square wafers can be cut. This method produces less waste of material or space than round single-crystal wafers. When the material cools, it forms imperfect crystals and random crystal boundaries. This imperfect crystallization means that the area per watt for polycrystalline models is larger than most single crystal modules, resulting in less efficiency. Other methods of creating polycrystalline modules include growth of crystalline film on glass and ribbon growth. Polycrystalline modules, as well as most crystalline silicon modules, are usually finished by laminating the cells between a tempered class front and a plastic backing using a clear adhesive and then framed in aluminum (Wholesale Solar).

There are certain advantages and disadvantages associated with polycrystalline solar panels. Polycrystalline panels are generally less expensive to buy and manufacture than monocrystalline panels yet are considered equally reliable.. However, polycrystalline panels are less efficient than monocrystalline panels and may be aesthetically unpleasing because of their multicolored look caused by having multiple crystals within the module (Discover Solar 2011).

THIN FILM PV

Amorphous or "thin film" solar panels are made with microscopically thin deposits of silicon or cadmium telluride that are deposited on a sheet of glass or metal. The cells are then deposited next to each other instead of being mechanically assembled. The thin film method of manufacturing solar modules requires less work and less semiconductor material than needed by other types of solar panels. The thin film panels are lightweight and can be made flexible by applying a plastic glazing. Thin film panels can even have tears or holes in their modules and still function. Another advantage associated with thin film is that they are more efficient than crystalline panels under low light conditions. Thin film panels are also less susceptible to power loss while being partially shaded. The main disadvantages associated with thin film are lower efficiency and durability than other solar panel technologies. The lower efficiency rating of thin film panels means that more space and mountings would be needed to achieve the output of crystalline panels. The thin film panels tend to be less stable than crystalline panels, which causes more degradation over time (Wholesale Solar).

SOLAR PANEL TECHNOLOGY RECCOMENDATIONS

A summary of the advantages and disadvantages of the various solar technologies is displayed in the table below:

	Monocrystalline	**Polycrystalline**	**Amorphous or "Thin Film"**

Advantages	• Most efficient • High longevity • More environmentally friendly • Higher heat resistance than polycrystalline • Proven track record	• Less expensive than monocrystalline • As reliable as monocrystalline	• Made with less materials and work than other panels • Flexible • Durable • Efficient under low light conditions • Little power loss while being shaded
Disadvantages	• High initial cost • Very fragile	• Less efficient than monocrystalline • Less aesthetically pleasing than other panels	• Less efficient than other types of panels • Experience more degradation than crystalline panels

Monocrystalline panels have the highest efficiency of the three panel technologies discussed above with an average efficiency range of 13-17 percent. Polycrystalline has an average efficiency range of 11-15 percent, whereas thin film panels have an efficiency range of 6-8 percent. Monocrystalline panels are traditionally the most expensive, followed by polycrystalline and thin film panels (Evo Energy 2011).

The type of panels that a community should invest in for a community solar installation will principally be based on the amount of money people are willing to spend and the amount of space available. For the Rancho Embarcadero community, the best solar panel option may be thin film because of the low price and the space available. Rancho Embarcadero has over 19 acres of cleared land appropriate for a community solar site, which is sufficient space for a thin film array to be installed to meet their energy demand. For example, a megawatt of thin film panels would require around 10 to 13.5 acres of land (Solar By The Watt 2009). However, if a smaller portion of the Rancho Embarcadero land is allocated for community solar, then a more efficient type of panel, such as monocrystalline, may be required which would typically occupy less than 5 acres per megawatt.

ENERGY STORAGE

Energy storage in this context means the technology capable of storing the generated electricity from a community solar project for later use. Energy is mainly stored to supply generated electricity at peak demand and also to balance any fluctuations in the electric grid (Deal et al. 2010). Energy storage is a key in any electricity generating system.

NEED FOR ENERGY STORAGE IN COMMUNITY SOLAR PROJECTS

An energy storage system in electricity generation, distribution and transmission offers various benefits. There are some important services it can provide especially for a community solar project. They are listed as follows (Deal et al. 2010):

1. Savings in monthly energy bill:

It is a well-known fact that consumers pay more when they use grid electricity during peak hours of the day. By drawing electricity from their energy storage during these peak hours instead of the grid, consumers will be able to save on their monthly electricity bills.

2. Profits earned by selling stored electricity:

Communities can store the electricity generated on-site and later sell it to utilities, schools, commercial buildings, manufacturing facilities or any interested party.

3. Steady, dependable and greener back-up power:

Community members can use the electricity captured in storage systems when black outs occur. On the other hand, communities could also sell this stored electricity to utilities when there is a power outage.

COST OF ENERGY STORAGE

There are many types of energy storage technologies because they are designed for varied applications. And for this reason, the costs of energy systems vary greatly too (Deal et al. 2010). The costs depend on the amount of power stored and the duration for which they need to be supplied. Other factors that influence the price of the system are efficiency and life span.

POLICY AND REGULATIONS FOR ENERGY STORAGE

There are many barriers that have prevented energy storage devices to be integrated into renewable energy extensively. Barriers may include high costs or the lack of a reliable technology presently in the market. Some experts feel that a major barrier is that no clear policy directs power producers to integrate energy storage in their systems (Lin and Damato 2010).

In 2011, Senators Ron Wyden, Susan Collins and Senate Energy Committee Chairman Jeff Bingaman introduced the Storage Technology for Renewable and Green Energy Act of 2011 (STORAGE). STORAGE is designed to support the growth of energy storage technologies (Wyden 2011). Senator Collins in a press release said "The STORAGE Act would help advance energy storage technologies to improve the efficiency of the nation's electricity grid, and energy storage for industrial, commercial, and residential establishments, while helping to promote wider use of clean, renewable energy."

The STORAGE Act intends to offer business incentives for the development of energy storage technologies. The STORAGE Act offers a 20 percent investment tax credit of up to $40 million for energy storage systems that are connected to the grid. It also provides a 30 percent investment tax credit of up to $1 million to businesses and homeowners for their on-site energy storage systems (Wyden 2011). This will encourage homeowners and businesses to install on-site renewable energy systems or help make their existing ones energy efficient.

WHAT DOES THIS MEAN FOR COMMUNITY SOLAR?

Energy storage systems offer a benefit for those communities who are located in remote areas. Additionally, as previously mentioned, communities could sell stored electricity back to the grid which might shorten the payback period of such a project, but only if storage becomes financially viable on smaller scales.

SPATIAL ANALYSIS

OBJECTIVES:

The key objective of the spatial analysis was to find the location and size of suitable areas for community solar projects in the state of California. Finding these locations needed the team to define certain 'constraints' for the analysis. These constraints when applied to the spatial analysis would produce the required results.

For this section, we chose to run our analysis on three counties in California – Santa Barbara, San Luis Obispo and Ventura collectively called the Tri-County Region.

Here and ideal site for community solar project would have the following attributes:

1. The project site (land or rooftop space) would be closely situated near cities and communities. This would also mean that there will be grid transmission lines close by and costs for the transmission of generated electricity will be minimal.
2. The project site will not be situated on federal, military or national and state park lands. It will either be privately owned or belong to the Bureau of Land Management (BLM).
3. There will be adequate amount of sunlight throughout the year to generate the required amount of electricity.

Figure 5 depicts the ideal site for community solar in the form of the Venn diagram. Each circle represents the key requirement used in the spatial analysis.

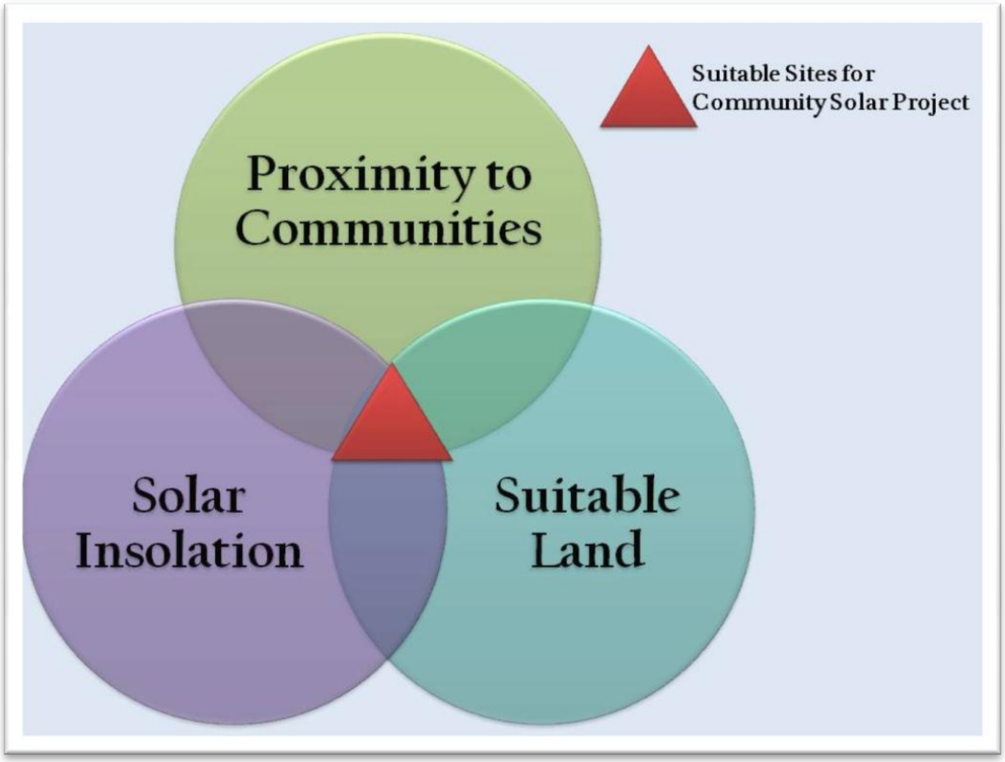


Figure 5: Spatial Analysis Objectives

METHODOLOGY:

PROXIMITY TO COMMUNITIES

The aim of this part of the analysis is to filter out the communities living in either very densely populated areas or, sparsely populated areas. Very dense areas might not have sufficient land space to install a PV array. Also, areas with very small population densities might not have sufficient resources in terms of transmission lines and number of participants needed to make their business model viable.

For the analysis, population densities of the three counties were calculated and the 20-80 percentiles were termed as the ideal population density. Population densities above 80 per cent were regarded as very high and densities below 20 per cent were very low and therefore disregarded in this study. The Census Tract 2010 shape files from the U.S Census Bureau website for the three counties were used to calculate the population densities.

SOLAR INSOLATION

National Renewable Energy Laboratory (NREL)'s Solar Energy Potential data was used to analyze the amount of solar radiation received by the three counties. This data represents the annual average solar resource potential in kWh/m2/Day for a flat plate collector, such as a photovoltaic panel. The values in the data set represents the average solar energy available to an array oriented due south at an angle from horizontal equal to the latitude of the collector location. The low resolution data set is calculated on grid cells of approximately 40 km by 40 km in size. According to this data, all the area covered by the three counties has either 'Excellent' or 'Very Good' potential for flat plate solar energy production. This translates to about 5901-5977 kWh/m2/Day for 'Excellent' and 5977-6093 kWh/m2/Day for 'Very Good'.

SUITABLE LAND

The base map 'USA Federal Lands' by ESRI was used to determine the areas that cannot be used to install community solar arrays. This data layer represents the federal and tribal lands in the United States. This data set also included the lands covered by state parks. Please find the complete citations in the references sections. Figure 6 shows Federal, State, Tribal and State park lands in the Tri-County Region.

RESULTS

Overlapping the three datasets and applying the constraints showed that the total area suitable for community solar projects is 599356 acres for the three counties. The total area of the three counties of Santa Barbara, San Luis Obispo and Ventura is 6152207 acres. Therefore approximately 10 per cent of the total area in these counties has suitable land for community solar projects.

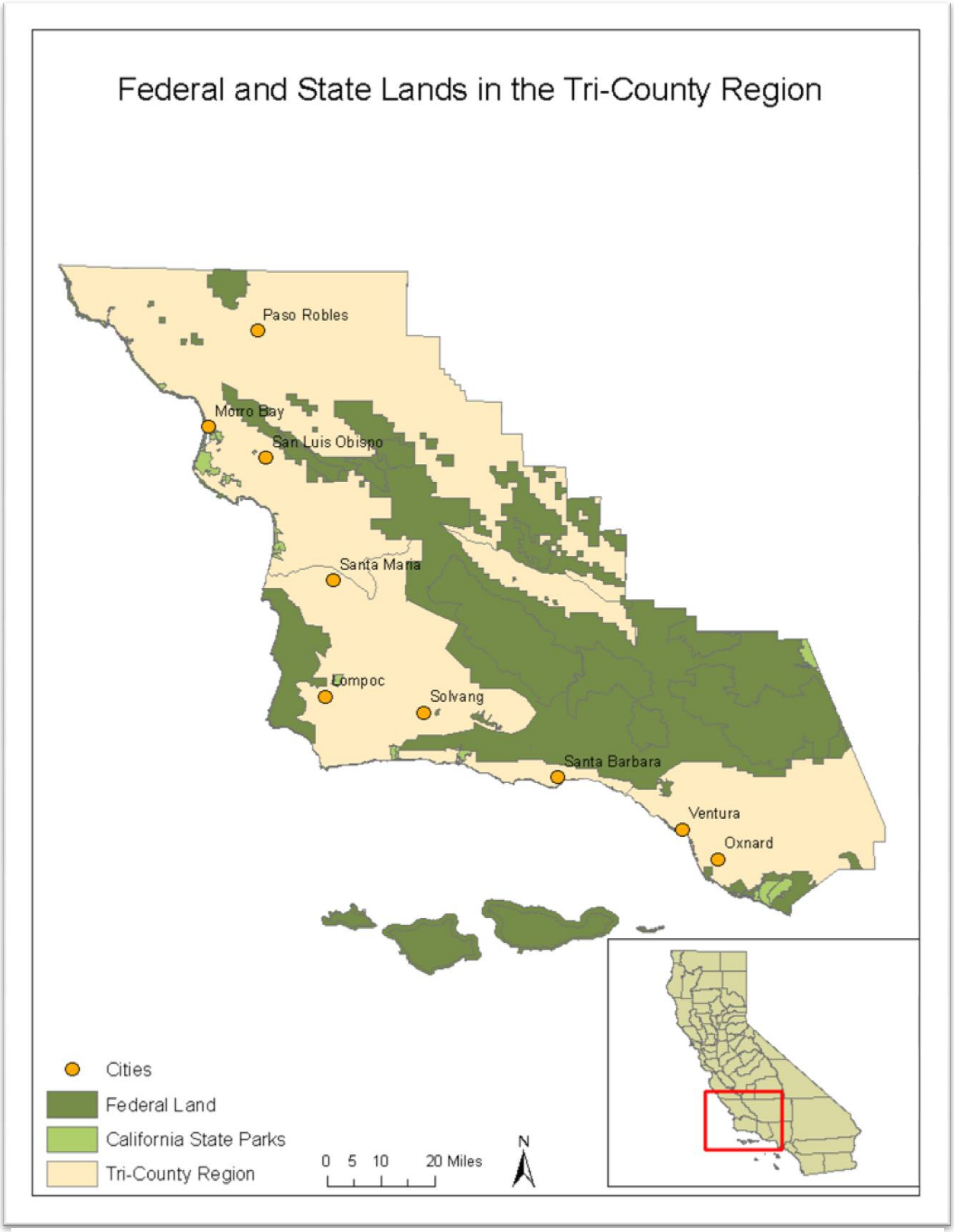


Figure 7: Map of Federal Lands in Tri-County Area

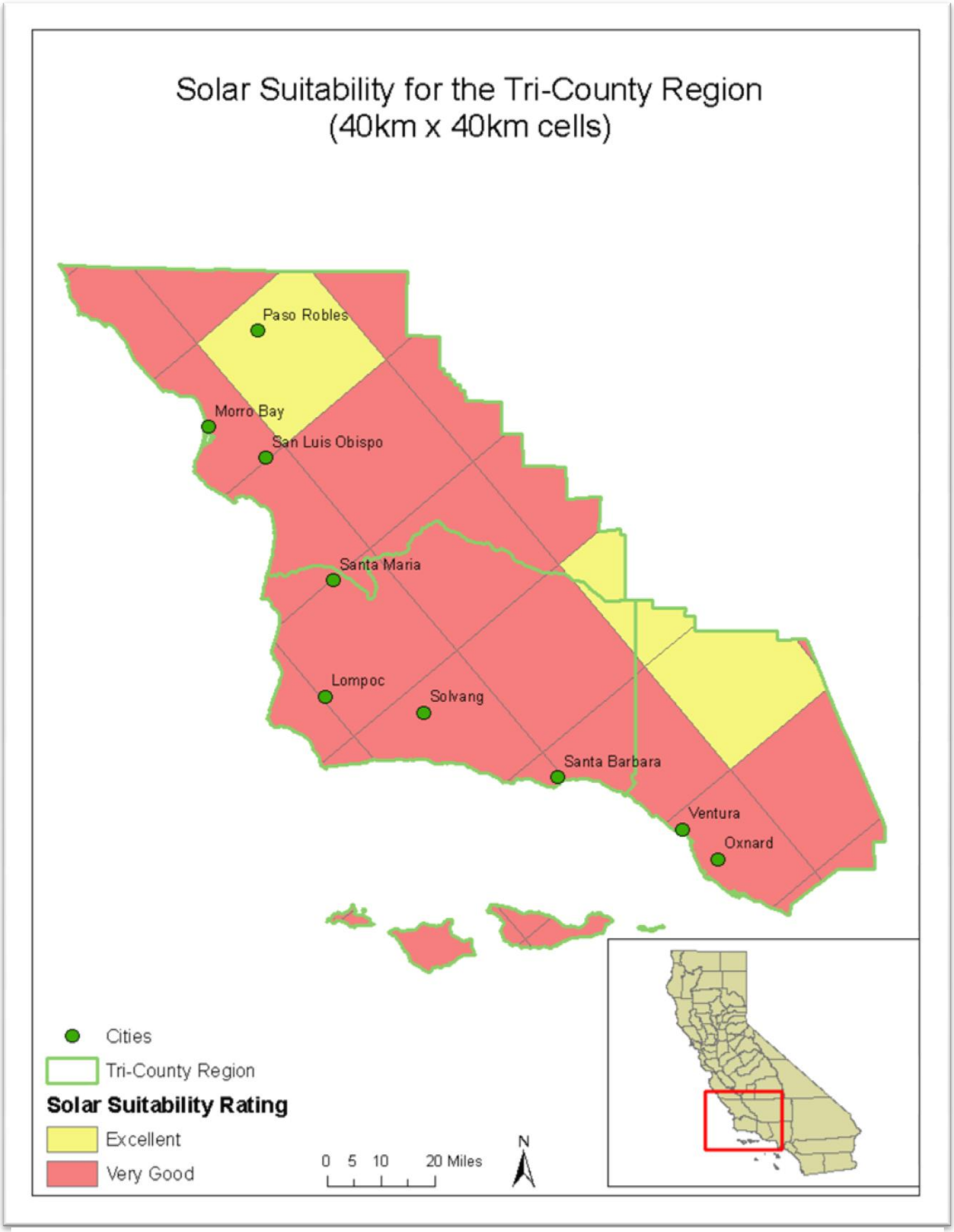


Figure 8: Solar Suitability for Tri-County Region

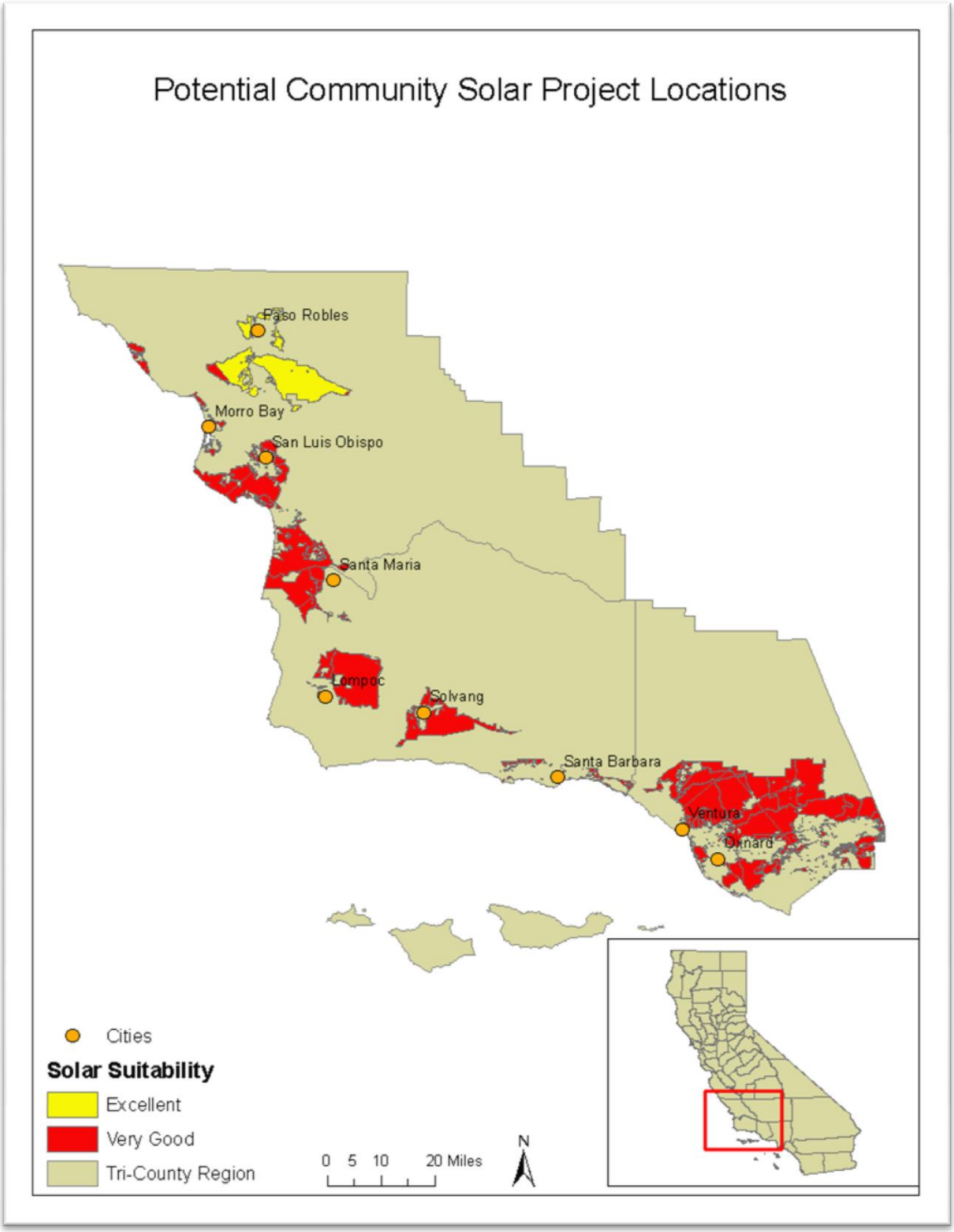


Figure 9: Suitability Map for Tri-County Region

EXISTING BUSINESS MODELS

This chapter explores the different community solar projects that are in operation presently in the country. This section aims to familiarize the reader with the different aspects of such a project and which will be explained in more detail in the following chapters. The studies differ in type because in each case the motives for building the projects differ. The following factors also help shape the business model (Coughlin et al. 2010):

1. Deciding how the costs and benefits are shared. For example RECs, revenue generated from selling electricity etc.
2. Taking into consideration the financial and tax implications of a community owned solar array.
3. Examining the implications of legal issues. This includes securities regulations, business and utilities regulations etc.

These business models can be divided into three categories depending on the owner and operator of the project (Coughlin et al. 2010). They are:

1. Utility-Sponsored Model: In this case, a utility owns and/or operates a system and offers a variety of participation options to the consumers.
2. Investor-Owned Model: Here, a business venture, mostly in the form of an LLC develops a project of this nature.
3. Non-Profit or Philanthropic Model: Here corporations or donors contribute for the capital costs of such a project.

UTILITY-SPONSORED MODEL

The local electric utilities can suitable sponsors for community solar projects. This is because utilities already have infrastructure capabilities to manage legal, finance and project management aspects needed to implement such projects. In the case of co-ops and investor owned utilities, this option, similar to the following example of Sacramento Municipal Utility District, might be a good alternative to consider.

EXAMPLE: SACRAMENTO MUNICIPAL UTILITY DISTRICT (SMUD) SOLARSHARES PROGRAM

The SolarShares program is offered by SMUD. According to their website, the subscriber pays a flat monthly fee to subscribe to SolarShares. The fee is based upon their historical energy use and the share size the subscriber selects. The subscriber receives energy credits on their electricity bill corresponding to the solar power their ‘SolarShare’ generates. Their SMUD bill will combine both the flat monthly fee and energy credits.

At the time of the construction, SMUD did not own the system instead a solar developer (EnXco) built, owned and maintained the 1-MW system (Coughlin et al. 2010). EnXco and SMUD have a PPA (Power Purchase Agreement) for a twenty year term. The generated electricity from the project is fed directly to the grid. The customer’s fixed monthly fee is based on two factors; the amount of PV they have agreed to subscribe to ranging from 0.5 – 4 kW and their average electricity consumption. SMUD makes the investment cheaper for customers who use less electricity in order to promote energy conservation. The customers are allowed to participate in the program for as long as they want. It is reported that there are around 700 residential SolarShares customers subscribed.

INVESTOR-OWNED MODEL

This is a good option to explore when the investors have a healthy tax appetite and can claim the tax incentives offered to commercial solar projects. The key points that need attention to make such a model viable are (Coughlin et al. 2010):

1. Using the federal and state tax benefits to its fullest.
2. Utilizing members outside the community with large tax appetites (if any) on one hand and serving the community on the other at the same time.

EXAMPLE: UNIVERSITY PARK (UP) COMMUNITY SOLAR LLC, MARYLAND

UP is a limited liability company formed in 2010 by the residents of Maryland. The main objectives were to generate on-site electricity to replace grid electricity. According to their website, the residents wanted to reduce the use of fossil fuel and stabilize electricity rates. The LLC used an installer, Standard Solar Inc. to install the solar panels on their host site – University Park Church of Brethren. The installer maintains the panels. The LLC sells the power generated from the panels to the Church and also sells the RECs earned during the project operation. The LLC has a Power Purchase Agreement for a term of 20 years with the Church who pays the LLC on a monthly basis. ComSol members interviewed members of this LLC. There are presently 35 investors from the community. Each investor can contribute according to their financial abilities and therefore owns a proportional share in the earnings. The total project size is 22 kW and the total cost was $133,315. The payback period estimated for the project it 6 years. Please check UP's website for further details (www.universityparksolar.com)

NON-PROFIT OR PHILANTHROPIC MODEL

In this scenario, the donors might not be able to reap the benefits of the solar installation. Their motivation will be to reduce energy costs for the non-profit that they choose to support (Coughlin et al. 2010). The donors will be able take advantage of the tax benefits accrued by the project when with state policies like SB 843 and virtual net metering become active.

EXAMPLE: SOLAR FOR SAKAI, BAINBRIDGE ISLAND, WASHINGTON

A non-profit organization from BainBridge Island called Community Energy Solutions raised funds to implement this project. This array is installed on Sakai Intermediate School (Bonneville Environmental Foundation 2008) . Twenty-six community entities made donations to Community Energy Solutions which were tax-deductible. The school (host site) owns the PV system and the generated power. As per their website, the construction of the 5.1 kW system was completed in January 2009.

CASE STUDY – RANCHO EMBARCADERO COMMUNITY

BACKGROUND

In order to gain a deeper understanding of the process of creating a community solar installation, it became necessary to identify and solicit a local residential community to take part in the project as a case study. The Rancho Embarcadero Community was identified as a potential candidate for a community solar because it possessed a number of characteristics conducive to the implementation of a community solar project. The most important aspect of the community that set it apart as a good candidate for community solar was its ownership of a parcel of empty land suitable for a solar installation of sufficient size to handle the energy demand of the community. The parcel of mowed land is approximately 20 acres in size and easily accessible by vehicles since it has a road on three sides. The land is suitable for development since it is low grade Agricultural-II land with few restrictions and is not a species corridor. The presence of a homeowners association makes it easier for the mobilization of the community for a community solar project. Also, the community is not located in an isolated rural area and therefore would not require any additional transmission lines. Finally, because the community has many shading and siting issues, a community solar installation could serve the needs of those homeowners desiring rooftop solar but who are constrained from doing so.

DATA COLLECTION

While there were many features of Rancho Embarcadero that made it a strong preliminary candidate for a community solar installation, it became necessary to gather data from the community in order to perform a complete analysis. The data would be collected through the use of a survey that would be sent to the roughly 150 households that made up the community. The survey that was created contained 15 questions, a cover letter that explained the purpose of the study, and instructions for filling out the survey. The questions featured on the survey addressed a number of topics including monthly energy consumption, interest in community solar, knowledge of solar energy, and receptiveness towards renewable energy and sustainability. The qualitative information obtained from the survey would be used to gage community interest in such projects, while the quantitative data would be used for installation modeling purposes.

Before the survey could be sent out to the homeowners, the Rancho Embarcadero homeowners association was approached by the group project members, along with Professor Chris Costello, and apprised of our project and the desire to use Rancho Embarcadero as a case study. The homeowners gave their blessing and a small article about our group project was included in the homeowner's association monthly newsletter in order to prime the homeowners for the survey. Approaching the homeowner's association and including the article in the newsletter were measures taken in order to reduce non-response bias by allowing more homeowners to be aware of the survey and encouraging them to participate. Approval for the survey was granted by the UCSB Human Subjects Board in November 2011. The survey and survey cover page was handed out to each house in the community along with a self-addressed envelope and paid postage in order for the homeowners to mail back their completed surveys. The surveys were distributed in early December 2011 and 27 out of 150 surveys were completed and mailed back within two weeks. Although the returned surveys amounted to an 18 percent participation rate and it was decided to send out the survey again in attempt to encourage greater participation. The second survey distribution was done through an internet survey created on surveymonkey.com. The online survey was an exact replica of the earlier survey and the link to the survey was included in the homeowner's association monthly newsletter for February 2012. After the newsletter was sent out, two online surveys were completed and submitted, bringing the total responses to 29 out of 150, or 19.3 percent.

ANALYSIS OF DATA

Table I shows that of the 29 respondents, 24 households relied on electricity from the electric grid provided by Southern California Edison. Five of the households obtained their electricity from a rooftop photovoltaic system.

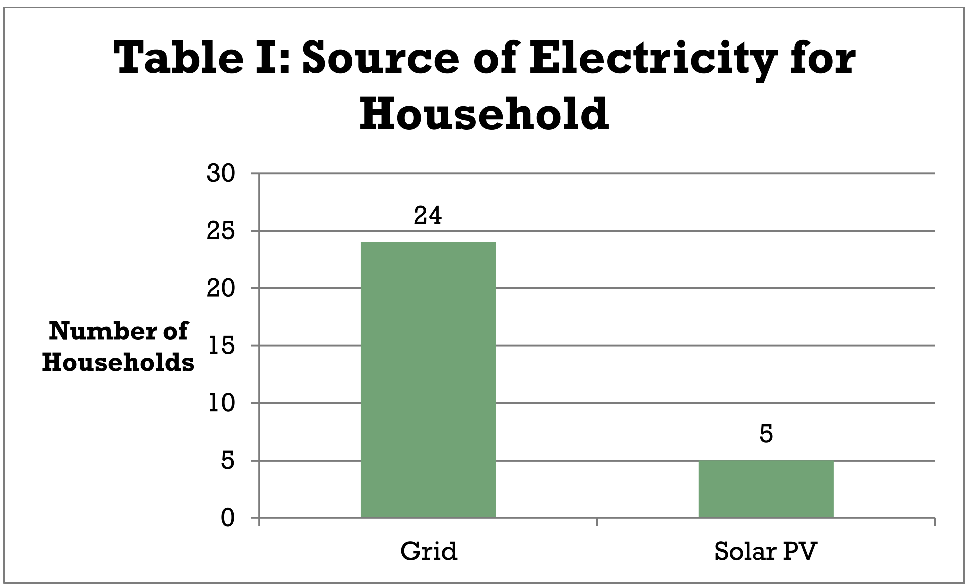


Table II shows the number of households that have attempted to install a solar PV system. The results show that 65 percent of respondents have not seriously attempted to install a system.

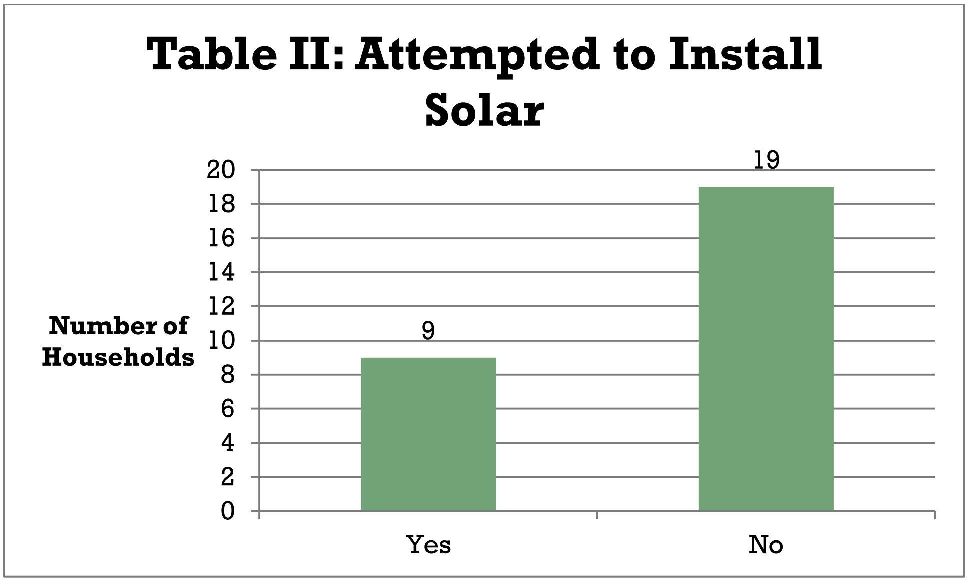


Table III shows the various reasons the respondents gave for not installing solar. Around 41 percent of respondents said cost as the main factor in preventing them from installing solar. Interestingly, shading was not a commonly cited reason for avoiding solar installation.

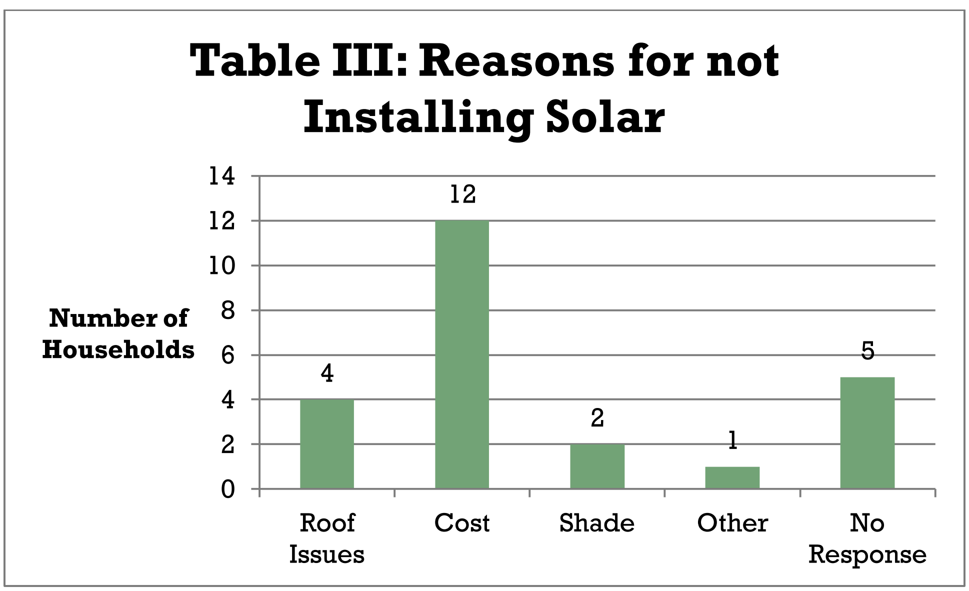


Table IV demonstrates the number of households interested in purchasing renewable energy. Of the respondents, 65 percent were interested in purchasing renewable energy.

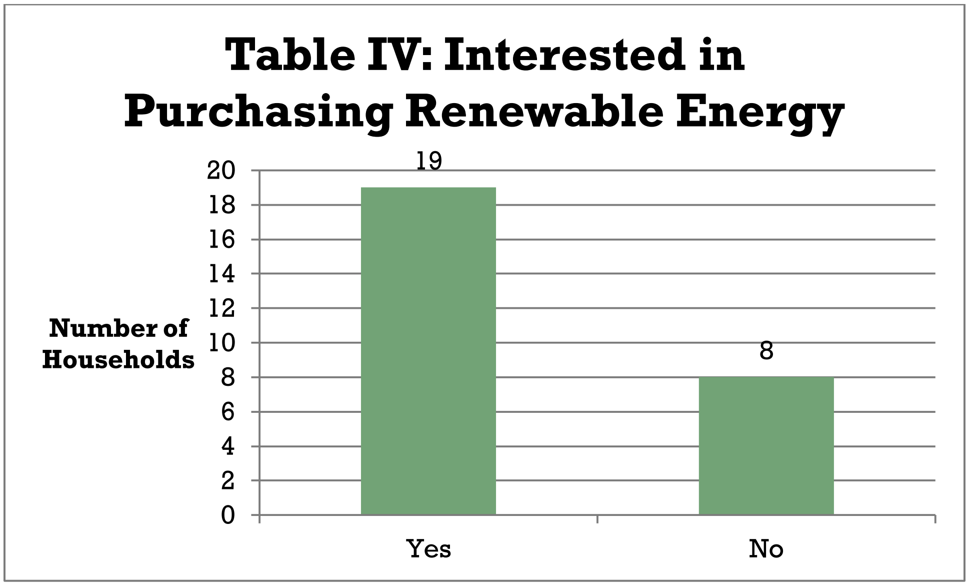
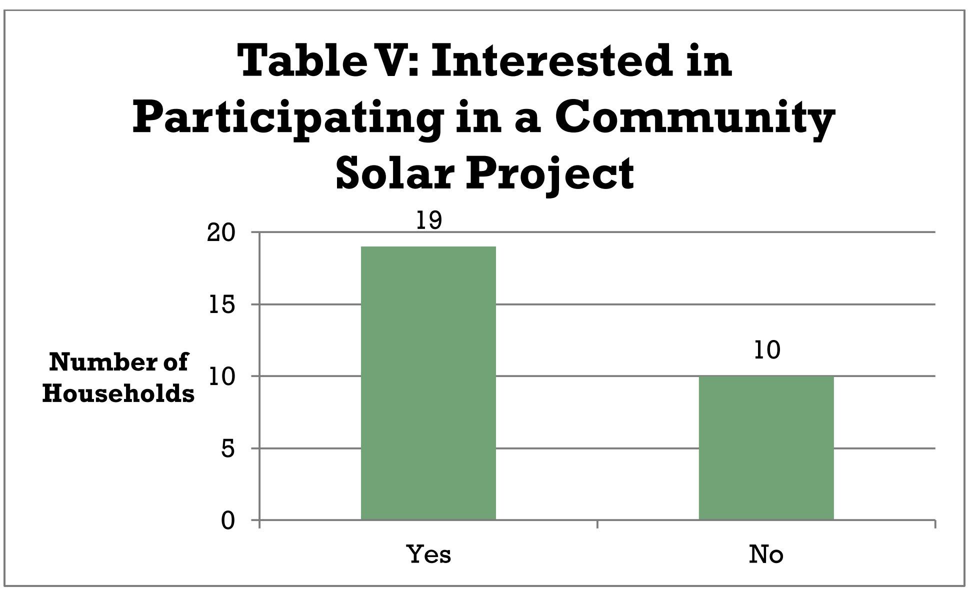
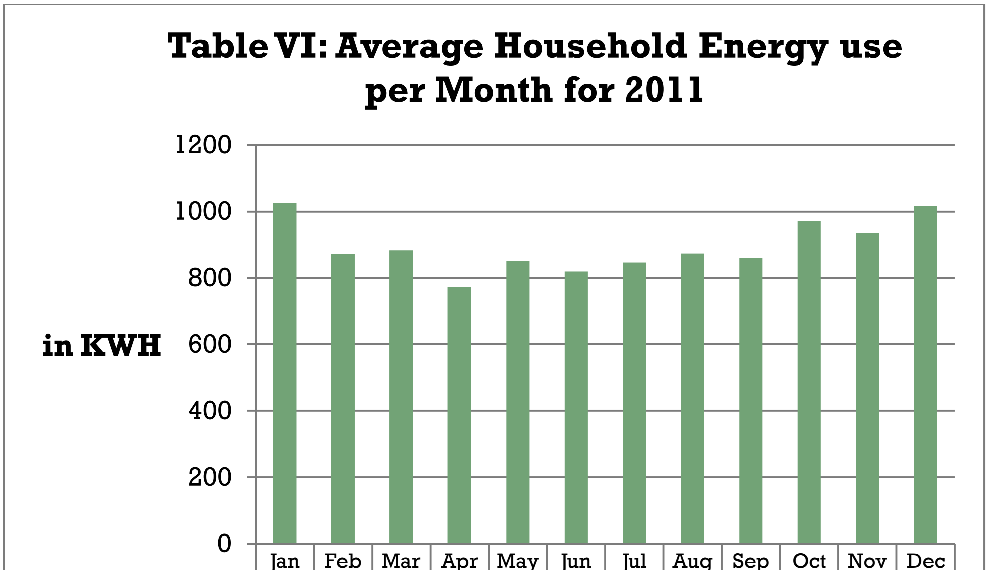


Table V shows how many households were interested in participating in a community solar project. Of the respondents, 65 percent were interested in participating in a community solar project.



Lastly, Table VI shows the average household energy use per month for the year 2011. The winter months, specifically January and December, were the months that most households consumed the most energy. The overall average monthly energy use for 2011 was 893.6 kWh.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	1026	870.9	883.3	772.9	849.4	820.2	845.7	873.1	859.8	971	935.4	1015

Generally, a 10 to 20 percent response rate is common for most surveys (Constant Contact 2010). Therefore, the 19.3 percent response rate from the Rancho Embarcadero survey can be considered a typical response rate. The survey results show that over 50 percent of respondents are interested in renewable energy and participating in a community solar project. These figures show that a significant portion of the community is interested in community solar being used to supply energy to the community. While the preliminary survey findings are promising, there are still a few unknowns that need to be addressed. A community solar installation may allow those only who are interested in purchasing energy from the installation to do so, meaning that the whole backing of the community is not necessarily needed. Therefore, the number of respondents who were in favor of community solar may be a sufficient portion of the community to help make a community solar installation feasible. However, because the survey did not include more specifics on how much electricity from a community solar installation for Rancho Embarcadero would cost, it is still unclear how those costs would ultimately affect community interest in community solar.

RECOMMENDED MODELS FOR EMID

INITIAL ANALYSIS

Based on data gathered by the group through the survey, interpretation of SCE's feed-in-tariff schedule, and model runs through the NREL S.A.M. analysis tool, we developed the following table to aid in the discussion of beneficial array sizes for the community.

It can be seen that a significant cost is borne by the community as a whole over the period of the analysis (20 years). Often as individuals, the costs are spread out as monthly bills and fluctuate throughout the months giving an impression that electricity is a minor contributor to community costs. However, when individual costs are aggregated across 150 households, it becomes clearer that energy costs, when they approach eight million dollars, should be considered a significant cost to the community.

With this estimate of costs based on the winter tiered rate from the survey, we established a baseline with which to judge the efficacy of the models. We compared the annual costs per household and extrapolated out to around a third of the households and for the entire community. It is informative to compare the initial costs for an array which will, in principle offset the total energy consumption of each household. It should be remembered that the distribution grid is essential for the evening hours and the cost of storage on the scale to be energy independent is prohibitive at this time.

The table also shows the difference in lifetime credits with SB-843 compared to the current guidelines for FIT's as set forth by the CPUC. The FIT is best suited to wholesale generation rather than retail and the difference is clear in terms of ROI for a community solar installation under two to five megawatts. Most communities will not have the experience or financial capacity to overcome the limitations required to finance and negotiate a favorable power purchase agreement (PPA).

Table 10 Costs and Credits.

Costs and Credits assuming 100% offset by PV array							
	Average Cost per month SCE	Cost 20 year period SCE	Initial Cost of Installation No tax credits applied	Credit per month SB-843	Value of REC's over 20 years	Value of Credit 20 years SB-843	Credit 20 year Feed-In-Tariff SCE
Per Household (1 HH)	$152	$51,916	$30,344	$179	$7,928	$43,775	$19,263
33% of Community (50 HH)	$7,526	$2,569,878	$1,502,024	$8,860	$396,422	$2,166,866	$953,522
100% of Community (150 HH)	$22,809	$7,787,511	$4,551,590	$26,850	$1,180,00	$6,556,262	$2,889,460

*Utility rates based on winter Tiered base rate.

**Credits based on RPS standard with 2.7% escalator

*** Calculated from first year

INVESTOR-OWNED MODEL

An investor owned model is simply a group of private individuals to investing in a project with a promised rate of return around fifteen percent over the lifetime of the project. Typically, this has been the domain of the Solar Service Providers who will negotiate a power purchase agreement with the local utility or a commercial enterprise to sell power at a beneficial rate with the investors taking advantage of the investment tax credit and accelerated depreciation.

Often these models are set up so that a partner gradually gains interest in the project over time until a point is reached where the tax benefits are exhausted and ownership is 'flipped' to the entity without the tax appetite. This can be a model which works well for communities with individuals interested in investing as owners in the project. They may still participate as subscribers but enjoy profit sharing as well.

Under this model, whether a community invests at the individual level or not, its members can still benefit from participation as subscribers through a discounted rate, lower than they would normally pay with the utility which is also fixed, or escalated at a consumer-friendly rate. Additionally, a community, if it holds title to land suitable for an array can host a solar project enjoying benefits through leasing or discounted power purchasing.

PHILANTHROPIC PPA MODEL:

Under the current legal framework a community or a non-profit cannot take advantage of tax incentives and accelerated depreciation provided by the federal government. Therefore, a private company must be created with the express purpose of purchasing and maintaining the proposed solar installation with private investor capital. Within this scenario,the community or non-profit buys power from the company and with it equity. This Philanthropic PPA allows the community to enjoy the benefits of solar power and at a predetermined time when the cost of the equipment is reached the private company ‘sells’ the equipment to the community for a nominal fee.

The discounts available to the LLC are significant, according to NREL, after the 30% federal tax incentive is applied and the accelerated depreciation is accounted for (after 5 years) the net savings are in the vicinity of 50% of the initial purchase price. This discount, combined with the credit rating available to private equity investors, makes solar a viable option to finance with the right credit worthiness. Costs per watt for the panels is expected to reach the $1.50 mark within the following year, while discounts on material and time, due to economy of scale will be available to the community when they purchase these larger arrays.

Assuming a $3.50/Watt installed cost and a 600 kW array size, we are nominally looking at around $2.1 million to install the array on the site provided. If the tax credit and the depreciation are applied, the amount is reduced to approximately $1.3million. With the cost for electricity set to rise, there is a potential for a relatively rapid payback of the loan amount for the investors. Some forecasters, based on the anticipated infrastructure costs, climate change legislation and other factors, see a 7% per year increase as credible. These factors combined with an anticipated drop in real personal income of 5.9% per year create a viable arena for solar with grid costs of electricity projected to be closer to 20 cents per kWh by 2020. Currently however, there is no clear line drawn between a philanthropic intent for an LLC and charitable behavior which would become non-profit in nature and may raise flags for the Internal Revenue Service.

LIMITATIONS OF THE RECOMMENDED MODELS:

1. The project team assumed that every person living in the community is a home owner and not renter. This may have influenced the number of respondents to the survey.
2. The team also assumed that every home owner in EMID has a good tax appetite with a good credit history. This assumption will help the participants to act as an active investor if an LLC is created. Being active investors will help reap all the federal and state tax benefits to the fullest.
3. The team assumes that the home owners are motivated to implement a community solar project.

CONCLUSIONS

There are still significant hurdles for a community to overcome to benefit from a community-solar array. There remain many unclear and complicated aspects within the existing framework that may be simplified with the passage of SB-843 (Wolk). Indeed, with the passage of the bill we can expect to see many new firms entering the market in order to supply an anticipated demand for community solar self-generation.

According to our definition of community-solar we would see an increase in solar projects involving participants who would agree to purchase an allotment of kWhs from a particular developer, but this is not community-solar through community ownership. There is, we believe, a significant opportunity for community owned generation through the passage of the bill assuming that the concerns regarding the rate at which credits are priced, and whether or not the Renewable Energy Certificates can be sold to the Utility and then retired.

RECOMMENDATIONS FOR OTHER COMMUNITIES

We have developed the following recommendations based on interactions with the community members of the case study and through our survey:

1. We believe that it is essential to engage with the prospective community to ensure that the concept of ‘community solar’ is well understood.

2. Community members are often constrained by the cost of a rooftop solar system. The cost was found to be the community member's primary concern.
3. Few communities will have land available at little or no cost. Therefore a clear understanding of the additional costs associated with the procurement of the site is an important part of the project.
4. True community solar (50% or more ownership share) is a worthy goal in terms of energy security for the community. However, many of the ecological benefits will be attained through the investor-owned model as well. Therefore this type of business model should not be underestimated.

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APPENDICES

APPENDIX A – LIST OF INTERVIEWEES

APPENDIX B – SURVEY FOR EMID

Rancho Embarcadero Survey for Bren MESM Group Project

*For the questions asked in this survey, please base your answers on information from energy usage from **September 2010 to September 2011**.*

1. What sources of electricity do you use for your household?
   ☐ Grid/SCE ☐ Renewables ☐ Generator
2. Please use the chart below to record your electricity consumption information as completely and accurately as possible.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Usage(KWH)												

3. Is your household interested in purchasing renewable energy? ☐ Yes ☐ No
4. Do you own an electric/hybrid car? ☐ Yes ☐ No
5. Have you attempted to install solar on your property? ☐ Yes ☐ No
6. If you have contemplated or explored having solar installed but have been unsuccessful, what were the reasons that prevented you from doing so?
   ☐
7. Is your household interested in participating in a community solar project?
   ☐ Yes ☐ No
8. How long would you expect the payback period to be (in years)? ☐
9. How much of your consumption of electricity would your household want to offset from this project?
   ☐ 20% ☐ 40% ☐ 60% ☐ 80% ☐ 100% ☐ More than 100%
10. If you want to produce excess power (i.e. more than 100%), what would you like to do with the power?
    ☐ Store in Battery ☐ Sell back to Grid

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Figure 11: Survey for Rancho Embarcadero Page 1

Questions 11 and 12 will be used to calculate your total energy consumption, allowing us to draw a comparison and calculate the energy a PV solar installation could possibly offset.

11. If your household uses natural gas, what is your households average monthly natural gas usage?
12. What is your household's average monthly water usage?

The following questions are for those households that have solar installed on their property. Please skip this section if this does not apply to your household.

13. What is the capacity of your system?
14. Why did you choose to install solar?
15. Have you been satisfied with your solar system?

Please include any other comments you may have below:

We would like to follow up the survey with a 15 min supplemental in person or phone interview. If you are interested, please check box below and provide your home phone number and/or email address.

☐ Yes, I would like to be interviewed Phone: Email:

Thank you for your time and input!

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Figure 12: Survey for Rancho Embarcadero Page 2

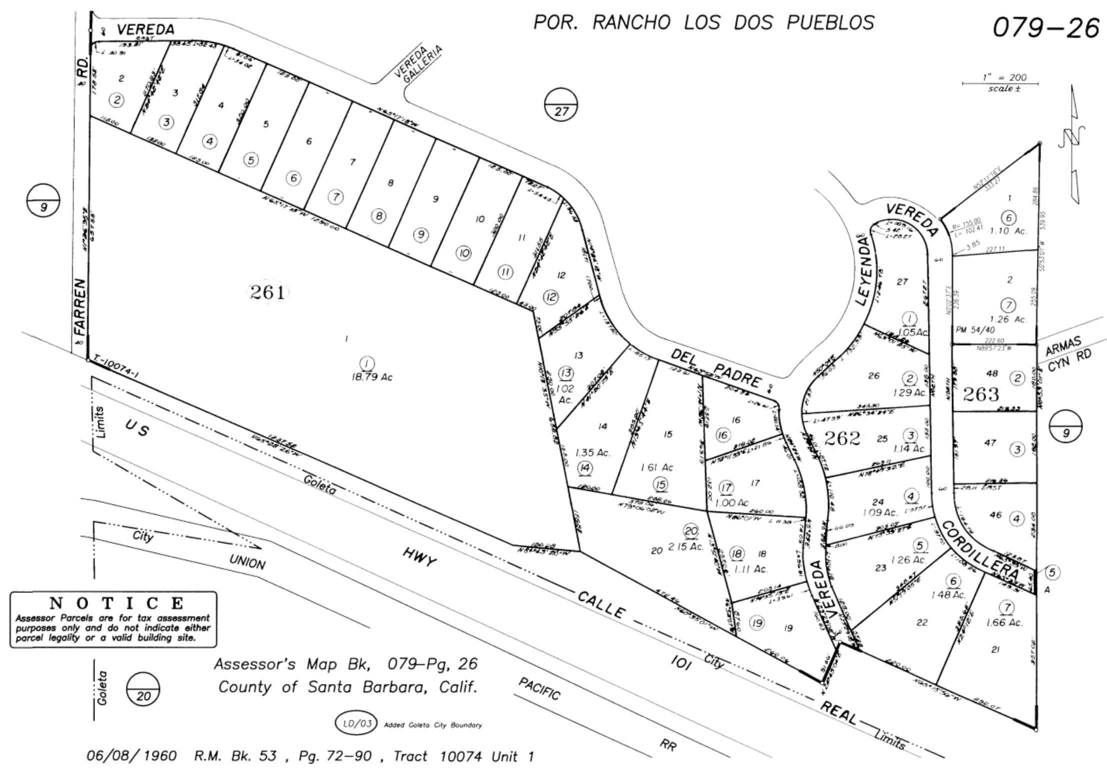

Figure 13 Assessor's Parcel Map of Proposed Lot #261