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Guide to Design Decisions for Utility-Sponsored Community Solar

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ABSTRACT

This report seeks to identify the important junctures in decision making when designing a community solar program and help clarify the magnitude of these choices and their consequences. As community solar continues to emerge across the country as a viable policy option for the expansion of solar access and environmental equity, program designers should be aware of the importance of garnering support from potential participants, non-participating ratepayers and the community at large. Utilities, policy makers, citizens and advocates will find this document helpful in understanding the concept of community solar and the decisions that must go into designing a successful community solar program.

ABOUT

UCLA Luskin Center for Innovation

The UCLA Luskin Center for Innovation translates world-class research into real-world policy and planning solutions. Based in the UCLA Luskin School of Public Affairs and organized around initiatives, the Luskin Center addresses pressing issues of energy, transportation and sustainability in collaboration with civic partners.

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Since 2010, residential solar installations have added more than 2,500 megawatts of clean energy[1] - enough to power more than two million homes for a year.[2] Yet nearly 75% of residential rooftop space is prohibited from participating in individual programs such as net metering due to structural constraints or ownership issues.[3] Community solar aims to resolve this impediment, providing restricted residents access to solar in a virtual fashion. An administrating entity will cover the cost of installing a large solar array and recoup these costs by allowing co-investors to buy into the project. Coinvesting participants then receive the benefits from their share's solar energy production.

Community solar programs continue to emerge across the country as a viable policy option for the expansion of solar access and environmental equity. The installations of these solar projects also serve as an opportunity for economic development, with workforces constructing solar arrays ranging from 2 kW to 20 MW in size. Over the last two years alone, community solar programs have nearly doubled in number, with 42 utility-sponsored community solar programs now active. In recognizing the opportunity of community solar, 9 states including the District of Columbia have crafted specific legislation in an attempt to encourage program development.

When designing a successful community solar program, three principles emerge as vital to a program's success, which in this case, is defined as a program that has support from participants, non-participating ratepayers and the community at large. These principles include:

1. **A program that entices a sufficient amount of participation to recover some portion of program costs.** Participation will largely be driven by the investment opportunity offered by the program. The program administrator should test the attractiveness of the community solar program investment by conducting a participant cost test (PCT).

2. **A program that is supported by non-participating ratepayers**, who may need to shoulder some portion of program costs. Due to annual overhead costs, the prospect of full cost recovery may be unrealistic, and any costs that are not recovered by participation fees will most likely need to be shifted to non-participating ratepayers. To determine the impact of the remaining program costs on the average utility customer, the program administrator should conduct a ratepayer impact measure (RIM).

1 Greentech Media Research & Solar Energy Industries Association (2014). U.S. Solar Market Insight Report: Q3 2014

2 Accessed December 7, 2014 from <http://www.nrel.gov/docs/fy04osti/35297.pdf> and <http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results>

3 Denholm, R., Margolis, R. (2008). Supply Curves for Rooftop Solar PV-Generated Electricity for the United States.

3. **A program that has buy-in from the community as a whole**. Public officials and community members should be made to understand the public benefit of the program including environmental equity and the economic development opportunities of constructing the solar project.

The outcomes of decisions made during the design process will greatly influence the success of a community solar program. A push-pull dynamic is often apparent in decision making, as the program designer will need to balance the frequently diverging motivations of the participant, the non-participating ratepayer and the community as a whole. A community may desire the full extent of co-benefits such as environmental equity or economic development, the participant may only respond to the lowest cost of participation and most lucrative investment opportunity, and the non-participating ratepayer may demand that the program administrator recover all program costs, so that no costs are shifted into increased rates. Reconciling these concerns and motivations is the integral challenge for the program administrator.

The design process will include features that affect the production of community solar including the siting, construction and operation of the community solar project, as well as those that affect the retail experience for the participant. At each step of the process, decisions will need to be made, and potential outcomes should be fully examined based on set criteria and a series of considerations. The following highlights these junctures of decision making and introduces these criteria and considerations.

Siting

The siting decision will set the table for the installation of the solar project. The program administrator will have to decide if the strategy of the site is to minimize costs or is to attract participants by investing in participant and community supported features. The program administrator should consider the size of the site, quality of the site, the land acquisition costs, the site's public visibility, the economic development benefits and environmental equity opportunities that can be sourced to the site and the grid services the location of the site can provide. The site will also determine how large of a community solar project can be installed. The project size decision should consider the amount of community solar demand in the service territory, the projected number of participants and the scale of co-benefits that are to be realized.

Construction and operation

Construction and operation is a stage where costs can be significantly minimized. The program administrator's firm will have the choice to construct and own the project, or contract with a third-party through a power purchase agreement. The program administrator should consider their own firm's ability to construct and operate the proposed project versus the private market's, any local labor, living wage, or local content requirements, eligibility for tax credits, availability of low-cost financing and the ownership ramifications of any renewable energy credits.

Retail design

The program administrator will need to design the participant-facing features of the program including how the participant enrolls into the program and how much it costs the participant to enroll. The program administrator will generally have two options in how a participant enrolls into the program: a capacity offering or a rate offering. A capacity offering is the most popular community solar offering and best replicates the feeling of traditional home panel ownership. Participants will pay an up-front fee for their respective share of the solar installation and in return, will most receive monthly bill credits for their solar share's production.

A rate offering allows participants to purchase kWh blocks of solar output to replace blocks of home energy use. The price a participant pays for their kWh block is usually locked, thereby hedging against future rate increases. In deciding between these two offerings, the program administrator should consider the desired cost structure for the target participant, the degree of financing risk for the administrating entity, the program cost recovery schedule, and administration requirements such as billing and cancellation fees.

The cost of participation is a crucial decision for the program administrator. Ultimately, the price offered must entice a sufficient rate of participation while recovering the greatest share of program costs. Any program costs that are not recovered through participation fees will most likely need to be shifted onto non-paticipating ratepayers. A program administrator must understand each party's willingness to shoulder their share of program costs. To assist in this exercise, the program administrator should conduct a Participant Cost Test to understand the investment opportunity from the participant's perspective and a Ratepayer Impact Measure to evaluate how any unrecoverable costs will impact the electricty rates for different utility customer classes.

Overhead

The overhead costs of a community solar program may make the goal of achieving full cost recovery, and hence a ratepayer neutral program, a difficult one to achieve. The program administrator will need to plan for a cost-effective budget that can operate a well-run program, all while maintaining buy-in from participants and the community at large. Overhead cost considerations include billing, financing, staffing requirements, customer support, and transferability and exit options. To maintain community and participant support, the program administrator should consider outreach to potential participants and marketing and education.

2. Introduction

Solar energy has experienced incredible growth over the last decade. Since 2010, residential solar installations have added more than 2,500 megawatts of clean energy[4] - enough to power more than two million homes.[5] As impressive as this uptake has been, residential solar growth continues to be restrained by the fact that around 75% of residential rooftop space is prohibited from participating in individual solar programs such as net metering.[6] Some residents are unable to install solar due to structural or shading issues with the roof space. Others experience ownership issues such as shared roofs on apartment buildings or condominiums, of which around 70% of residents live below the national median income level.[7] This latter point presents not only an issue of access, but also an impediment to environmental equity and the fair distribution of the benefits of alternative energy.

Community solar aims to solve this issue, providing these restricted residents access to solar in a virtual fashion. The idea is simple: an administrating entity covers the costs of installing a large solar array and recoups these costs by allowing co-investors to buy into the project. Coinvesting participants then receive the benefits from their share's solar energy production.

Although conceptually straightforward, there are three over-arching principles a program administrator should be aware of that require a bit of a balancing act when designing a successful community solar program. First, the program must entice a sufficient amount of participation to recover some portion of program costs. Participation will largely be driven by the investment opportunity offered by the program. Second, any program costs that are not recovered by participation fees will most likely need to be shifted to non-participating ratepayers, so the program administrator must be certain this party would be willing to accept some cost in support of the community solar program. Finally, the program should have buy-in from the community as a whole. Public officials and community members should be made to understand the public benefit of the program including environmental equity and the economic development opportunities of constructing the solar project.

Throughout the design process, a program administrator will be faced with a series of decisions whose outcomes will have consequences for the success of the program. These decisions include design features that affect the production of community solar including the siting, construction and operation of the community solar project, as well as those that affect the retail experience for the participant. Often times, the program administrator will need to weigh the outcomes of design decisions in terms of trade-offs. For example, cost minimization during the production stage of community solar may result in lower participation fees and thus higher

4 Greentech Media Research & Solar Energy Industries Association (2014). U.S. Solar Market Insight Report: Q3 2014

5 Accessed December 7, 2014 from <http://www.nrel.gov/docs/fy04osti/35297.pdf> and <http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results>

6 Denholm, R., Margolis, R. (2008). Supply Curves for Rooftop Solar PV-Generated Electricity for the United States.

7 Based on 2013 United States Census Bureau American Community Survey

participation rates - as long as it does not sacrifice a program feature the community values such as high public project visibility. Another example could be providing on-bill financing to potential participants in an attempt to drive down up-front costs and encourage low-income participation - even though this may require higher staffing costs, thus increasing the overall cost of the program. The additional cost would mean a higher price of participation, or a higher potential cost shift to non-participating ratepayers. A program administrator should understand these trade-offs and anticipate how their outcomes can influence program success.

2.1 The Organization of this Report

The purpose of this report is to identify the important junctures in decision making for designing a community solar program, and help clarify the magnitude of these choices and their consequences. By doing so, program designers can use this report as a guide when tailoring a program to their own community's set of goals. Examples of program objectives and design decisions will be supported by case studies from programs across the United States. Utilities, policy makers, citizens and advocates will find this document helpful in understanding the concept of community solar and the decisions that must go into designing a successful community solar program.

Section 3 of this report offers a brief overview of the current state of community solar within the United States. This section will display the rapid growth of community solar, especially since 2010, and give the reader a sense of the geographic dispersion of community solar programs around the country.

Section 4 of this report evaluates the design choices that are required for the production of community solar. These choices determine the actual siting and construction of the community solar project and highlight the trade-offs required primarily between minimizing installation costs and adding features to the project that may lead to increased program participation or other program objectives such as economic development.

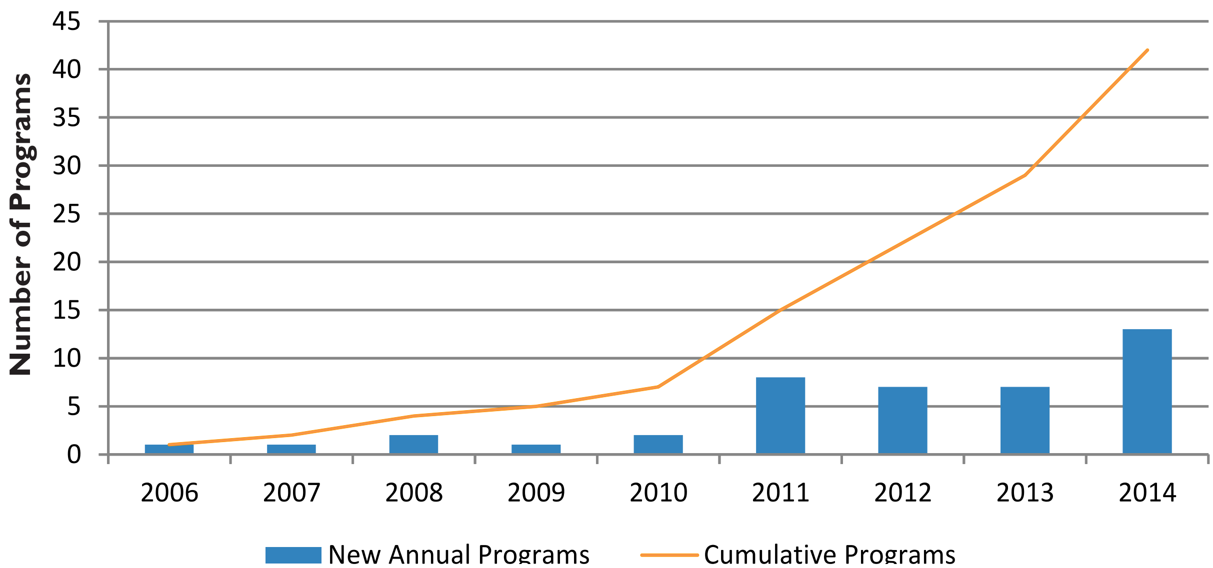
Section 5 of this report evaluates the design choices that shape the retail experience for the participant. These choices include how a participant enrolls into a community solar program, the cost of participation, and the overhead costs required to manage the initial enrollment period and sustain participation and community buy-in for the duration of the program. Again, trade-offs of these critical design choices will be highlighted along with the consequences.

3. Current State of Community Solar

Residential rooftop solar has grown at an increasingly rapid pace over the last decade. As installation costs continue their decline, a growing number of homeowners are recognizing the investment opportunity of solar energy. Yet even as the cost barriers of home solar installation continue to be chipped away at, a significant number of residents remain unable to participate in rooftop solar due to non-cost factors such as structural or ownership issues. In response, utilities, electrical cooperatives and solar companies have looked for alternative mechanisms of solar participation. Community solar is a relatively new concept, with the first project going live in 2006 and only a handful more created through 2010. Each year since, there has been a significant increase in the number of programs, and community solar has emerged as a viable policy option for the expansion of solar access and a means for environmental equity and economic development.

Currently, there are 42 active utility-sponsored community solar programs across 19 states.[8] In total, 9 of these states plus the District of Columbia have legislation with specific language regarding the implementation of community solar.[9] Much like the rest of the solar environment, community solar has grown most rapidly in recent years.

Figure 1. Utility-sponsored Community Solar Growth Since 2006

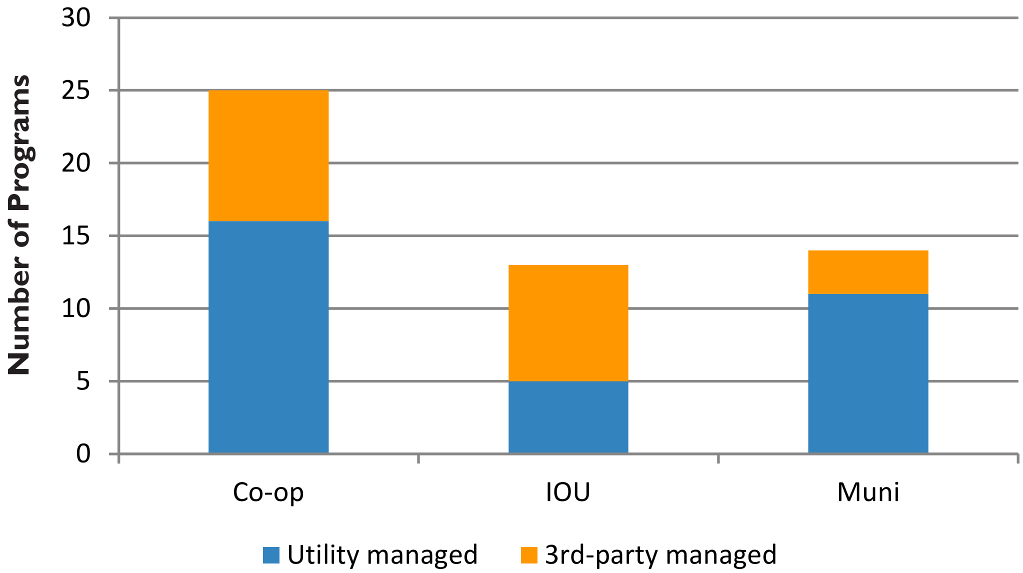


Source: Campbell, B., Chung, D., Venegas, R. (2014). Expanding Solar Access Through Utility-led Community Solar.

8 Campbell, B., Chung, D., Venegas, R. (2014). Expanding Solar Access Through Utility-led Community Solar.
9 California, Colorado, Delaware, Maine, Massachusetts, Minnesota, New Hampshire, Vermont, Washington, Washington DC (see appendix)

A utility-sponsored community solar program can be administered by an investor-owned utility (IOU), a public municipal utility or an electrical co-op. Currently, electric co-ops account for the highest number of community solar programs with 25 active projects.

Figure 2. How Community Solar Programs are managed by Utility Type

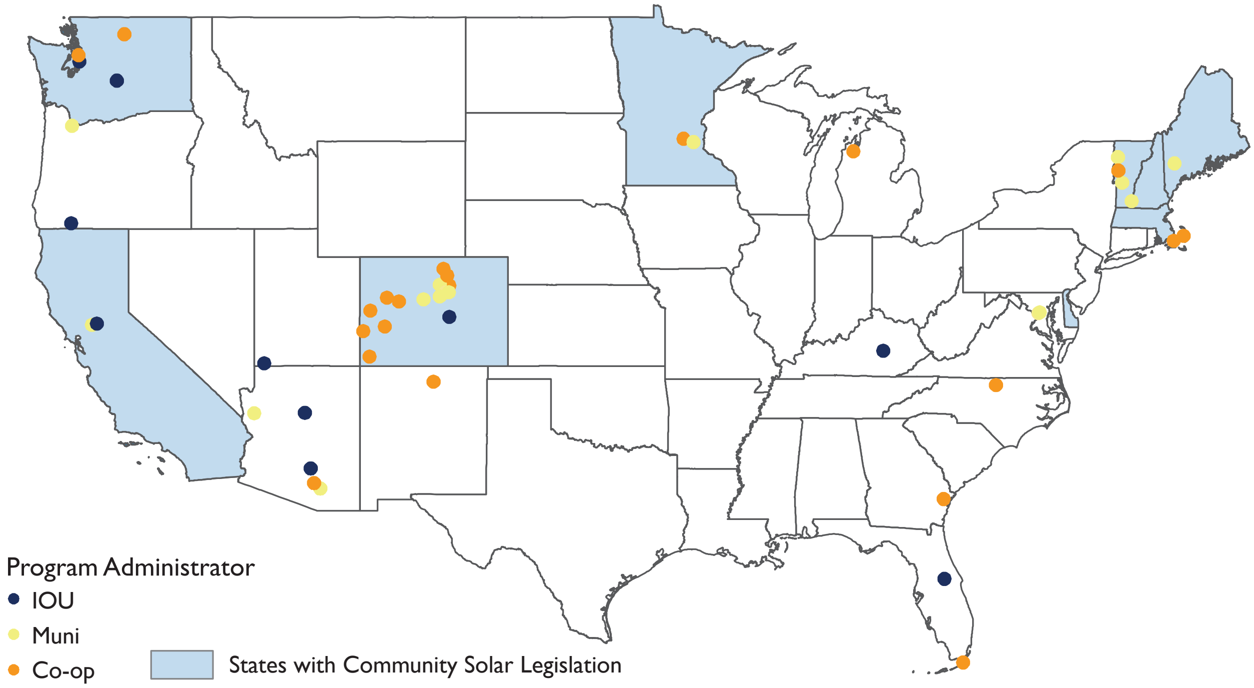


Source: Campbell, B., Chung, D. Venegas, R. (2014). *Expanding Solar Access Through Utility-led Community Solar*

Some program administrators may find it more cost-effective to partner with a third-party to install and/or oversee the program. Third-party firms specifically geared to community solar have started to emerge, especially in states that have passed community solar legislation. An example of one of these firms is the Clean Energy Collective (CEC), a company based out of Colorado who currently operates or is in the planning stages for 35 community solar projects across 7 states.[10]

10 Accessed December 4, 2014 from <http://morecleanenergy.com/communitysolarprojects.aspx>

Figure 3. Community Solar Programs in the United States



Source: U.S. Census (TIGER/Line state boundary shapefiles). Program locations accessed January 7, 2015 from sharedrenewables.org.

Community solar programs are found across the country and range in size from 10 kW up to 20 MW. Colorado is home to the highest number of programs, where early legislation has led to nearly 20 projects, ranging in size from 10 kW to over one megawatt. Arizona offers the most capacity of community solar, with over 25 megawatts available from their five programs. These two states provide a good contrast as to how an entity can approach and design a community solar program.

The Colorado model has many projects that are relatively small or medium in size and frequently visible to the community. Project shares are sold with a participant understanding that they are getting something local, and a sense of ownership is important. In the case of Arizona, several utility scale solar farms have been built and participants can sign up for a share of the output. This model does not generate a sense of community in the local neighborhood sense, but rather provides a general community benefit for interested people who cannot host rooftop solar on their own homes.

Other states with community solar projects include California, Oregon, Washington, Utah, Minnesota, Michigan, Tennessee, Kentucky, Florida, Georgia, Maryland, Massachusetts, Vermont and Maine. The look of community solar varies in each of these states and will look different in new states depending on legislation, utility model, regional particularities and other factors.

4. Program Design Decisions for the Production of Community Solar

When planning for a community solar program, a program administrator should start by identifying the goals that are considered important by potential participants and the community at large. Programmatic goals can be as simple as minimizing costs and passing the savings on to participants or as broad as generating a strong sense of community with a highly visible project or a local jobs program that can be aligned with the project's installation. In order to achieve these set goals, the program administrator will need to make a strategic series of decisions over the span of the design process.

The following section identifies the stages of producing the community solar project's energy, and evaluates how the outcomes of design choices may influence program success. Design decisions that determine the production of energy include the siting and construction and ownership of the community solar project.

4.1 Siting Decisions

There are a number of considerations a policy maker should be aware of when surveying the potential location of a community solar project. While site-specific attributes such as size and surface quality directly impact the cost per watt installed, additional site features based mostly on location provide an opportunity to capture additional sources of value for the community solar program, the program administrator and the local community.

In choosing a location, a program administrator will be making a series of decisions simultaneously. The location of the community solar project(s) will determine the quality of the hosting site(s), whether there needs to be one site or multiple sites, the visibility of the project to the broader community, the commuter shed from which economic development benefits will be generated, opportunities for environmental equity, and any grid services that may be provided by the active solar project.

Siting Considerations

Cost per watt installed
Size of site
One site vs. multiple sites
Quality of site
Land acquisition
Public visibility
Economic development benefits
Environmental equity opportunities
Grid services

An objective of a program administrator during the siting stage may be to minimize the **cost per watt installed.** When searching for a potential location, this means evaluating both the site's size and surface quality. The **size of the site** will dictate how large of a project can be installed. Larger projects tend to be less expensive per watt due to economies of scale that are realized during the planning, design and installation stages. A large site can also accommodate one single project and avoid the need to spread the size of the project over multiple sites. Again, a single site generally offers the least expensive alternative when compared to multiple installation sites.

The **quality of the site** also has a direct impact on the cost of installation and the energy production capabilities of the project. Whether the project is to be a rooftop or groundmount installation, a high quality site should possess the necessary orientation, tilt and shade free characteristics of a high production solar array. For maximum solar production, a program administrator should seek out a site with a flat surface that allows for the optimal tilt of the panel and southward facing mounting capabilities. And of course, the site should be free of shade from trees or surrounding buildings. Other quality factors may include the age of the rooftop if it is to be a rooftop installation and the site's electrical configuration.

Finally, if the program administrator does not currently own or lease land adequately suited for the proposed project, they will need to buy or lease new land or partner with another entity. Depending on the type and quality of site, **land acquisition** may be a significant factor in overall program costs.

4.1.1 Public Visibility

In addition to site attributes, a program administrator will also need to decide on locational features that may increase costs, but may also help achieve program objectives such as strong participation and economic development. A key design feature that illustrates this investment choice is the **public visibility** of the community solar project(s). High visibility projects may not only promote the program and solar energy as a whole, but they may also directly stimulate program demand with participants wanting to publicly contribute to the community. These strategically located projects can be sited at or around public, high-traffic areas such as parks, civic centers or zoos. As one would expect, these specialized sites will usually correspond with higher land acquisition costs and may require several smaller projects, thereby increasing the cost per watt installed.

4.1.2 Economic Development and Environmental Equity Opportunities

The decision of where to site the community solar project may also present **economic development opportunities**. The construction of the solar array will create a number of quality pay jobs. The program administrator can target these job opportunities spatially based on the site selected and give full consideration to the workforce commuter shed in which the site(s) will be located. As a result, the program administrator may be able to align a green jobs or skills training program with the project installation.

The siting decision can also provide an opportunity for **environmental equity**. Disadvantaged communities are often located near traditional power plants and industrial facilities, and are impacted most by the deleterious health effects associated with these high-polluting sources such as respiratory illnesses, hospitalizations, and premature death.[11] By locating the community solar project in a disadvantaged community, the program administrator can help turn this trend around locally by providing a clean energy alternative.

4.1.3 Grid Services

Finally, a utility will be able to strategically locate the new generation source on the grid to maximize **grid services**. The project can be placed where generation is needed or away from areas where the grid is already potentially burdened by a rapid expansion of solar. The site may also allow for additional grid strategies such as a westward facing array – a strategy utilities can employ to help smooth out the supply behavior of southward facing solar arrays.[12]

The **Seattle City Lights (WA)** Community Solar Program consciously made the investment choice to prioritize public visibility. The program hosts four sites, all with optimal solar exposure and community appeal. Sites include Jefferson Park, where three new picnic shelters were constructed to host the panels. Another project is fixed to the roof of the Seattle Aquarium and showcases solar to more than 800,000 visitors per year including 40,000 school children.[13] Both of these projects highlight Seattle City Lights program objective of visible siting, where dual benefits such as shelter, education and program marketing work to encourage participation.

Seattle City Light aquarium array
Photo Courtesy: Seattle City Light

11 Accessed January 20, 2015 from <http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120SB535>

12 "It is now generally accepted that orienting solar panels to the west-southwest increases the output during the afternoon hours, while reducing output during morning hours. This would produce a more valuable profile of power output, better suited to the shape of load to be served." Lazar, Jim (2014.). Teaching the Duck to Fly.

13 Accessed November 21, 2014 from <http://www.seattle.gov/light/solarenergy/commsolar.asp>

Counter to this strategy may be the lowest cost possible tactic. The **Orlando Utilities Commission (FL)** Community Solar Farm chose utility-owned land to site one large 400 kW solar array. The carport project covers the employee parking lot, thereby forgoing the need to lease or buy new land. However, the community solar project is only visible to utility workers and those who visit the utility campus. It is assumed the costs saved during the siting stage of design were passed along to the price of participation.

OUC campus carport array
Photo Courtesy: Orlando Utilities Commission

4.2 Construction and Ownership Decisions

The policy maker must also decide how the project will be constructed, operated and maintained. The administrating entity may choose to undertake all of these actions internally, or contract with a third-party to carry out some or all of these responsibilities. Much like siting, this decision may have a significant impact on the total cost of the community solar program and cost factors such as labor requirements, tax incentives, and renewable energy credits (RECs) should be examined.

Construction and Ownership Considerations

Cost of internal construction/O&M
Administrator competence
Market competence
Local solar market maturity
Labor/content requirements
Eligibility of tax credits
Availability of low cost financing
Ownership of RECs

A program administrator should begin with evaluating their firm's ability to construct and operate the proposed solar project. Does the program administrator have experience with constructing a similarly sized solar array and if so, has the program administrator learned enough from past projects to achieve cost reductions throughout the construction process? If not, the program administrator may find constructing the project in house to be a greater cost than initially anticipated.

The program administrator should also assess the current state of the local solar market. When compared to the administrating entity, has local industry achieved a point of market maturation that realizes significantly lowered construction costs? If the private market is deemed more competent and cost-effective in constructing and/or operating the proposed solar project, the program administrator may realize significant savings by looking outside of the firm and tapping into these market advantages through an agreement with a third-party. In many cases, this will come in the form of a power purchase agreement (PPA) where a third-party will construct and own the project, but sell the solar power produced back to the program administrator.

4.2.1 Labor/Content Requirements

When deciding between internal construction and operation or a power purchase agreement with a third-party, the program administrator should consider additional cost factors specific to the firm. One of these factors may be **local labor, living wage, or local content requirements**. Some utilities, for example, may have established hiring agreements with local labor unions. In most cases, such arrangements would increase the cost of internal construction.

4.2.2 Leveraging Tax Incentives and Low Cost Financing

A significant cost factor when constructing a community solar system is the ability of the installing entity to access **federal tax credits**. Foremost is the federal Investment Tax Credit (ITC). The ITC enables solar developers to obtain a 30% tax credit for costs associated with solar installations until the end of 2016.[14]

The federal government also allows solar developers to take advantage of the Modified Accelerated Cost Recovery System (MACRS). The MACRS represents a method of depreciation that would recover investments into property - in this case, the solar equipment - for tax purposes over a 5-year time period. In total, these federal tax incentives can represent over 50% of the solar installation costs.[15]

The ITC and MACRS are available to any taxable entity, meaning tax-exempt organizations such as municipal utilities are ineligible for these significant cost savings. If the program administrator is a tax-exempt organization, partnering with a taxable third-party will allow them to take advantage of the ITC and MACRS by proxy.

Additionally, a policy maker should consider the availability of **low cost financing** to cover the cost of capital. The administrating entity should take advantage of financing options such as low-interest municipal bonds to fund the installation of the project.

Certain states or municipalities may also provide incentives that a community solar project may be eligible for. Moreover, local stakeholders may be interested in providing gifts, grants, or loans in sponsorship of the program. A program administrator should conduct their due diligence and investigate all potential federal, state, municipal and private incentive or financing opportunities.

14 The ITC is set to be reduced to 10% after 2016

15 Mendelsohn, M., Kreycik C., et al. (2012). The Impact of Financial Structure on the Cost of Solar Energy.

4.2.3 Ownership of Renewable Energy Credits

A controlling entity will also have the opportunity to retain the value of any **renewable energy credits (RECs)** associated with the generating facility. RECs represent the environmental benefits derived from the community solar project and can be sold as a commodity separate from the electricity. In states that have a renewable portfolio standard (RPS) or a similar renewable energy compliance mechanism, the RECs received from community solar generation could be used to help achieve environmental mandates or could be sold separately with the intention to lower program costs.

A program administrator of a community solar program will have three choices on how to manage RECs: retain the RECs themselves, pass the RECs to the participant or retire the RECs on behalf of the participant. In many cases, the program administrator will retain the RECs and capture the associated value.

The **City of Ashland (OR)** Solar Pioneers program is owned and operated by the Ashland Municipal Utility. As the owner of a 30 kW and 63.5 kW solar project, this tax exempt organization could not receive the federal ITC but made clever use of the Oregon Business Energy Tax Credit pass through, which allowed it to sell the tax credit associated with the project and receive a one-time payment. The utility also took advantage of low interest financing from the federal Clean Renewable Energy Bond (CREB) program (expired in 2013).[16] The RECs from the project are retired on behalf of the participants, so the participants can claim the environmental attributes as their own but cannot trade or resell them.

The **City of Ellensburg (WA)** Community Solar Project constructed their arrays in phases so that initial participation funds would provide the capital for subsequent installations. The project is owned by the Ellensburg public utility and did not qualify for the ITC or MACRS. The first phase, a 36 kW project, was financed by the initial round of participants and by grants from a local environmental foundation and the Bonneville Power Administration.[17] The second phase, a 22 kW array, was financed with a grant from Central Washington University and another from the Bonneville Power Administration.[18]

The Clean Energy Collective partnered with **Holy Cross Energy (CO)**, a local electric cooperative, to construct a 77.7 kW community solar project. The final construction cost was reduced by the ITC and also by a rebate from the utility and the up-front sales of the retained RECs.[19] The project also leases land from a local wastewater treatment plant, which additionally lowered land acquisition costs.

16 Accessed November 15, 2014 from <http://nwcommunityenergy.org/solar/solar-case-studies/the-vineyard-energy-project>

17 The Bonneville Power Administration is a federal nonprofit agency based in the Pacific Northwest and is part of the U.S. Department of Energy.

18 Accessed November 15, 2014 from <http://nwcommunityenergy.org/solar/solar-case-studies/chelan-pud>

19 Farrell, J. (2010). Community Solar Power: Obstacles and Opportunities.

The **Sacramento Municipal Utility District (CA)** SolarShares program partnered with third-party solar developer enXco to build and maintain a one megawatt solar system to serve their community solar program. The utility signed a 20-year PPA with enXco, who was then able to take advantage of both the ITC and MACRS, thus significantly lowering installation costs.[20] The RECs associated with the project are retired on behalf of the participants.

The **City of St. George (UT)** SunSmart program was financed by both the City of St. George Energy Services Department and Dixie Escalante Electric. The two utilities split the sale of RECs and participants are able to take advantage of a 25% tax credit for their purchase, as the state treats solar share ownership the same as owning the panels outright.[21]

The **United Power (CO)** Sol Partners Solar Farm offers participants capacity from a 10 kW solar array. The rural electric cooperative was unable to take advantage of the ITC, but instead received a grant from the Colorado Governor's energy office and an in-kind donation for the construction of modules.[22]

20 National Renewable Energy Laboratory (2010). A Guide to Community Solar: Utility, Private, and Non-profit Project Development.

21 Farrell, J. (2010). Community Solar Power: Obstacles and Opportunities.

22 Farrell, J. (2010). Community Solar Power: Obstacles and Opportunities.

5. Program Design Decisions for the Retail Experience of Community Solar

During the design process, the program administrator will need to make decisions that shape the retail experience for the community solar participant. This critical set of decisions include the method by which the participant pays as well as the price the participant pays to enroll into the program. The importance of this bundled decision is twofold. First, the offering type and price composes the cost structure for the participant and will be a significant driver of participation. Second, the pricing decision establishes how much of program costs can be recovered through participants, and if there will be any need to shift unrecoverable costs to non-participating ratepayers. In this case, the program administrator will need to evaluate the impact of the price on both the participant and the non-participating ratepayer, and determine if both parties would tolerate their respective cost burden in support of the community solar program. The outcomes of these choices have consequences for the participant, the non-participating ratepayer and the program administrator, and can ultimately determine the success of the program.

Lastly, the program administrator will need to determine how the program will be run on an annual basis. This will include cost considerations such as additional hiring for administering the program as well as for marketing and outreach. A program administrator will need to evaluate what is required to manage the initial enrollment period as well as to sustain participation and community buy-in for the duration of the program.

5.1 Type of Offering

The program administrator will generally have two options for how a participant can enroll into the program. First, a *capacity offering* allows participants to lease panels, or a set amount of kW capacity, and then receive credit for their respective share's solar generation. This option replicates the feeling of traditional home panel ownership. A *rate offering* allows participants to replace some portion of their current electricity use with a specified amount of solar generated electricity. The decision between these two types of offerings will have consequences for both the potential participant and the program administrator.

5.1.1 Capacity offering

The most popular community solar offering to date is the leasing of a solar project's kW capacity.[23] In most cases, participants pay an up-front fee for their respective share of the solar installation and in return, receive monthly bill credits for their solar share's production. The "ownership" mechanism can come in three primary forms: owning a certain number of panels,

23 Campbell, B., Chung, D., Venegas, R. (2014). Expanding Solar Access Through Utility-led Community Solar.

owning kilowatt increments or owning a percentage share of the solar project.

The participant value proposition can often mimic net metering, offsetting the participant's home energy use with their solar share's production. Some program administrators may choose to differentiate the community solar rate from the retail rate, and credit the participant's bill with their share's generation at the distinct community solar rate.

Capacity Offering:

- Easy billing
- High up-front cost
- Low financing risk

For a program administrator, distributing participant bill credits for a capacity offering may be an easier task when compared to the rate offering. Since the price of participation is paid at the start of the program, the administrating entity needs only to calculate the participant's share production, and represent this production as a credit on the utility bill. A program administrator with net metering experience may find it helpful to look here for guidance and support.

The high up-front cost of the capacity offering may prove to be cost prohibitive to certain groups. This can stand in contrast to a program administrator's primary community solar goal of expanding solar access to customers who are unable to afford to install a home solar system. Occasionally, program designers have eased this up-front cost barrier by offering some sort of on-bill financing, although doing so may add a layer of complexity to the billing mechanism for a capacity offering program.

The **City of Ashland** Solar Pioneers II program allows customers to buy a certain number of panels from a 63.5 kW community solar system. Participants can purchase a full panel for $578.00, a half-panel for $289.00 or a quarter-panel for $144.50. At the end of each year, participants receive a once-per-year credit on their utility bills, representing the monetary value of power produced at the retail rate by each participant's share of the project. As an alternative to purchasing a full panel (or half or quarter-panel) outright, participants may opt for a zero interest monthly loan option. For $9.63 per month, participants can purchase a full panel and effectively spread out the high up-front cost of participation over 5 years.

The **City of St. George** SunSmart program allows customers to purchase up to 4 "units" in the form of 1 kW increments from a 250 kW community solar system. Participants can purchase a full "unit" for $5,000 and also a half "unit" for $2,500. Each month, participants receive kWh credits - in a net metering manner - on their utility bills, based on the amount of energy produced by their unit share of the system.

The **City of Ellensburg** Community Renewable Park allows customers to invest an amount that represents a certain percentage of the cost of installing a project. In return, the customer receives the same percentage of the solar system's output. Participants receive a quarterly credit on their utility bills at the wholesale rate based on the number of kWh produced by their percentage share of project ownership.

The Berea Municipal Utilities Solar Farm allows participants to lease 235-watt panel units for a one-time lease fee of $750 per panel. This one-time fee covers a 25-year period. The customer receives credit every billing period for the electricity generated by their panels.

The **United Power** Sol Partners Solar Farm allows participants to lease a 210-watt panel for $1,050. Participants will receive a credit on their bill for the energy generated by the leased panel.

The **Florida Keys Electric Cooperative (FL)** Simple Solar Program allows participants to lease a 175-watt panel for $999. This one-time fee covers a 25-year period. The customer receives a monthly bill credit for the electricity generated by their panels.

The **Traverse City Light and Power (MI)** Solar Up North (SUN) Program is a joint venture with Cherryland Electric Cooperative. Customers make a one-time payment of $470 per panel and then receive a $75 "Energy Optimization" rebate for a final per panel cost of $395. Customers receive a monthly bill credit for their share of output.

5.1.2 Rate offering

An alternative design option is the rate offering. With this, participants purchase kWh blocks of solar energy output to replace a portion of their home energy use. The price a participant pays for their kWh block is often locked, thereby hedging against future rate increases. In some cases, participants pay a fixed, monthly fee to lock in their solar share at a rate at or slightly above the current retail rate. Other times, the administrating entity offers participants a community solar rate clearly above the current retail rate. Here, the participant does not pay a set monthly fee; rather, they pay a premium rate for their solar production at least until future electricity prices catch up and possibly surpass the established community solar rate.

Rate Offering:

- Complex billing
- Low up-front cost
- High financing risk

From the program administrator perspective, the billing complexity of the rate offering may demand greater administrative capacity and thus, additional hiring costs. Contrary to the single up-front payment nature of the capacity offering, the rate offering requires a monthly balancing transaction for each individual participant, depending on that customer's retail rate and ownership share.

For the participant, the rate offering does not present a significant cost hurdle. Therefore, it may be a reasonable choice if the goal of the program is to provide access to lower-income customers. Highlighted here is a potential trade-off, as the rate offering may lead to greater participation due to less expensive up-front costs, albeit at the cost of a greater administrative requirement.

Tucson Electric Power (AZ) Bright Tucson program allows customers to purchase solar power in "blocks" of 150 kWh per month. Each block will replace the charges for an equivalent amount of traditional power on the participant's monthly utility bill at a cost of $3 per block purchased in addition to the retail rate minus two surcharges. The community solar rate participants pay for remains fixed except for non-fuel rate changes for the 20-year contract.

The **Xcel Energy (CO)** SunShare program allows customers to lock in an escalating solar rate for a one-time membership fee of $500. The solar rate increases annually at 3.5% while the utility anticipates annual utility rate increases of 4.6%.

The **Orlando Utilities Commission** Community Solar Farm program allows customers to subscribe to 1 kW "blocks" of solar energy from a 400 kW community solar project. The kWh production of a participant's block share is fixed at a rate of $0.13 per kWh, meaning a participant will pay $0.13 per kWh for their project share's production, which is slightly above residential and commercial rates. The subscribed solar "blocks" will offset the participant's normal electricity use. The utility will then bill the participant $0.13 for every kWh that their share produces while any electricity consumption exceeding will be charged current retail rates.

The **City Utilities (MO)** CU Solar Initiative allows participants to join with no up-front cost. Customers subscribe to 1 kW blocks of energy at a special solar rate, which amounts to the normal energy rate, plus a special, fixed fuel adjustment factor of $0.0404 per kWh. The fuel adjustment factor remains fixed for the 20 year duration of participation, making it possible to hedge future fuel adjustment factor increases.

5.1.3 The Effect of the Offering Decision on Project Financing

Before the community solar project breaks ground, the program administrator will need to finance the costs associated with siting and construction. In some instances, the administrating entity will purchase a municipal bond to cover these costs and immediately bear the associated financing risk. When the program is launched and participants start to buy in, the risk spreads out among new participants whose subscription fees can begin repaying the borrowing costs. The offering type selected will affect the degree of risk related to the financing of the community solar project's capital costs.

The one-time up-front nature of the capacity offering allows the administrating entity to recoup program costs in one payment at the beginning of term, meaning a higher degree of certainty in recovering costs. The financing risk, in other words, is effectively passed on to the participants at the start of enrollment.

The rate offering spreads out payments over the life of the program. Therefore, the program administrator is only able to recover costs over time through monthly participant fees or by the premium rate participants pay for their solar share. This tends to be a riskier proposition for the administrating entity as participants may default at some time during the life of the program, leaving the administrating entity with unpaid capital expenditures that would need to be repaid by non-participating ratepayers.

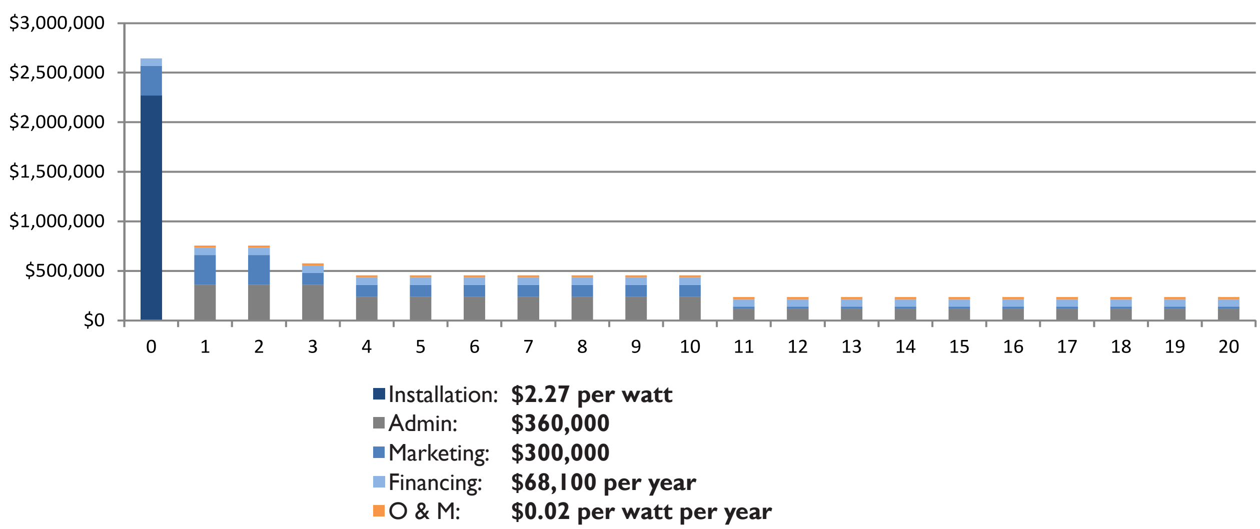
5.2 Pricing the Offering

Whether the decision is to provide a capacity offering or a rate offering, the program administrator will need to determine how much it will cost the participant to enroll in the program. From a participant perspective, the cost of participation represents a significant component of the investment opportunity, and the greater the perceived payback, the more likely the program will experience robust participation.

For a program administrator, the set price provides a mechanism by which to recover program costs. The program administrator will need to finance the costs associated with siting and constructing the project including site acquisition, construction and any borrowing costs required to complete the solar array. Program costs will also include annual overhead such as operation and maintenance, administration and marketing and education. The annual costs can vary from year to year, and it may be assumed that the program will reach a lower cost equilibrium once the initial enrollment period is complete. The set price and corresponding participation fees allow the program administrator to recover all or some of these costs.

A sample program cost structure can be seen in Figure 4 and in more detail in the Appendix. This sample cost structure will be used throughout Section 5.2.

Figure 4. Sample Cost Structure of Community Solar[24]



24 Installation: Greentech Media Research & Solar Energy Industries Association (2014). U.S. Solar Market Insight Report: Q3 2014.
Financing: Assumed cost of 20-year bond
Operation and management: accessed January 6, 2015 from http://www.nrel.gov/analysis/tech_lcoe_re_cost_est.html>

The decision to pursue full or partial program cost recovery will have consequences that extend beyond the community solar program itself, as any cost that cannot be recovered may need to be shifted to non-participating ratepayers. In making this choice, the program administrator is implicitly deciding how much of the cost recovery burden can be placed on the participants while still achieving a desired level of participation, and how much can be placed on the non-participating ratepayers. A delicate and integral balance thus emerges for the program administrator in finding a price that both participants and non-participating ratepayers can tolerate. To assist in making this decision, a program administrator should calculate the impact of the price on both the participating and non-participating ratepayer.

5.2.1 The Participant Cost Test

To understand the financial consequences for a participant of a program, the program administrator should conduct a participant cost test (PCT) – a commonly used cost-effectiveness test that evaluates whether the participant will benefit over the life of the program. Simply, it is the net present value of participant benefits and costs over the life of the program, with a positive result reflecting a profitable investment opportunity. A PCT allows a program administrator to view the program from a participant's perspective and gauge the financial attractiveness of the investment opportunity. From this, the program administrator should be able to more accurately forecast participation rates.

In the case of a community solar program, the PCT will have different inputs for the capacity offering and the rate offering. For a capacity offering, the costs for participation generally include the one-time up-front cost of enrollment and any possible borrowing cost the participant has to incur to buy into the program. The benefits include the estimated bill credits received annually over the life of the program. To calculate the bill credits, the policy maker needs to estimate an average participant share's annual production and multiply this by the proposed community solar rate. The program administrator should also be aware of any state or municipal incentives that may increase benefits or decrease costs.

Figure 5. Participant Cost Test for Capacity Offering Calculations

$$\text{NPV} = \Sigma \text{ benefits (\$)} - \Sigma \text{ costs (\$)}$$

$$\text{NPV} = \Sigma \text{ (Bill reduction + Incentives)} - \Sigma \text{ (Total up-front cash payment + Total loan payments)}$$

$$\text{Bill reduction} = \text{Participant's capacity share output} * \text{Community solar rate}$$

For a rate offering, the cost for participation is either a monthly fee or the premium rate the participant will need to pay from the onset of the program. The benefit will be the bill reduction experienced when future rates surpass the locked in community solar rate. Until then, the participant is experiencing a cost in the form of a bill increase. The program administrator will need to forecast future rate increases to determine what this cash flow schedule will look like for the participant. The future rate assumption is critical, as the rate increase schedule will have a significant impact on the financial desirability of the investment from the perspective of the participant. The program administrator should be reasonable in this assumption.

Figure 6. Participant Cost Test for Rate Offering Calculations

$$\text{NPV} = \Sigma \text{ benefits (\$)} - \Sigma \text{ costs (\$)}$$

$$\text{NPV} = \Sigma \text{ (Bill reduction)} - \Sigma \text{ (Bill increase + any monthly or annual fee)}$$

A PCT that results in a positive net present value means the participant will experience some benefit over the lifetime of the program. A negative net present value may indicate that customers will not participate, as their investment does not experience a return. The outcome measures of the PCT will include the estimated payback period, expected cost savings, the time at which cost savings begin to accrue, or how large of a cost the participant will experience if the investment does in fact not experience any return.

While the PCT calculation will give a sense of the financial attractiveness of the offer, the program administrator should also consider additional benefits that may not be so easily quantified. These can include the community's appetite for solar energy or the community's willingness to contribute to additional program objectives such as environmental equity and economic development. In some instances, this set of benefits may outweigh a net cost.

5.2.2 The Ratepayer Impact Measure Test

The PCT may demonstrate that it will not be possible to recover all program costs while maintaining sufficient participation. If this is the case, the remaining costs may need to be shifted to non-participating ratepayers. Again, the administrating entity will need to assess the tolerability of this party to shoulder some costs in support of a community solar program.

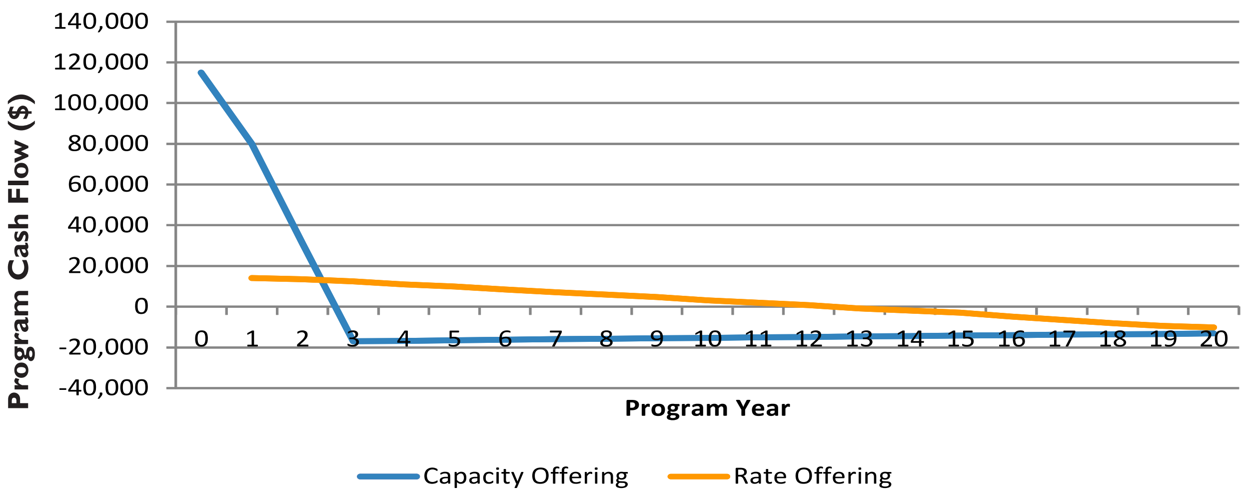
To understand the cost-burden that may need to be shifted to non-participating ratepayers, the program administrator should conduct a ratepayer impact measure test (RIM). A RIM calculates the potential distribution of costs across utility customer classes in the form of increased rates.

To begin, the program administrator will need to estimate the annual cost of the community solar program including the siting, construction and any financing costs required to install the project in year zero, as well as the operation and maintenance and annual overhead costs from year one until the end of the program (see Figure 4).

The program administrator must then estimate the cash flow schedule over the life of the program based on the set price of participation and the anticipated participation rate (see Figure 7). In the case of a capacity offering, the program administrator will estimate enrollment rates and multiply the anticipated number of participants by the up-front price of participation. The program administrator must also approximate the total amount of bill credits that will need to be paid out over the life of the program by estimating the enrolled share of the community solar project and its annual production, and multiplying this by the proposed community solar rate.

For a rate offering, the program administrator will estimate enrollment rates as well as the monthly premium a participant will pay. This premium is assumed to decrease as the program progresses and eventually become a payment due to the future increasing behavior of electricity rates. Again, the future rate increase assumption exhibits its importance. Figure 7 shows the payment and receipt schedule of the capacity and rate offering. Notice both the up-front cash receipt nature of the capacity offering, and the gradual diminishing cash receipt and eventual cash payment nature of the rate offering.

Figure 7. Sample Cash Flow from Participant to Program Administrator



With the annual costs and revenues accounted for, the program administrator can now calculate the net present value of the community solar program. A negative net present value indicates a deficit that may need to be offset by non-participating ratepayers through increased rates. To allocate this potential rate impact to each customer type, the program administrator must perform a series of calculations that require a collection of inputs including 1) total annual electricity (kWh) sold by the program administrator, 2) the kWh share of total annual electricity sold to each customer class, and 3) total number of customers per customer class.

First, the program administrator must divide the program's negative net present value, as determined by the estimated annual cash flow, by the total annual amount of kWh sold by the administrator. With the subsidy per kWh sold now in hand, the program administrator will need to calculate the average customer's electricity use for each customer class and then multiply each average customer's consumption by the original subsidy per kWh sold. The result will be the potential rate increase per customer for each customer class.

Table 1. Methodology for RIM per Customer per Customer Class

Step	Result
1. Forecast annual program cash flow and calculate the NPV	NPV of program
2. Divide program NPV by total annual kWh sold	Net Subsidy per kWh sold
3. Calcualte each customer class's share of total annual kWh sold	Annual consumption per customer class
4. Divide each customer class's share by total number of customers per customer class	Average annual consumption per customer per customer class
5. Multiply the result of Step 4 by the result Step 2 for each customer type	Annual rate increase per customer per customer class

5.2.3 The Societal Cost Test

If the program administrator believes a more comprehensive cost-effectiveness test should include benefits such as environmental externalities, the societal cost test (SCT) provides a method for doing so. In addition to avoided cost benefits such as avoided losses, avoided capacity costs, avoided transmission and distribution costs, and avoided RPS or additional environmental regulatory costs, the SCT can also include non-energy benefits such as avoided GHG costs and avoided health care costs. Although the latter set of benefits may be difficult to quantify, a program administrator may feel there is value that should be accounted for.

5.2.4 Determining the Discount Rate

A primary component of the PCT, the RIM, the SCT and any discounted cash flow calculation is the discount rate assumption. The discount rate takes into account the time value of money and the risk of future cash flows when evaluating a long-term investment. The greater the uncertainty of future cash flows, the greater the discount rate should be. This assumption will have a large impact on the outcome of the calculation, and the program administrator should consider which interest rate best matches the perspective they are testing for.

For a participant and the PCT, the consumer-lending rate is often used since this is the debt cost that a private individual would pay to finance their participation into a community solar program.[25] This number will likely differ depending on the participant.

For the program administrator and the cost recovery that must be calculated in the RIM, the discount rate will usually equal the firm's weighted average cost of capital (WACC). The WACC takes into account debt and equity costs for the program administrator and the proportion of financing obtained from each.[26]

25 Environmental Protection Agency (2008). Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy Makers.

26 Environmental Protection Agency (2008). Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy Makers.

The SCT generally uses the lowest discount rate of all, as it takes into account the reduced risk of an investment that is spread across an entire state or region. For example, California used a 3% real social discount rate when evaluating the cost-effectiveness of the Title 24 Building Standards.[27]

5.2.5 The Prospect of Full Cost Recovery

As discussed, the pricing decision requires the program administrator to find an enrollment price low enough to entice the desired rate of participation, while at the same time, high enough to recover as much program costs as possible. This balancing act may make the prospect of full cost recovery, and hence a ratepayer neutral program, a difficult, if not impossible objective to accomplish. As a result, a program administrator may aim only to recover a portion of program costs such as the construction and operation and maintenance of the project.

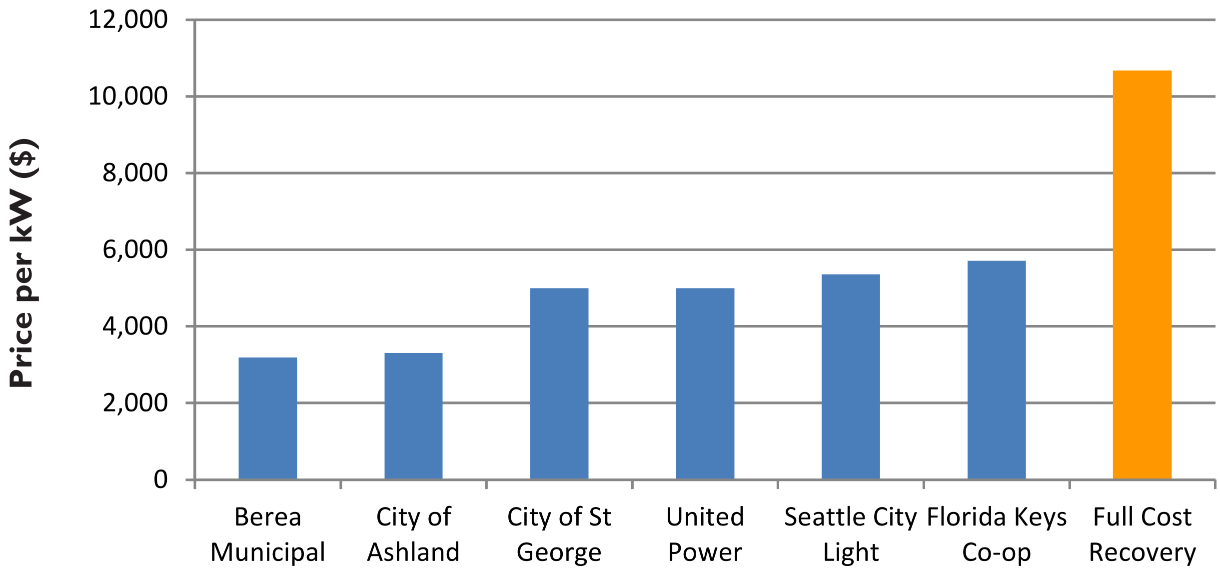
The following simplified financial analyses will show what price a program administrator must charge the participant - in the case of both the capacity and rate offering - to recover the full cost of the program, as well as to only recover the construction and operation costs. These prices will then be compared with programs used as cases throughout the report. The hypothetical 20-year, one megawatt community solar program that will be used throughout the analyses exhibits those cost attributes found in Figure 4.

5.2.5.1 Recovering Costs through a Capacity Offering

The cost recovery method will look different for each type of offering. For the capacity offering, the price represents the one-time up-front cost of enrollment. The payout, in our hypothetical case, will be a set community solar rate,. To recover full program costs, the program would need to not only achieve 100% participation, but also charge participants nearly double the price per kW of capacity than the next highest priced surveyed capacity program. With this cost structure, one can safely assume full cost recovery will not be possible while simultaneously achieving sufficient participation.

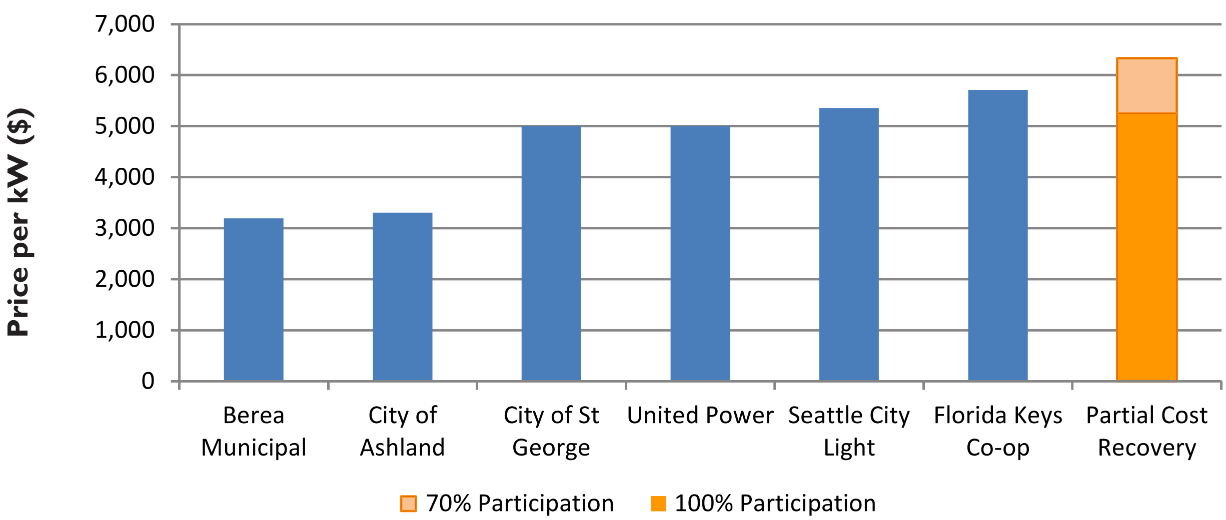
27 Environmental Protection Agency (2008). Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy Makers.

Figure 8. Price per kW to Recover All Program Costs for a Capacity Offering



A more feasible strategy may be aiming to recover a portion of costs such as construction and operation costs. As seen in Figure 9, partial cost recovery becomes a much more realistic objective when setting the price. The trade-off, of course, is that remaining costs may need to be shifted to non-participating ratepayers.

Figure 9. Price per kW to Recover Construction and Operation Costs Only for a Capacity Offering



5.2.5.2 Recovering Costs through a Rate Offering

The analysis can also be calculated for a rate offering and again, the same implications result. For rate offerings in which participants are charged a premium rate, at least until future electricity prices catch up, the community solar rate would need to stand far above the current retail rate in order to recover only construction and operations costs. In fact, the program administrator would need to charge $0.14 more per kWh than the assumed $0.12/kWh.[28] This may point to a reason why capacity offerings currently far outnumber rate offerings.[29] To provide a community solar rate that is attractive to potential participants, that is, a rate that is competitive with current retail rates, the program would require a strong subsidy from non-participating ratepayers.

5.2.6 The Effect of Cost Recovery on Program Costs

A unique attribute of community solar is the ability for the program administrator to recover costs on its capital investment in a manner that differs from a traditional rate increase. Full cost recovery may not be entirely possible, but a portion of cost recovery can be expected. And the more effectively the program administrator is able to balance strong participation, reasonable but maximum price of participation, and program cost minimization, the greater share of program costs can be recovered - leaving the administrating entity with an affordable option for alternative energy generation.

Table 2 shows the per kW price a program administrator would need to charge participants to recover a certain percentage of costs, as well as the corresponding net subsidy that would need to be provided from non-participating ratepayers. For reference, capacity offering case studies ranged from $3,200 to $5,700 per kW.

Table 2. Program and participant Costs per Percentage of Costs Recovered[30]

Participant Cost per kW	Percent of Costs Recovered	Net Subsidy per kWh
-	0%	-$0.208
$3,525.50	10%	-$0188
$4,318.89	20%	-$0.167
$5,112.28	30%	-$0.146
$5,251.36	Construction and operation	-$0.142
$5,905.67	40%	-$0.125
$6,699.05	50%	-$0.104
$7,492.44	60%	-$0.083
$8,285.83	70%	-$0.063
$9,079.22	80%	-$0.042
$9,872.61	90%	-$0.021
$10,666.00	100%	$0.000

28 See assumptions in Appendix 6.3

29 Currently, 74% of active or planned community solar programs are capacity offering:
Campbell, B., Chung, D., Venegas, R. (2014). Expanding Solar Access Through Utility-led Community Solar

30 Program costs based on cost structure in Figure 4

Another potential option for the program administrator is to offer separate prices within the program – say a low-income carve-out and a premium, higher-priced membership – thereby having the subsidy come from within the program rather than from non-participating ratepayers.[31] Of course, the program administrator should test the participant pool's willingness to pay a premium in support of a low-income carve-out in this scenario, or for other program features such as high project visibility.

The preceding exercise demonstrates the reality of cost recovery. In most instances, a program administrator will simply not be able to set a price that recovers all program costs; it will be far more practical to recover a portion of costs, such as construction and operation and management. What remains then are the overhead costs associated with running a program. In all likelihood, it will be the annual cost of running a program that will need to be subsidized by non-participating ratepayers, and because of this, a program administrator will need to strategically budget for a program that is both well operated and cost effective.

5.3 Overhead Costs

To effectively run a community solar program, the program administrator should plan for annual costs, particularly for the administrative, marketing and educational aspects of operating a program. These costs may be more significant during the initial enrollment period of the program and then reach a lower cost equilibrium once participation rates maintain a steady churn. The administrating entity will need to evaluate how much overhead is required to manage the initial enrollment period and sustain participation and community buy-in for the duration of the program.

Overhead Considerations

Administration
Billing
Financing
Staffing
Transferability and Exit Options
Marketing and Education
Outreach to potential participants
Maintaining program awareness

5.3.1 Administration

A significant administrative decision will be how to treat a participant's bill. A new billing mechanism will be needed for conveying the participant's solar production as well as their bill credits (either in kW, kWh or dollars) they will be receiving. This new information should be expressed on a participant's bill in a clear manner so they can clearly distinguish the benefits of their membership.

31 Although no surveyed program explicitly offered a low-income option, the Colorado Community Solar Gardens Act requires IOUs to reserve 5% of community solar array capacity for low-income customers.

Much of the billing decision hinges on whether the program administrator has selected a capacity offering or a rate offering, as billing for these offerings will be calculated using different methods. A capacity offering tends to be a more straightforward billing exercise - the administrating entity must only account for the generation credits of each participant's share. The billing credits will change solely based on the variable monthly generation output of the community solar project.

A rate offering, on the other hand, often times requires either a credit or a charge based on comparing that participant's dynamic retail rate to their locked in community solar rate. Not only is this transaction contingent on the variable monthly output of the community solar project, but also the ever-changing retail rate schedule.

In addition to bill credits, some program administrators may offer some form of **financing** to the participant in order to break down the initial up-front costs of a capacity offering. The financing option can come in the form of low-interest loans or through an on-bill installment plan. Although this may add a layer of complexity onto the billing activity, a number of community solar programs have found a financing option to increase participation.[32]

A program administrator will also need to determine how much staff is required to launch and manage the community solar program. The program administrator should anticipate higher **staffing** costs during the initial enrollment period and a reduction in costs once the program becomes more established and participation reaches a level of consistent and minimal participant churn.

Some billing examples include:

A one for one energy reduction, in which a customer's generation is subtracted from their consumption, and any remaining usage is charged at the retail rate (essentially virtual net metering), as seen with Berea Municipal Utilities Solar Farm and the City of St. George SunSmart program

A bill credit based on the production from the participants' share of solar capacity. This billing method is similar to the previous one, but adds one step to the process - converting the solar electricity generation to money before deducting it from the bill, as seen with City of Ashland Solar Pioneers, Salt River Project (AZ) Community Solar Program, and the Green Mountain Power (VT) Putney Solar Array.

A distinct and locked-in solar rate billed for each kWh of solar generated electricity. The billing entity will need to calculate each participant's share at the locked in "community solar" rate, and then charge the remaining surplus of that participant's consumption at the retail rate., as seen with Orlando Utilities Commission Community Solar Farm.

An additional fixed monthly fee for locked-in blocks of solar energy. An example includes Tucson Electric Power's Bright Tucson program

In some cases where a third party operates the program for a utility, customers receive a bill from both the utility, which will include a solar credit, as well as a bill from the company administering the community solar program, as seen in the partnership between Colorado Springs Utility (CO) and third-party SunShare.

32 "70% of survey participants offering a financing option for capacity-based programs have participation rates exceeding 75% of the available capacity". Campbell, B., Chung, D., Venegas, R. (2014). Expanding Solar Access Through Utility-led Community Solar

5.3.2 Transferability and Exit Options

Potential participants may need to leave the program for any number of reasons (e.g. moving out of the service territory, moving to a smaller residence, change in financial conditions, etc.). The program administrator will need to evaluate the administrative burden of participant withdrawal and decide if there should be any penalty enforced for any or all of these circumstances. This decision may depend on whether the program is a capacity or rate offering, as this design feature may indicate the complexities involved with cancellations.

For a capacity offering, participant movement should be a fairly straightforward administrative procedure. If the participant needs to exit the program, it should not be difficult to account for that person selling their share back to the administrating entity or a third-party. If the participant needs to move but remains within the program administrator's service territory, transferring the bill credits to the new address should also be a reasonably simple exercise. Here, a termination fee may appear excessive to potential participants.

For the rate offering, a participant who exits the program early may leave the entity that financed the community solar project with unpaid debt. In this case, the administrating entity may need to offset this real cost with a termination fee. Also, due to variable customer rates and other customized utility billing features, transferring a participant's rate offering to another party may prove to be a complicated administrative task.

5.3.3 Marketing and Education

Education and marketing will also be key factors for enhancing participation and sustaining awareness for the role the community solar project plays in the community. A new program like community solar may present a complex concept and **outreach to potential participants** that highlights the benefits of solar energy and details the investment opportunity may assist in fostering program awareness and interest. The program administrator will need to decide how to educate potential participants and how to convey answers to questions that may arise.

Upon hearing about community solar, potential participants may start their research online, and accordingly, program designers should anticipate funding a robust online presence, filled with detailed programmatic and financial information. The web page should at the very least link to a page of frequently asked questions (FAQs). These pages are particularly important for education around a program like community solar, where both the concept and implementation are new.

Community solar may also require a call center to complement the program website. Call centers should be operational before a community solar project is actually generating electricity, both to educate potential new customers, and eventually help enrolled participants when inevitable issues arise. Like many of the administrative choices, call centers may need more funding at the outset of a program, and get scaled back when a program reaches a more consistent participant churn.

The program administrator may also need to maintain a level of **program awareness** within the community. Doing so will sustain participation rates and continue the promotion of program goals including environmental equity, economic development and a community's broader sustainability goals. Continued buy-in from public officials and the community as a whole will be crucial for sustained program success. There are multiple strategies for perpetuating program awareness including online project features, participant benefits and a project's public visibility.

A helpful and simple marketing tool can be an online solar dashboard. The **Seattle City Light** Community Solar program maintains a solar dashboard for each of the community solar arrays in its portfolio. The dashboard features educational information on the specific array, links to the community partners (e.g. the Seattle Aquarium), and general educational information about solar. The **Orlando Utilities Commission** Community Solar Farm also displays an online dashboard that shows live status and production, weather information and an overview of the project.

Mayor Buddy Dyer cuts the ribbon at the OUC community solar unveiling. Photo Courtesy: Orlando Utilities Commission

Participants sign their panels for an Excel energy program. Photo Courtesy: Clean energy Collective

There are a number of other low-cost, but creative marketing tools currently being utilized by established community solar programs. The **Orlando Utilities Commission** Community Solar Farm not only invited participants to the community solar farm ribbon cutting ceremony, but also recognizes them on the solar project site as an original subscriber. Participants will also receive signage for the home or business to showcase participation. The **City of Newark (DE)** McKees Solar Park also recognizes their funders on their website, while the Clean Energy Collective project for **Excel Energy (CO)** invited participants to come and sign their panels.

As discussed in the siting section, project visibility may be a project's greatest marketing tool and an important driver for participation. The **Seattle City Light** Community Solar program provides participants the added benefit of being investors in some of Seattle's most visible public spaces including local parks and the city aquarium. The **City of Ellensburg** Community Renewable Park's project is highly visible from one of Washington's busiest highways. To bring attention to the project and educate passersby, the City of Ellensburg selected the local University's graphic design students to create a large sign.[33] Doing so brought attention to the project and achieved additional buy-in from the community.

33 Accessed November 15, 2014 from <http://nwcommunityenergy.org/solar/solar-case-studies/chelan-pud>

5.3.4 Scaling Up to Reduce Overhead Costs

For a program administrator, the task of recovering the one-time construction cost and annual operation and maintenance cost proves to be much more realistic than recovering total program costs. This is due to overhead costs that will last the duration of the program. To spread this cost out across participants, the program administrator can scale up the size of the community solar project.

Installation and operation and maintenance costs are usually assumed to be near linear. In other words, there is little or no incremental difference in cost per additional kW. The same cannot be said for administration, marketing and any other overhead cost associated with running a community solar program. With a larger scale project, the program administrator is able to use labor more efficiently, and economies of scale are realized. Say, for instance, for every 10 MW increment of capacity installed, one additional full-time equivalent (FTE) worker will be needed for administrative tasks.[34] This cost is effectively spread over the additional kW, thereby reducing the overall program cost per kW. Using the assumptions used in Section 5.2.5., a 10 MW program would experience a 48% drop in cost per kW, with the overhead cost now only accounting for a 23% of the program cost.

Table 3. Diminishing Overhead Cost per kW of Project Capacity

	1 MW Program		10MW Program	
Installation	$2,161.91	29%	$2,161.91	56%
Operation and Maintenance	$237.38	3%	$237.38	6%
Financing	$873.12	12%	$873.12	15%
Administration	$4,195.21	56%	$561.95	23%
Total Cost per kW	**$7,467.62**		**$3,922.81**	

34 Using the assumptions from Section 5.2, one FTE worker will cost $120,000 in salary and benefits.

Table 6. Overview of Design Decisions and Considerations

Design Step	Decision	Considerations
Siting	Lowest cost option or invest in participant/ community supported features?	• Size of site • Quality of site • Land acquisition costs • Public visibility • Economic development benefits • Environmental equity opportunities • Grid Services
	How large of a solar project should be built?	• Community solar demand • Anticipated number of participants • Ability to spread out overhead costs
Construction and Operation	What offers most cost-effective installation: Internal or 3rd party through PPA?	• Internal vs. 3rd party competence • Labor/content requirements • Eligibility for tax credits • Availability of low-cost financing • Ownership of RECs
Retail Design	Which offering to provide: Capacity or rate?	• Billing requirements • Cancellation fees • Cost structure for target participant • Financing risk • Cost recovery
	What price to set for the offering?	• Entice sufficient participation • Minimize cost burden on non-participating ratepayers
Administration	What budget will be needed for a well-run program?	• Bill credits • Financing • Staffing requirements • Web/call center presence • Transferability and exit options
	What budget will be needed to maintain partici-pant/community buy-in?	• Outreach to potential participants • Marketing and education

6. Appendix

6.1 Community Solar State Legislation

State	Bill/Code #	Bill Name	Program Goal/Method
California	SB 43	Green Tariff Shared Renewables Program	Will allow participating customers to purchase 100% of their electricity from renewable energy, receiving a bill credit from a renewable project as if it were located on their own property (virtual NEM). Currently in the implementation phase at the California Public Utilities Commission (CPUC)
Colorado	HB 10-1342	Colorado Community Solar Gardens Act	Customers can purchase up to 120% of their annual average electricity consumption, may not own more than 40% stake in a solar garden, and must buy at least a 1kW stake. IOUs must reserve 5% of community solar array capacity for low-income customers.
Washington D.C.	B20-0057	Community Renewables Energy Act of 2013	Amends the previously enacted net metering laws to allow for community generating facilities and virtual net metering. Creates a mechanism to credit excess production from community facilities to low income residents.
Delaware	Title 26, Chapter 10	State Codes of Delaware: Public Utilities ELECTRIC UTILITY RESTRUCTURING	Amended previously existing net metering law to allow virtual net metering.
Maine	Chapter 20, H.P. 272 - L.D. 336	Net Energy Billing to Allow Shared Ownership	Participants are required to have an ownership stake in the generation facility, precluding more flexible participation models (i.e. leasing, temporary subscription). Cap of 10 participants per facility.

State	Bill/Code #	Bill Name	Program Goal/Method
Massachusetts	SB 2768	Massachusetts Green Communities Act	All net metering capped at 6% of utility's peak load (3% allocated to government-owned systems, 3% to non-government systems
	SB 2395	Neighborhood Net Metering	Subject to statewide net metering cap of 6% of peak load. 3% of Utility Peak Load, 3% of peak load for municipal or government facilities
Minnesota	HF 729	Solar Energy Jobs Act	Requires states largest IOU to submit a community solar gardens plan to the state PUC. Voluntary for other utilities. Individual subscriptions no less than 200w and no more than 120% of annual average consumption. Subscribers may live in county adjacent to where the project is located.
New Hampshire	SB 98	Group Net Metering	Modifies the net metering law to allow group net metering (i.e. virtual net metering). Group paid for excess production at the end of the year.
Vermont	Act 125	Group Net Metering	Vermont's shared renewable program is not run by a utility or third-party administrator. Participants are free to organize themselves and stipulate their own process for allocating the generation credits amongst their accounts.
Washington	RCW 82.16.110	Community Renewables Enabling Act	The Washington law provides direct payments of $0.30/kWh to owners of shared renewables systems. They are limited in scope though to 75kW and projects must be on community-owned property, like schools, parks, or government buildings.

6.2 Hypothetical Community Solar Program Cost Schedule

	Program Year						
	0	**1**	**2**	**3**	**4**	**5**	**6**
Installation	$2,270,000	0	0	0	0	0	0
O & M	0	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Administration	0	$360,000	$360,000	$360,000	$240,000	$240,000	$240,000
Marketing	$300,000	$300,000	$300,000	$120,000	$120,000	$120,000	$120,000
Financing	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000

	Program Year						
	7	**8**	**9**	**10**	**11**	**12**	**13**
Installation	0	0	0	0	0	0	0
O & M	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Administration	$240,000	$240,000	$240,000	$240,000	$120,000	$120,000	$120,000
Marketing	$120,000	$120,000	$120,000	$120,000	$20,000	$20,000	$20,000
Financing	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000

	Program Year						
	14	**15**	**16**	**17**	**18**	**19**	**20**
Installation	0	0	0	0	0	0	0
O & M	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Administration	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000
Marketing	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Financing	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000

6.3 Model Assumptions

Figure 8 and 9	1,900 kWh per kW per year
	0.5% panel degradation
	$0.12 community solar rate
	5% discount rate

Table 13	Tucson Electric Rate equals $.115 per kWh
	kWh capabilities vary depending on location
	0.5% panel degradation
	$0.12 community solar rate
	5% discount rate

6.4 Program Cases Websites

Utility	State	Program Homepage
City of Ashland	OR	http://www.ashland.or.us/Page.asp?NavID=14014 http://www.ashland.or.us/Page.asp?NavID=14017
Berea Municipal Utilities	KY	http://www.bereautilities.com/?page_id=348
City Utilities	MO	http://www.cityutilities.net/renewable/rnw-solar.htm
City of Ellensburg	WA	
Florida Keys Electric Cooperative	FL	http://www.fkec.com/Green/simplesolar.cfm
Green Mountain Power	VT	http://www.vermontsolargardens.com/
Holy Cross Energy	CO	http://www.holycross.com/green-programs/purchase-clean-green-power/community-solar-garden
City of Newark	DE	http://cityofnewarkde.us/index.aspx?nid=900
Orlando Utilities Commission	FL	http://www.ouc.com/environment-community/solar/community-solar
Salt River Project	AZ	http://www.srpnet.com/environment/communitysolar/home.aspx
Seattle CityLights	WA	http://www.seattle.gov/light/solarenergy/commsolar.asp
Sacramento Municipal Utility District	CA	https://www.smud.org/en/residential/environment/solar-for-your-home/solarshares/
City of St. George	UT	http://www.sgsunsmart.com/index.htm
Traverse City Light and Power	MI	http://www.tclp.org/Mutual/CommunitySolar/EnergySmart
Tucson Electric Power	AZ	https://www.tep.com/renewable/home/bright/
United Power	CO	http://www.unitedpower.com/mainNav/greenPower/solPartners.aspx
Xcel Energy	CO	http://www.mysunshare.com/a-new-way-to-go-solar

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