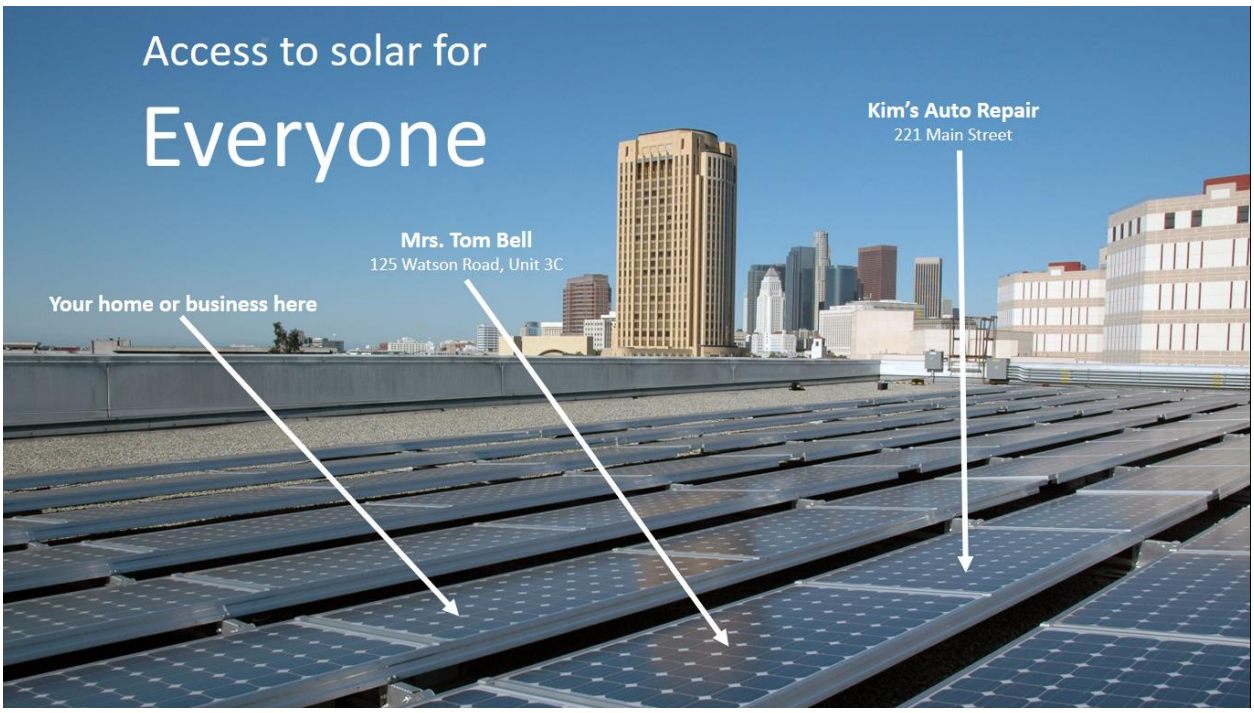
EcoMotion *– Sustainability Solutions*
601 W. Fifth Street, Suite 650 Los Angeles CA 90071 ● (949) 450-7155 ● www.EcoMotion.us

Community Solar:
Design Options and Innovations

Second Edition

September 2016



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SECTION 1: Executive Summary

Ten years after the nation's first Community Solar Plant (CSP) was commissioned in Ellensburg, WA, the project not only continues to operate successfully, but has also expanded, not once, not twice, but three times. The Ellensburg Community Renewables Park pilot continues to attract "resident-investors," community members who both fund the project and receive the full benefit of their investment in kilowatt-hour credits on their utility bill. Given its success, there are plans yet for a fourth expansion in the near future.

When this paper was first published in 2012,[1] there were roughly a dozen Community Solar Plants in operation. Today, there are more than ninety CSPs in 25 states with more than 100 MW of cumulative capacity. New plants are commissioned every month. More than ever, Community Solar is bringing solar to neighborhoods and homes that otherwise do not have the opportunity. Local residents and businesses, whether they own, lease, have suitable roof space, or adequate sunshine, are able to invest in our green power future without the requirement to purchase outright their own individual solar system. It is all made possible through the power of collective investment and anyone living within a utility service territory that offers a program can buy "a piece of the rock." Community Solar is today quite possibly the most affordable way to go solar.

At the outset, Community Solar Plants promised to provide a win-win-win for consumers, local jurisdictions, and utilities. Today, that dream has become a reality. Consumers have access to local solar production; cities and counties aggregate, promote, and achieve their climate goals; and utilities provide new green service product offerings and reach Renewable Portfolio Standard mandate requirements.

The focus of the Second Edition of *Community Solar: Design Options and Innovations* is to explore how to expand solar access for all community residents and businesses through Community Solar. We'll bring readers up to date on the state of Community Solar, beginning with a review of the genesis of "solar gardens," and continuing with the concept's evolution into one of the fastest growing markets of the solar industry. Two predominant models are detailed by looking closely at two working plants in California and Colorado, one based on a subscriber model, the other on direct ownership.

This white paper also presents a robust set of benefits for the spectrum of stakeholders, from individual consumers, to regional agencies and municipal institutions, and even those initiatives spurred by aggregators and non-utility energy companies. This paper concludes with design options for entities interested in developing CSP activities, drawing lessons learned from those leaders and their communal solar arrays plants that pioneered the concept.

We at EcoMotion wish you the absolute best in your endeavors into the realm of Community Solar program design, development, and implementation.

Sincerely,

Shaun Miller

Shaun Miller
Project Manager, EcoMotion, Inc.

[1] Flanigan, Ted. "Community Solar Plants: A Review of Predominant Design Options for Utilities." (2011).

SECTION 2: Introduction

In recent decades, electric utilities have had to adapt to the emergence of the green power market. As such, a combination of private investment, government regulation, and consumer demand have forced utilities to expand their renewable portfolios. As renewable generation assets expand, so does the demand for renewables that serve everyone, not just those who both have the available space on their roof and can afford to install a system of their own.

Community Solar represents just one of the many recent green power concepts available for utilities to further develop a more sustainable grid. While the concept has been developing for more than a decade, and mature programs exist from which data can be analyzed and lessons can be learned, Community Solar is still an idea young enough to contain many exciting opportunities for implementation. As this white paper demonstrates, Community Solar Plants are a tested, valuable, efficient, and scalable clean power alternative.

The Genesis of Solar Gardens

Community Solar Plants were originally known as Community Solar "gardens." Just as individuals join community gardens because they do not have the available space to grow their own vegetables, those without adequate roof space, and who desire a clean energy alternative for their home's electricity use, can likewise join a Community Solar "garden." Conveniently enough, both types of garden harvest the sun's energy!

The first Community Solar garden was built in Ellensburg, Washington in 2006. The Ellensburg garden, a 36 kW ground-mount system consisting of 120 solar modules, was truly a community endeavor. Local residents partnered with the city to invest in the system and students at Central Washington University helped to design, advertise, and seek grant funding for the project. In a few short years, the solar garden concept spread across the United States, and by 2011, seven states had Community Solar gardens in operation. Most were under 100 kW and several were smaller than 10 kW.[2]

The concept of Community Solar first gained traction because nearly three-quarters of all residential rooftops are not suitable to host a solar system.[3] Many rooftops are shaded by trees, others are covered by equipment, and others still face in directions that lead to inefficient production. In addition, there are numerous economic factors that impede and prevent individuals from purchasing their own solar system. They may be renters, or own a condominium in a larger building, or they might be unable to afford a solar system. This last reason makes Community Solar a great option for projects focused on issues of Environmental Justice.

While the first gardens were small, ground-mounted, and lacked large-scale replication, as solar technology advanced, and scale could be more efficiently and affordably achieved, solar gardens quickly evolved into Community Solar Plants. The tables below frame these early efforts.

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[2] Details on the design contrasts of these Community Solar Plants can be found in the following articles: Coughlin, Jason, et al. "A Guide to Community Shared Solar: Utility, Private, and Non-Profit Project Development." (2012): n. pag. Web; Farrell, John, "Community Solar Plants: Obstacles and Barriers." (2011): n. pag. Web.

[3] Coughlin, Jason, et al. "A Guide to Community Shared Solar: Utility, Private, and Non-Profit Project Development." (2012): 2. Web.

Table 1: Comparison of Existing CSP System Design Basics

	Location	Year Built	Size kW	Term	Configuration
Ellensburg Municipal Utility	Ellensburg, WA	2006	36	20+ years	Ground mount
Ashland Municipal Utility	Ashland, OR	2008	93	20 years	Rooftop
Florida Keys Electric Co-Op	Marathon Key and Crawl Key, FL	2008	120	25 years	Ground mount
St George Energy and Dixie Escalante Electric	St. George, UT	2008	100	19 years	Ground mount
United Power	Brighton, CO	2009	10	25 years	Ground mount
Clean Energy Collective	El Jebel, CO	2010	78	50 years	Ground mount
University Park Community Solar	University Park, MD	2010	22	20 years	Rooftop
Seattle City Light	Seattle, WA	2011	24	9 years	Picnic shade structures in park
Tangerine Power	Edmunds, WA	2011	75	10 years	Rooftop of community center
Grand Valley Power	Grand Junction, CO	2011	722	4 years	Ground mount
Pikes Peak Solar Garden	Colorado Springs, CO	2011	3,200	25 years	Ground mount
Lake Region Electric Co-Op	Pelican Rapids, MN	2013	245	20 years	Ground mount
Heartland Power Co-Op	St. Ansgar, IA	2014	852	20 years	Ground mount
Western Massachusetts Community Solar Array	Hadley, MA	2014	997	25 years	Ground mount
Clark County PUD	Clark County, WA	2015	319	20 years	Ground mount
Avista Utilities Solar Array	Boulder Park, WA	2015	423	20 years	Ground mount
Bar Harbor Community Solar Farm	Bar Harbor, NE	2016	49.6	15 years	Rooftop

Table 2: Comparison of Existing CSP Participation Levels

	Min/Max Shares	Cost to Buy-In	Customer Structure	Compensation
Ellensburg Municipal Utility	Monetary contribution with no cap	Voluntary contributions that vary	20 year lease	Quarterly bill credit at retail rate
Ashland Municipal Utility	¼, ½ and full modules with no cap	$825/module	20 year lease	Annual bill credit at retail rate
Florida Keys Electric Co-Op	$999 to lease 175w module output	$999/leased model	25 year lease	Monthly bill credit at retail rate
St. George Energy and Dixie Escalante Electric	Minimum 0.5 kW to Maximum 4kW	$6,000/kW	19 year lease	Net Metering Economics
United Power	Each 210 module is leased	Initial $1,050 fee	25 year lease	Net Metering Economics
Clean Energy Collective	One module or up to 120% of annual kWh use	As little as $525	50 year Specific Ownership	Net Metering Economics plus REC payment
University Park Community Solar	LLC must have fewer than 35 members	Varies by PPA share	Passive LLC ownership	Proceeds from revenue
Seattle City Light	Min 1, Max 2 unit (50 kWh/yr)	$600 per unit	9 year lease	State production credit and kWh bill credit
Tangerine Power	Min 1, Max 10 "SunSlices"	$1000 per SunSlice	10 year lease	State production credit and kWh bill credit
Grand Valley Power	16 solar panels	$0 down, 2 cents/kWh	4 year non-profit	Net metering bill credit for 4 year
Pikes Peak Solar Garden	½ module min, 15 module max	$690 per ½ module	25 year subscription	Quarterly bill credit
Lake Region Electric Co-Op	½ panel and up to 10 panels	$700/half panel	20 year lease	Monthly bill credit or up to 100% annual usage
Heartland Power Co-Op	Min 1 panel, no max	$1,300 per panel	20 year lease	Monthly bill credit
Western Mass Community SA	Min 1 panel, no max	$1,230/panel or $.25/watt	25 year lease	Monthly bill credit
Clark County PUD	1 module min, 5 module max	$1,395 per module	20 year lease	Quarterly bill credit
Avista Utilities Solar Array	Min 1 panel, max 3	$1,400 per panel	5 year subscription	$1.129/kWh from state incentives plus value of energy generated
Bar Harbor Community Solar Farm	Min 15 modules (4.65 kW)	$1,400 per module	15 year lease	Monthly bill credit

Evolution of the Aggregator

So how did the concept of Community Solar evolve from 73 individuals in Washington building 36 kW of solar garden in Ellensburg, Washington, to an approach that is set to build 1.8 GW of CSPs in the next five years? Participants in Ellensburg were originally solicited by the City's municipal electric utility and asked to pledge funds for a portion of the project. While it was an excellent beginning, the group of participants, essentially part of a not-for-profit project, were ineligible for rebates and incentives. In the long term this was neither an affordable nor scalable arrangement.

One lesson learned from the Ellensburg CSP was that, in order to make solar maximally cost effective, the project must take advantage of any and all rebates, incentives, and tax credits. When creating its SolarShares® program, the Sacramento Municipal Utility District (SMUD) contracted a third-party developer to build and operate the 1 MW solar array so that the for-profit entity could reap all incentives and tax benefits to lower construction costs and, therefore, the eventual cost for participants. SolarShares® subscribers effectively receive these benefits as a monthly subscription fee that is lower than it otherwise would be if the CSP were built by a non-profit entity.

The Clean Energy Collective took this approach a step further; it's participants join a business enterprise created for and specific to each project. Today this is called a special purpose entity, an entity created to develop a Community Solar project. Members of a special purpose entity receive any and all rebates, incentives, and tax credits and, therefore, see their up-front purchase price directly reduced by these benefits.

It was this organization of special purpose entities that gave rise to the aggregator. A Community Solar aggregator acts as a broker who packages the solar electric service and sells it to consumers. The move to third-party aggregators has streamlined both the development and participation of CSPs. Rather than each individual utility developing a program and marketing and selling to its customers, a third-party aggregator has already developed strategies that are cost-effective for and valuable to electric utilities.

Community Solar Defined

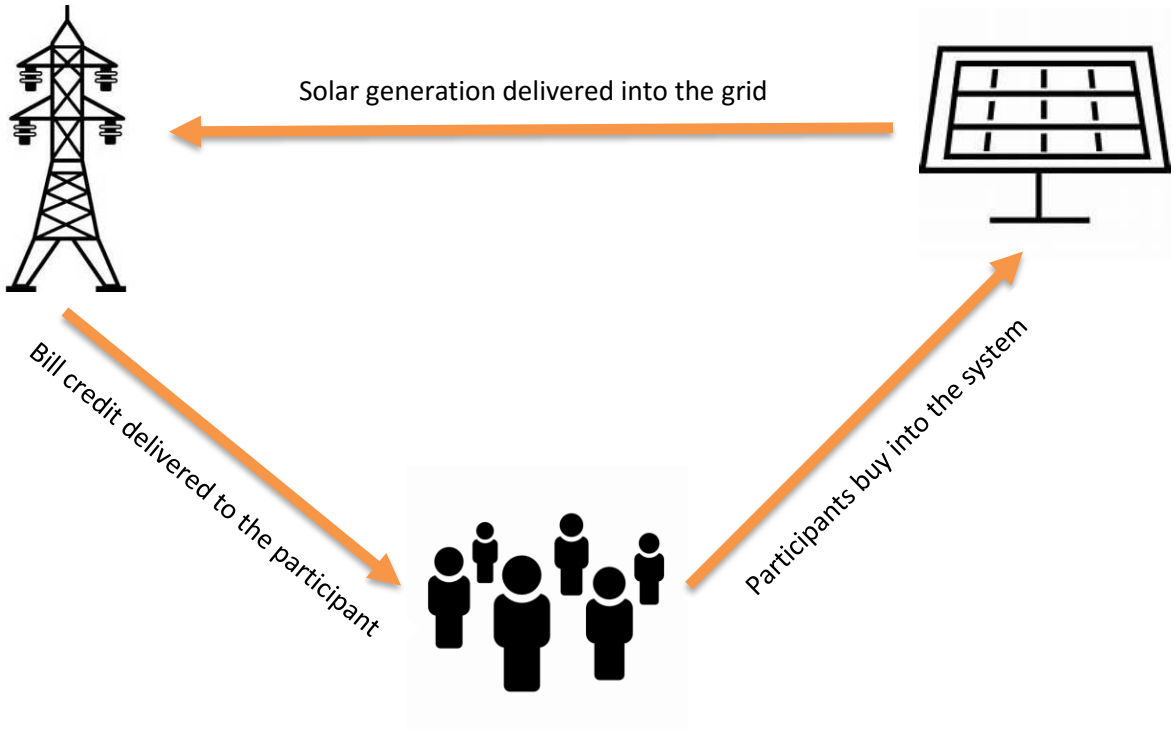
Let's back up for a moment and clearly define Community Solar. When is a solar system considered a Community Solar plant rather than a utility-grade solar array?

With Community Solar comes a definition that has been malleable and sometimes difficult to pin down. While general definitions exist, utilities, developers, and regulating and legislative bodies apply these definitions in various ways suitable to particular projects, and not only across projects, but also across states. As ruling bodies refine the definition of Community Solar, these rulings will have significant implications on program design and requirements.

The National Renewable Energy Laboratory (NREL), in its report *A Guide to Community Shared Solar*, defines Community Solar as "a solar-electric system that provides power and/or financial benefit to multiple community members."[4] For the purposes of this white paper, NREL's broad definition is the best starting place because of the flexibility it affords, allowing interested parties to approach Community Solar from a wide variety of original positions.

[4] Coughlin, Jason et al. "A Guide to Community Shared Solar: Utility, Private, and Non-profit Project Development." (2012): 2. Web.

Figure 1: Community Solar Flow Diagram



Three types of system ownership have emerged, but two predominant options offered to the average utility rate-payer. Customers either directly "own" a purchased portion of the array, owning specific panel assets and their output; or they "subscribe" to a fixed-quantity of kilowatt hours. Each offers its customers a set of benefits however different depending on the type. While a third non-profit model exists, this paper addresses the owner/subscriber model types.

Utility Power Acquisition

Community Solar Plants can be implemented within any utility territory which can purchase clean power under a Power Purchase Agreement (PPA) or Feed-in Tariff (FIT), or if the utility is allowed and/or regulated to provide virtual net metering services. Under a PPA or FIT, the utility agrees to purchase the production of the CSP, with an added slight twist: instead of paying the CSP directly for the power purchased, individual CSP customers are "paid" through a credit directly on their utility bills. This form of virtual bill crediting provides for a generating meter that can transfer its generation credits to another location within the utility service territory.

Virtual net metering (VNM) is allowed for in at least some capacity in sixteen states across the U.S. (This represents a healthy subset of the 42 states and the District of Columbia that offer Net Energy Metering.) In Maine, Massachusetts, New Hampshire, Pennsylvania, and Vermont, VNM is available to all customers. In Colorado, Delaware, Minnesota, New York, and Wisconsin, VNM is available only to customers with solar and then only within certain utility service areas. In California, Connecticut, the

District of Columbia, and Rhode Island, it is available only to certain customers (i.e. non-commercial), and in Illinois, it is optional for utilities to offer it.[5]

In California, virtual net metering is available but only to multi-tenant properties and local governments and schools. Through the Multi-family Affordable Solar Housing (MASH) program,[6] owners of multi-family affordable housing with individually-metered tenants can pass on a portion of the solar generation to those tenants as "Benefitting Accounts." In addition, California municipalities and school districts are able to virtually net meter excess generation from one account and credit it to another "Benefitting Account." The California Public Utilities Commission allows excess generation to be applied at the retail rate, however, at the end of the year any balance of surplus is "trued-up at a separate fair market value, known as Net Surplus Compensation (NSC).[7]

A Donation-Based Model

Before discussing the two predominate models for Community Solar, a third, non-profit model, should be briefly explained. The non-profit model operates in one of two ways, either it is organized and administered by an organization that shares the benefits of the system with participating members, or it solicits donations from third-parties who do not receive any benefit from the project except potential tax benefits for their gift.

While the non-profit model is intended to specifically benefit non-profit organizations, another type of donation-based model was launched by Solar Mosaic, a for-profit crowdfunding company that developed a grass roots PPA model. It sought suitable roofs, whether on schools or businesses, and gathered donors willing to buy shares in the project. The power was sold to the host and the donors recouped their investment within 7-10 years, however without a profit. Solar Mosaic earns project development fees and drives additional earnings into future projects. Solar Mosaic completed its first solar rooftop project, a 28.8 kW system located on top of the Asian Resource Center in Oakland, CA, in 2011.[8]

With approximately 75% of all roof space unsuitable for solar, such crowdfunding platforms have the potential to become as popular as online resources like Kickstarter, GoFundMe, and Kiva. In fact, in 2015 London hosted the second annual Renewable Energy Crowdfunding Conference, attended by industry leaders, major financiers, software and project developers, agency regulators, and utility sponsors.

Two Predominant Models of Scale

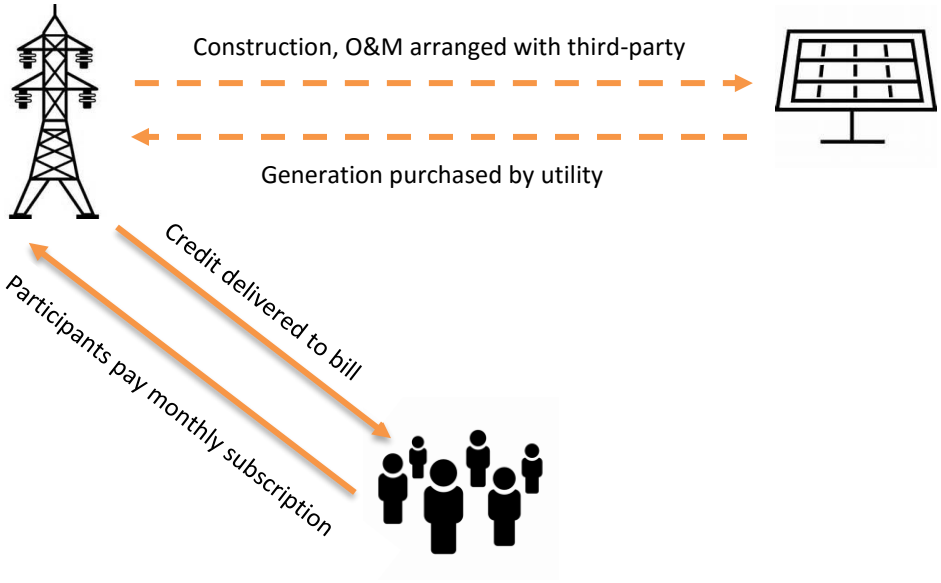
Two emergent community solar models are explored in this white paper. The first is the subscriber model, sometimes called the utility-sponsored model. Second is the ownership model. We examine one of each type more closely in the sections below. Each system examined is large enough to achieve considerable economies of scale and to engage several hundred customers. They stand as examples of

[5] Farrell, John. "Updated: States Supporting Virtual Net Metering." *Institute for Local Self-Reliance*. Institute for Local Self-Reliance, 5 Nov. 2015. Web.
[6] *California Public Utilities Commission*. State of California, n.d. Web.
[7] California (State). Public Utilities Commission. Decision. "Decision Adopting Net Surplus Compensation." (June 9, 2011). Web.
[8] Fehrenbacher, Katie. "Solar Mosaic Turns 'the Kickstarter of Solar' into a Way to Make Money." *GigaOM*. Knowingly, Inc., 6 Jan. 2013. Web.

choice for communities eager to employ Community Solar Plants to boost energy independence while also reducing carbon emissions.

The first project, built on the subscriber model, is a 1.25 MW SolarShares® system in Wilton, California. This CSP, built within the Sacramento Municipal Utility District (SMUD), is owned by SolarShares®, the third-party developer and operator who sells the CSP's output to SMUD through a Power Purchase Agreement (PPA). SMUD then arranges for subscribers to purchase a set amount of solar capacity while also buying down the rate to increase palatability for the consumer. For instance, a consumer might purchase the minimum 0.5 kW share and receive, as a bill credit, the fixed kWh output of that share over the life of the term. All Renewable Energy Credits (RECs) are held by the utility.

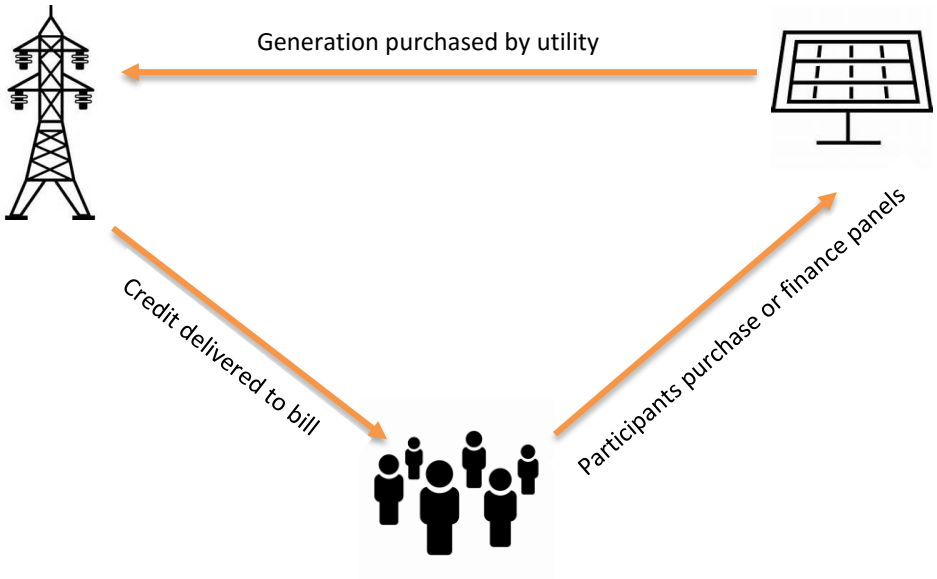
Figure 2: Subscriber Model Flow Diagram



The second project, the ownership model, is an 858 kW Clean Energy Collective system in Rifle, Colorado. This CSP is much more akin to an individually owned solar system in that consumers actually purchase a physical piece of the system. Built within the Holy Cross Energy service territory, it is both built by the community and owned by community.[9] Owners receive a bill credit for the kWh production of their panel's output, which can fluctuate depending on weather and time of year. In this model, the Clean Energy Collective collects and monetizes individual ITC tax credits, captures accelerated depreciation benefits, and gathers utility incentives on behalf of participants. The utility purchases RECs as a block from the Clean Energy Collective.

[9] Farrell, John. "Community Solar Power: Obstacles and Opportunities." (2011): n. pag. Web.

Figure 3: Ownership Model Flow Diagram



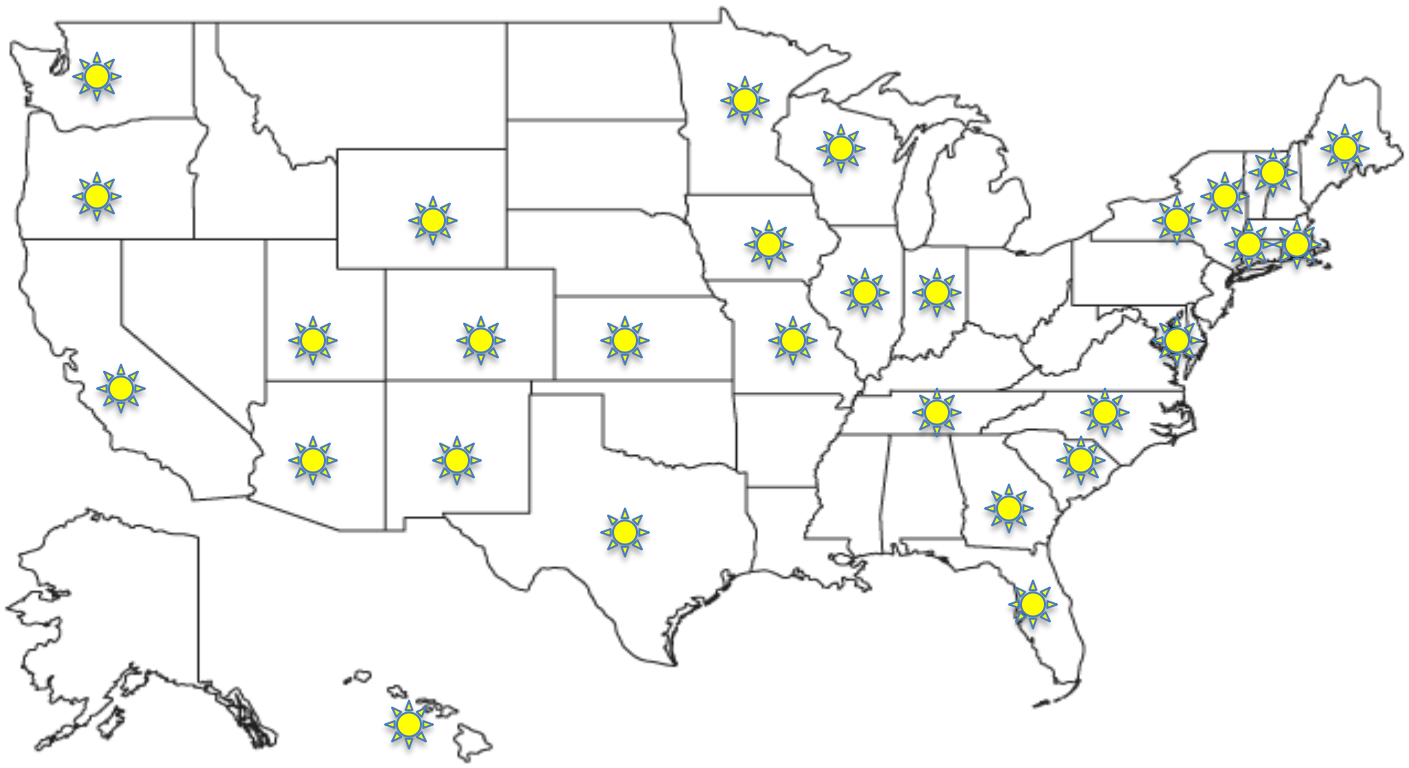
In addition to the benefit of local solar-generated electricity that each model gives to consumers, the latter Clean Energy Collective model, provides consumers with two added benefits. The first is that consumers receive additional credit for the Renewable Energy Credits produced by the system. Depending on the market, RECs are of sellable value to utilities. The second, and greatest benefit of the owner model, is that as utility prices increase over time, a participant's return will also increase, while, in the subscriber model, participants are limited to only their share of the output, no matter what the price may be.

To be clear, both models have been quite successful. As this white paper shows, Community Solar Plants have many utility and consumer benefits, giving customers a new form of energy independence, while providing a reliable source of capacity and energy for the utility, and at significantly less cost than individual net energy metering.

SECTION 3: Legal and Regulatory Updates

Community Solar Plants make sense for many reasons. They can be a win-win for utilities and consumers alike, and the concept is spreading increasingly across the nation. In many places utilities are free to pursue CSPs as they wish without legislative restrictions, while in others utilities must follow legislated state laws, advice from Public Utility Commissions (PUCs), PPA guidelines, or Feed-in Tariff (FIT) program requirements. The map below illustrates states that have either already developed CSPs or are currently pursuing legislated/regulated programs.

Figure 4: States with Existing CSPs or Currently Pursuing Legistlated/Regulated Programs



California

In 2011, State Senator Lois Wolk introduced legislation to allow Community Solar Plants of up to 20 MW to be developed in the State. According to the bill, SB 843, kWh credits would have been applied to customer bills with priority given to highest tier charges first, and for Time of Use (TOU) customers credited according to the time of day the electricity was generated. [10]

SB 843 was inspired by agreements made for transferring the Photovoltaics for Utility Systems Applications (PVUSA) in Davis, California to the City of Davis in 2001. PVUSA was originally built by Pacific Gas & Electric (PGE) in 1986 as a photovoltaics test site. It was then sold to the California Energy Commission for research purposes and, eventually, given to the City of Davis by the State. The City wished to use it for its own power generation, so special legislation was passed to allow this. Its current leaseholder, Clean Energy Assets, in conjunction with development partner, CleanPath Ventures, is planning to expand the site to as much as 15 MW for a solar garden.

From the outset SB 843 met resistance from California's investor-owned utilities (IOUs). Before the bill could go up for a vote, it was agreed by all parties that the California Public Utilities Commission would oversee and regulate development of Community Solar in the State. In 2016, the CPUC ruled in favor of

[10] California (State). Legislature. Senate. SB No. 843. (S. 2832 *f* 4&5) 2011-2012 R eg. Sess. (February 18, 2011). Web.

requiring the State's three IOUs to hold public auctions to deploy a combined 600 MW of Enhanced Community Renewables projects across the State by the end of 2018.[11] CSP participants will receive a bill credits the generation value plus a time-of-delivery adjustment, a value that is less than half the retail rate. This rate applies only to customers in investor-owned utility territories.

While California has not yet legislated treatment of community solar plants and/or gardens, new developments with virtual net metering, and a track record of limited solar penetration, speak to community solar plants. California already allows virtual net metering for local governments and schools such that a single site can power-up multiple facilities with green electrons. Now a CPUC Advice Letter on Virtual Net Metering is calling on VNM for all residential rental properties. These developments speak to utility management of VNM, one of the key pieces in the CSP equation.

Colorado

Colorado: HB 10-1342, the Community Solar Gardens Act[12], was signed into law on June 5, 2010 by Governor Bill Ritter. The bill specifies that energy must be sold directly to an investor-owned utility which provides participants with compensation for both the energy value and the renewable energy credit value.

Any legal for-profit or nonprofit entity may own and administer the solar garden. Utilities are required to provide the virtual net metering credit, minus transmission, distribution and rider fees, on the subscribing customer's bill. The PV system size is limited to two MW per garden and must subscribe at least ten participants, none of whom may own more than 40% of the CSP's capacity. If the subscriber's county has a population less than 20,000, it may subscribe participants from a neighboring county. Subscribers may buy up to 120% of their own power use worth of solar power.

To date, Colorado has more CSPs than any other state. Twenty-eight CSPs have been built and are generating more than 16 MW of electricity for local participants. Another 26 projects are in development with the potential to generate another 31 MW.[13] In addition, the Colorado Energy Office (CEO) announced last year that it would launch the Low Income Communities Shared Solar Demonstration Project to develop viable approaches to delivering solar electricity to low income subscribers. By January 2016, CEO and its partner, Grid Alternatives, announced it had secured agreements with five Colorado electric cooperatives to develop low-income projects totaling 579 kW of capacity.[14]

Delaware

In 2011 the Delaware Public Service Commission issued Order 7946, proposing revised net metering rules.[15] For one, it allowed retail customers, through aggregation of accounts or by investment, to obtain

[11] California (State). Public Utility Commission. *Decision Addressing Participation of Enhanced Community Renewables Projects in the Renewable Auction Mechanism and Other Refinements to the Green Tariff Shared Renewables Program*. (May 12, 2016). Web.
[12] Colorado (State). Legislature. House. House Bill 10-1342. 2010-2011 Reg. Sess. (June 5, 2010). Web.
[13] Colorado (State). Colorado Energy Office. *Community Solar*. Web.
[14] Scott, Jessica. "Colorado Launches Low Income Rural Shared Solar Projects." *Vote Solar*. Vote Solar. (January 29, 2016). Web.
[15] Delaware (State). Public Service Commission. Order No. 7946. (April 19, 2011). Web.

net metering benefits via community-owned generating facilities. In addition, the further revised proposed provisions allow Delmarva Power & Light Company (DP&L) the opportunity to utilize an alternative value to calculate the level of payment for excess net metering credits in the context of community-owned generation facilities. Finally, the further proposed revisions allow DP&L to recover from stand-alone community-owned generation facilities a customer charge and other applicable charges related to supply, transmission, and delivery costs.

Hawaii

In June 2015, the governor of Hawaii signed Act 100 into law which required Hawaii's public utilities to create a community renewables tariff program. It was inspired by the idea that all of the State's residents should be able "to participate in and enjoy the economic, environmental, and societal benefits of renewable energy."[16] The following month, the Hawaiian Electric Company delivered a proposal to the Hawaiian Public Utility Commission (HCPUC) for a Community Solar pilot program. Under the program as proposed, participants would pay an upfront cost plus an enrollment fee, then pay a monthly maintenance fee. In turn, the participants would receive a monthly bill credit. For users averaging 500 kWh per month would see a monthly bill reduction of up to 45%.[17] The HPUC denied the initial proposal, however, there is still an active docket for implementation of a Community-Based Renewable Energy program.

Massachusetts

In 2008, Massachusetts passed the Green Communities Act,[18] which gave Community Solar programs a stimulus for development. Among many energy efficiency and reform measures the law introduced, it also established funding alternatives and renewable energy source construction projects. The law allowed neighborhood groups to construct renewable facilities for net-metering on neighborhood land. In the first six years, the Green Communities fund delivered $30 million dollars to 123 communities.[19] Today, customers within National Grid and Eversource service areas have the option of participating in a Community Solar program called SolarPerks™. Members in the National Grid service area also have the opportunity to participate in the Harvard Solar Garden.[20] Other CSPs in Massachusetts include the Brewster Community Solar Garden and the Sippican Community Solar Garden as cooperative providers of solar electricity.

In April, 2016, Bill H.4173[21] was passed by the legislature to increase existing caps on net metering and preserve retail net metering for small existing solar systems. However, the bill raised the net metering cap by only 3%, and also established a revised net metering rate of only 60% of the retail rate for newly constructed systems. No exceptions were made for low-income and environmental justice projects, the

[16] Hawaii (State). Haw. Sess. Laws Act 100. (§ 1, p. 1). (2015). Web.
[17] "Hawaiian Electric Proposes Community Solar Pilot Project." *Hawaiian Electric*. Hawaiian Electric Company, Inc. July 15, 2015. Web.
[18] Massachusetts (State). Legislature. Senate. SB 2768. Reg. Sess. (July 2, 2008). Web.
[19] Hibbard, Paul J. et al. "The Impacts of the Green Communities Act on the Massachusetts Economy: A Review of the First Six Years of the Act's Implementation." (2014): 17. Web.
[20] This is the town of Harvard, Massachusetts, not Harvard University.
[21] Massachusetts (State). Legislature. House. Bill H.4173. Reg. Sess. (April 6, 2016). Web.

results of which were the cap reaching its limit on the same day as implementation, and projects serving low-income and disadvantaged communities must effectively give away 40% of their production.[22]

Minnesota

Minnesota Statute 216B.1641 on Community Solar Gardens was written and passed in 2013. It put no limit on the number or cumulative capacity of solar gardens except where expressed limitations already exist. The statute does, however, limit the size of a single system to 1 MW nameplate capacity. Otherwise, each project must have at least five subscribers, none of which may hold more than 40% of the project's generation. Owned capacity is limited to 120% of a customer's average annual consumption. The project must be located within the customer's same utility service territory, and the utility must purchase all system generation produced.[23]

While residential solar in Minnesota has been net metered since its inception, a 2015 law changed that by allowing municipalities and cooperatives to charge residential customers a "grid fee" for distribution system operations and maintenance costs.[24] Then, in 2016, the Minnesota Public Utilities Commission moved to allow investor-owned utilities to charge a Value of Solar (VOS) tariff. Under the Minnesota VOS tariff, customers purchase electricity at the retail rate, but are then compensated at a separate VOS rate calculated by their utility provider.[25]

Washington

In May 2009, the State of Washington passed SB 6170, effective July 1, 2009.[26] This legislation allowed Community Solar projects to receive the State's production incentive. All projects are eligible for a $0.096/kWh State production incentive up to $5,000/year until June 30, 2020. Projects that use Washington-made modules and inverters can claim an incentive of $0.54/kWh, again capped at $5,000 annually.[27] Community solar projects are defined as solar energy systems up to 75 kilowatts (kW) that are owned by local entities and placed on local government property or owned by utilities and funded voluntarily by utility ratepayers.

Federal Legislation

U.S. Senator Mark Udall (D-Colorado) sponsored and introduced to Congress the Solar Uniting Neighborhoods or SUN Act—SB 3137 in 2010, 2011, and 2013. The bill intended to "amend the Internal Revenue Service Code of 1986 to provide that solar energy property need not be located on the property with respect to which it is generating electricity in order to qualify for the residential energy efficient property credit."[28] Essentially, this bill would have allowed the 30% Federal ITC to be extended

[22] "Solar Policy and Legislation." MassSolar. MassSolar is Working, Inc. Web.
[23] Minnesota Statutes. 216B.1641. (2015). Web.
[24] Shaffer, David. "Big Industry, utilities win on energy legislation in Minnesota." *Minneapolis Star Tribune*. (May 19, 2015). Web.
[25] Minnesota (State). Public Utilities Commission. Docket No. E-015/M-15-825. "Order Approving Pilot Program with Modificiations." (July 27, 2016). Web.
[26] Washington (State). Legislature. Senate. SB No. 16170. (2009). Web.
[27] Washington (State). Department of Revenue. "Incentive Programs: Deferrals, Exemptions, and Credits." Web.
[28] United States (Federal). Legislature. Senate. S. 1225 (113th): Solar Uniting Neighborhoods (SUN) Act. (2013). Web.

to residential participants of CSPs. While the bill was never passed, the 30% ITC was extended through other legislative measures, and residential participants can receive the monetized benefit through the CSP developer.

In 2016, Community Solar Plants were praised by the White House and the President's Clean Energy Savings for All Americans Initiative.[29] The initiative will work toward developing 1 GW of Community Solar capacity reserved for low- and moderate-income families by 2020. CSPs have also been singled out by the Department of Energy's SunShot Initiative in its Community Solar Challenge.[30]
While it must be mentioned that the road to Community Solar isn't totally clear—CSP-limiting commission regulations and antiquated utility infrastructure and billing software are sometimes roadblocks—state legislation and federal support are enable the Community Solar movement.

SECTION 4: The Benefits of Community Solar Plants

Community Solar Plants offer a host of benefits to both project sponsors and participants. While utility companies and their customers have been the primary beneficiaries to date, CSPs stand poised to deliver the same benefits and potentially more to sponsoring groups like city and county governments, transportation authorities, school districts, and religious organizations. These groups have yet to employ CSPs to their advantage. But that is about to change. In July 2016, the Department of Energy SunShot Initiative® announced its first Community Solar Challenge to encourage and incentivize local public non-utility-led teams to develop Community Solar programs in new and innovative ways. This challenge will provide local teams with funds and will expand the concept of how and for who Community Solar can be implemented. In the following paragraphs we'll explore how Community Solar benefits not only sponsoring agencies but also consumers.

Benefits for Project Sponsors

Reliability: CSPs, especially those operated, maintained, and administered by third-parties, result in reliable solar power for many years—in some cases as long as 50 years. Very often sponsoring agencies have neither the personnel nor the expertise to maintain a solar system at its peak function, and if a system does not perform at its peak, then it will not deliver its expected returns. When operations and maintenance is wrested from the sponsoring agencies responsibility, monitoring and preventative maintenance activities are performed at regular intervals, and sponsors can expect the system to perform better, longer.

Return on Investment: While not the primary reason Community Solar is pursued, sponsoring agencies stand a greater chance of a return on their investment when a third-party operates and maintains the system. This is especially true if they choose to participate as an anchor tenant. As system size increases, solar transaction and installation costs decrease.

[29] Secretary, Office of the Press. "Fact Sheet: Obama Administration Announces Clean Energy Savings for all Americans Initiative." *White House*. USA.gov. July 19, 2016. Web.
[30] United States Department of Energy. "Request for Information: Community Solar Challenge." *United States Department of Energy*. USA.gov. (2016). Web.

Energy and Climate Goals: Through CSPs, local agencies have the opportunity to be local energy and climate leaders. By developing a CSP they will be a rallying cry for local citizens who wish to participate. What's more, in select utility service territories the agency could potentially retain any Renewable Energy Credits created by the project.

Environmental Justice: The spirit of Community Solar is to provide solar to those who otherwise do not have access. This might be a question of available roof space but, more recently, it has been a question of affordability. Agencies have an opportunity to target disadvantaged communities, especially through incentives and subsidies, as one of the primary beneficiaries of a CSP. The same can be said for small and disadvantaged businesses. The DOE Challenge and the California PUC have both prioritized Environmental Justice project development in their programs and regulatory decisions.

Constituent: CSPs help meet a growing consumer demand for access to renewable clean energy. By helping to lower the barriers to access for solar power, local agencies gain credibility within the communities that they serve.

Public Relations and Good Will: An agency's actions will precede its reputation within the community. Agencies will reap significant public relations benefits from developing CSPs. While they are doing good by cementing ties in the community, they can also garner tremendous good will. CSP provides for colorful photo opportunities, positive press, and a chance at redefining its role within the communities in which it operates. CSPs are a means of fulfilling additional objectives at no additional cost.

Early Adopter Status: The status that comes with being an early adopter in any endeavor can be transformative. While Community Solar has been a viable concept for almost a decade, very few non-utility entities have moved into the space. Those that do will be poised to garner a reputation of innovative strength and unparalleled community engagement. For public agencies, these are two qualities of indispensable value.

Benefits for Consumers

Access: Since most U.S. residents do not have access to solar generation, because either they cannot afford it or their roof will not support a system, CSPs offer access to solar power to individuals who would not otherwise have it. The same can be said for business owners who do not own the building or commercial space in which they operation.

Affordability: CSP provides a means for more customers to participate in solar with a much smaller initial investment than buying an individual system. Participants can purchase per panel, sometimes even a ½ or ¼ panel, or pay a reasonable subscription fee. More to the point, if consumers pool their monies, then they have buying power. As a project becomes more to scale, it significantly reduces installation costs, and all participating parties win.

Smart Investment: CSPs make sense as an investment for both businesses and consumers. When aggregators pool the funds of participants it delivers buying power. This means lower costs, less risk, and greater upside potential for a return on investment. In particular, ownership models often deliver a net positive cash flow result over the life of the system. In addition to providing a clear means for taking responsible action for a sustainable future, businesses that operate from renewable energy attract the growing number of sustainability-conscious consumers.

Transferability: In California, for example, residents are on the move. They move homes every seven years on average and are hesitant of long-term, non-transferable investments. CSPs, on the other hand, allow for easy transfer or sale of ownership, as new members are always on hand to take ownership of the panels for their own benefit.

Benefits for Communities

Economic Development: CSPs boost economic development. A typical CSP costs $5 – 6 million dollars, an infusion of cash into an economy. And through CSP ownership, consumers see a return on their dollars, growing steadily as their solar purchases serve as hedges to future price uncertainty.

Workforce Development / Job Creation: CSPs provide local jobs, both in the form of construction and ongoing maintenance. Local production of solar pushes the jobs in this area into the fabric of communities.

Sustainable Energy Future: Similarly, CSPs are a true manifestation of utilities' support for a sustainable energy future. In such a scenario, energy efficiency is optimized and the remaining demands for power generation are fulfilled by renewable forms of energy. CSPs are harbingers of the future, with clean and green power generation embedded in California communities. By leading the charge, embracing and encouraging CSP, utilities can take full advantage of such strategic position, assuring a central role in the future.

SECTION 5: Models of Scale

The SMUD SolarShares® Subscriber Model

For almost a decade the Sacramento Municipal Utility District SolarShares® program had the distinction of being not only the nation's largest Community Solar Plant but also the first municipal utility district to promote the concept. In 2008, the program debuted with a 1 MW CSP built on a turkey farm southeast

of the city. Within six months of opening the program sold out its capacity, and to date it has kept customer retention above 95%.[31]

Since its inception the program has remained almost fully subscribed. Interested new customers must join a waiting list and enroll when existing customers opt out or leave the territory. In the SolarShares® model participants buy blocks of solar capacity in one-half kilowatt increments, up to 4 kW, and pay a fixed monthly fee for as many years as they continue to participate. The fee for 0.5 kW is $10.75/month. The generated output is credited to participants' utility bill at the full retail rate.

SolarShares® is essentially a green pricing program model. While SMUD also offers a conventional green pricing program made up of a variety of renewable sources from different places, SolarShares® is 100% solar and 100% local. The plant is also built with panels and components made in the USA.

Its design also protects non-participating ratepayers from the risks and costs associated with the CSP. But just as non-participating ratepayers are protected from increasing in marginal costs, CSP participants, and early adopters especially, will benefit from future technology, materials, and design cost decreases. This is especially true as the program expands its capacity. As an added benefit, since monthly fees remain flat even as utility prices escalate, participant benefits will increase as the years go by. The table below summarizes the pricing structure for the 1 MW CSP. [32]

Table 3: SolarShares® Participant Pricing Structures

		Customer Annual Usage (kWh)					
		Small (≤6,000 kWh/yr)		Medium (6,001-14,000 kWh/yr)		Large (>14,000 kWh/yr)	
Size (kW)	kWh/yr	Monthly Fee	$/kWh	Monthly Fee	$/kWh	Monthly Fee	$/kWh
0.5	868	$10.75	$0.15				
1.0	1,736	$21.50	$0.15	$26.50	$0.18		
1.5	2,604			$39.75	$0.18		
2.0	3,472			$53.00	$0.18	$66.00	$0.23
3.0	5,208					$99.00	$0.23
4.0	6,944					$132.00	$0.23

The pricing structure for the SolarShares® program has remained the same since its inception, but this is likely to change in 2017 when SMUD transitions from energy-dependent to time-of-use rates. While the municipal utility district plans to keep its energy charges fixed over time, the costs of participation will increase due to line and equipment costs.[33] Even so, as the program expands, and it is expected to increase fourfold in 2017, the SMUD pricing structure treats early adaptors favorably. As the cost of succeeding systems fall, fees for first-generation participants are reduced to reflect the decreasing average PPA price of the entire SolarShares® portfolio.

[31] Burke, Jim. "SMUD's SolarShares Experience--A Community Model." Solar Energy in Inland Southern California Conference. University of California, Riverside, Riverside. 6 Feb. 2014. Lecture.
[32] Frantz, Stephen. "SMUD Solar Shares in a Nutshell." *Solar Gardens*. Solar Gardens. June 8, 2011. Web.
[33] Burke, Jim. *Personal Interview*. (August 19, 2016).

The Clean Energy Collective Ownership Model

Counterpoint to the subscriber model is the Clean Energy Collective ownership model. Participants within this model own the system by direct purchase and receive a bill credit for the kWh their panels produce. Since participants own a quantity of panels rather than a set capacity, they receive credits on a variable basis, as panels produce more in the summer months than the winter months. The Clean Energy Collective monetizes the Federal Investment Tax Credit, utility and government incentives, and accelerated depreciation up front, thus making a participant's initial buy-in more affordable and thus more attractive as an investment.

Clean Energy Collective built its first pilot project in El Jebel, Colorado in 2010. Located within the Holy Cross Energy service territory (a cooperative utility), the 77.7 kW system went online with 19 participants each purchasing at least one panel. After accounting for the ITC, incentives, and depreciation, the initial investment ranged between $2.15 to $3.15/watt. In return, participants receive a bill credit of $0.11/kWh of generated electricity, a rate negotiated by the Clean Energy Collective on behalf of participants and which escalates as utility rates increase. Other features of the Clean Energy Collective ownership model include a 50-year ownership agreement with maintenance and performance guarantee, full transferability of ownership, and free monitoring and bill credit function through RemoteMeter® online portal.

Building on the success of the El Jebel pilot, Clean Energy Collective built an 858 kW array at the Garfield County Airport in Rifle, Colorado. At the time it was the largest community-owned solar plant in the nation, and the opening ceremony was attended by then-governor Bill Ritter. To meet increasing demand for access, the Garfield County Airport plant will expand by 500 kW this year.[34]

The below table provides a snapshot comparison of the two models.

[34] Staff, RealVail. "Eagle County adding 500 kW of solar at Garfield County Airport." *RealVail*. RealVail. June 29, 2016. Web.

Table 4: Comparison of Models of Scale Case Studies

	SolarShares	Clean Energy Collective
Year Built	2008	2011
System Size	1.25 MW	858 kW
System Site	Wilton, CA	Rifle, CO
Participating Utility	Sacramento Municipal Utility District	Holy Cross Energy
Host Site Type	Ground mount	Ground mount
Participant Shares	0.5 kW to 4 kW shares	Up to 120% of annual electricity use
Program Length	20 years	50 years
Cost to Participate	0.5 kW share $129/yr	As little as $525
Compensation	Bill credit; 800 kWh / 0.5 kW solar	Virtual credit for kWh production on utility bills
Ownership	Third party	Customer Owned
RECS	Held by Utility	Purchased by Utility

SECTION 6: Design Options

Getting It Done…

Now that you've decided that Community Solar simply makes sense, it's time to decide how you will design your program. There are several decisions to be made. In its paper *Community Solar: Program Design Models*[35], the Solar Electric Power Association identifies a list of twelve crucial design decisions that should be made by any utility developing Community Solar. These decisions include determining project siting and scale, participation limit, minimum term, REC treatment, the economic proposition, and the rest, but while its list of design decisions is only twelve, the options for each decision is multiple. Minimum terms might be set at 12 months, 24 months, 48 months, or none at all. The program might continue for 10 years, 25 years, 50 years, or anywhere in between.

While SEPA's list is excellent, we do not replicate that list here. In fact, there is one item that predetermines all other decisions that SEPA does not include, but at which we'll begin our discussion of the design options. It's about getting it done, and being realistic about how you are going to be getting it done! Do you or your utility have the resources to design, build, and administer a Community Solar Plant, or do you want a third-party developer to do it for you?

[35] Chwastyk, Dan, and John Sterling. "Community Solar: Program Design Models." (2016): n. pag. Web.

In-House v. Third-Party Administration

Deciding whether your plant will be managed in-house or by a third-party is more than just answering a simple YES or NO question. A full review of your utility's capabilities and resources is in order. Do your existing personnel have the available time to administer the program? Will they maintain the physical system? Is your billing software be capable of applying bill credits to individual customer bills? How will the program be advertised? These are just a few of the questions you'll need to ask to determine how the program will be administered.

A prime example of in-house Community Solar management is the SMUD SolarShares model. While its arrays are owned and operated by third-parties, SMUD initially designed and issued RFPs for plant construction. And while SMUD purchases generation from the third-party operator, SMUD performs all sales, marketing, and administration of the program. It interfaces with participants at every level through the program from sign-up and waitlist queue management, to kWh credit and on-bill payment management. Any utility considering this path must determine the costs and benefits of this path.

Taking this concept even further, a utility could choose to build and maintain its own community solar plant rather than buying the energy through a PPA. This would give the utility full control and responsibility for the plant and the base of participants required for its success. Note that rules of normalization would apply and any tax credits or depreciation write-offs would be taken over the life of the solar system rather than on an accelerated basis.

On the other end of the spectrum, the Clean Energy Collective model relieves the host utility of all administrative burdens. Clean Energy Collective offers a turn-key utility solution that handles all design, construction, sales, marketing, rebate processing, tax benefits, and customer service for the life of the project, which is guaranteed and maintained, without additional cost, for 50 years. In this case, the potentially burdensome task of assigning bill credits is automatically handled through Clean Energy Collective proprietary software, RemoteMeter®. Even easier, the software consolidates rebate applications into one application and allows utilites to pay a single lump sum rather than hundreds of smaller rebate payments.

The Customer Offer

The mission and spirit of Community Solar is to provide access to solar-generated electricity to those who do not otherwise have access. While this spirit should encompass anyone and everyone who desires access, at the beginning, initial investment cost, even for CSPs, was a real barrier to entry. In 2008, in Brighton, Colorado, United Power Sol Partners developed a CSP with 48 individual participants. Each participant paid $1,050 for the output of a single 210-watt module for 25 years. Effectively, that investment cost to participants was $5/watt. This example demonstrates the ownership model.

Utilities have two choices here: 1) whether to directly invest in construction of the CSP and deliver solar to participants through a monthly subscription fee, or to have customers deliver the initial investment in a CSP, like the example above; and 2) whether to charge a one-time enrollment/connection fee. As we discussed earlier, SMUD's SolarShares® is an example of the subscriber model. One benefit of the subscriber model over the ownership model is that it makes solar access more affordable to

participants. There is no large up-front investment cost in the subscriber model, though sometimes a small enrollment/connection fee is required. SMUD does not charge an enrollment fee, however it does charge participants $100 if they cancel their subscription within the first 12 months.

Table 5: The Customer Offer Compared

	Investment	Purchase	Output	RECs	Compensation
Ownership	Up-front/financed	$/W	Variable	Purchased by utility	Virtual credit
Subscriber	Monthly Subscription	$/kWh	Fixed	Held by utility	Bill credit

While utilities choose whether a participant's investment will be in either $/watt or $/kWh, it has several additional ways to help minimize a participant's initial investment in order to maximize participation levels. In the United Power Sol Partners case above, the utility was able to collect a $50,000 state grant that lowered the initial investment for participants. In another example, also in Colorado, Grand Valley Power delivers participants an ownership opportunity with no money down. GVP builds and maintains the CSP, and rather than pay for panels up front, participants finance panels for five years through the utility. What's more, in 2015, GVP expanded its program to deliver solar-generated power to low-income customers for free. As part of a small and unique pilot, GVP partnered with GRID Alternatives to build a 24 kW array reserved for low-income families. Each family receives the benefits of solar power for four years at no up-front cost plus $0.02/kWh for maintenance. The program projects each family's savings to be approximately $600/year.[36]

In the end, the utility has a choice in presenting its customers with a participation offer. While not mandatory, utilities which actively seek ways to minimize a participant's initial investment and attract participants from all income levels creates more successful and therefore more expansive programs.

Bill Credit Considerations

While certain design decisions lend to framing participants first, determining how to credit participants for their assigned output should aim to relieve as much of the administrative burden from the utility as possible. One way or another, participants receive a credit, but some methods for crediting a participants' bills are more intensive than others. Partnering with and allowing a third-party to handle all billing-related crediting is an effective way to minimize administrative costs.

The way in which credits are delivered is yet another decision. Generally speaking, when utilities deliver a bill credit, they do so against the participant's kWh consumption—their consumption is reduced by the amount of their owned or subscribed output. The rate at which this credit is provided varies depending on availability of net metering, state production credit incentives, and SREC values. States that allow full retail net metering are the most valuable to participants, though for utilities full retail rates potentially disproportionately level risk and grid maintenance costs on non-participating ratepayers. In California,

[36] Taylor, Mike. "Solar Success for Non-profit Utilities: Grand Valley Power's Low-Income Community Solar Program." (2016): 4. Web.

utilities are pleased that a hybrid structure of incentives and net-energy metering has spurred the solar market, but they do not believe that paying the full retail value is fair to ratepayers.

Utilities that elect to promote CSPs must think about what bill credit value to provide. Some utilities want to limit the value of the credit to the value of the generation of power. In California, for instance, the CPUC ruled that credits must be delivered based on the value of generation plus a time-of-delivery adjustment that leads to an effective value of $0.07, almost half of the retail value.[37]

The Solar Electric Power Association offers another option, which is to credit customer bills through a line item payment based on avoided costs, the value of solar, or another accounting method.[38] This credit is applied to the entire bill rather than to kWh consumption.

For program designers, and ultimately consumers, there is a key benefit that reduced bills—through bill credits—are not taxable. Programs issuing monetary non-bill related credit instead of kWh credit will likely need to first clarify its tax and securities position to avoid classification as a security or taxable.

The SEC Lesson

A big lesson was learned about community solar in University Park, Maryland, a self-espoused "tree-lined community." It came up with a solution using the solar interest of its congregation: Now the Church of the Brethren roof is adorned with 81 panels, each producing 230 watts of PV power. Pooled money from the congregation was fed into the University Park Solar LLC, that sold discounted power to the church (PPA), benefitting the church's operations while providing a return for investors.

Then the project reportedly ran afoul of the Federal Securities and Exchange Commission and its definition of a regulated security. The SEC "registration" requirement can cost hundreds of thousands of dollars. The LLC was able to limit this cost by keeping registrants in-state, limiting "non-wealthy" members to fewer than 35, limiting advertising to word of mouth, and having each member furnish ten-page disclosures.

The lesson learned is that it is possible to "share" ownership of a Community Solar Plant. Owners can individually take tax benefits, and by earning bill credits, they appear to steer clear of the SEC rules on the sale of shares and the distribution of their benefits, using bill credits for their piece of the rock. However, this model is clearly limited in its scalability and replicability.

Location Options

CSPs can be located anywhere a residential, commercial, or utility-scale solar array can be placed. Obviously, future scalability depends on placement, but otherwise there is no limitation for where a CSP can reside. In 2016, the City of Bar Harbor in Maine hosted its first Community Solar plant on the roof of one of its Public Works buildings. While the project investors are private citizens and businesses, the City receives a leasing fee and positive public relations for hosting the plant. A 2011 project by Seattle Power

[37] California (State). Public Utility Commission. *Decision Addressing Participation of Enhanced Community Renewables Projects in the Renewable Auction Mechanism and Other Refinements to the Green Tariff Shared Renewables Program*. (May 12, 2016). Web.
[38] Chwastyk, Dan, and John Sterling. "Community Solar: Program Design Models." (2016): 12. Web.

& Light mounted panels for its pilot project on picnic shade structures in a public park. The City of Santa Monica is studying whether they should host CSPs on the top level of public parking structures.

Below is a list of sites that also might be viable for hosting CSPs:

- City/government property,
  - Municipal buildings
  - Parking structures
  - Airports
  - Parks
- Utility property
- Transmission rights of way
- Transportation rights of way, cloverleafs
- Churches, community centers, non-profits
- Schools and universities
- Landfills, brownfields
- Covered and uncovered reservoirs
- Private property (e.g. supermarkets)

What follows is a brief discussion of some other less popular but completely viable locations for solar arrays. While these location examples have not been specifically used for Community Solar, any site that can host solar can no less host Community Solar.

On behalf of the City of Santa Monica, EcoMotion has had discussions with Caltrans to explore use of rights of way for solar. One innovative solar company, Republic Solar Highways, specializes in using the cloverleafs in highway interchanges for solar arrays as a location for a ground-mount system.[39]

New York City is planning 50 MW of solar on covered landfills for the future. The City of Dinuba, California has teamed with Tioga Energy and Chevron Energy Solutions to develop a 1.15 MW solar electric system to reduce energy costs for operations at the City's wastewater treatment plant. The ground-mounted system sits atop a capped landfill near Dinuba's wastewater treatment facility, which is the City's largest energy-using facility.

Covered and uncovered reservoirs are being used for photovoltaic arrays. "Float-o-voltaics" literally float on reservoirs. While water and electricity are not known partners, when properly installed these systems have the additional benefit to the host site of cutting evaporation. Such systems can also reduce the need for expensive replacement bladders (covers).

In the fall of 2010, the City of San Francisco completed construction on a 5 MW solar photovoltaic system installation on the roof of the City's largest reservoir.[40] The solar plant is operated under a Power Purchase Agreement between the San Francisco Public Utilities Commission and Recurrent

[39] The solar panels would have been located on Caltrans property, which is owned by the State of California, and is unusable for the purposes of residential or commercial development. No part of the proposed project would have been located on private property, and Republic would have rented the land from Caltrans in the form of a long term ground lease. Unfortunately, negotiations ended and the project was never implemented.

[40] The San Francisco Sunset Reservoir Solar Project: http://www.recurrentenergy.com/resources/sfsunset.php

Energy. The electricity goes directly into the grid and is distributed to municipal users such as the General Hospital, airport, port, municipal light-rail, and public schools.

Naturally, a key consideration for locating CSPs must be with the serving utility's distribution system. Where can a 1 MW load be easily interconnected, and accommodated? Given the intermittency of solar, it cannot be used to reliably "firm up" distribution circuits. Working with distribution system professionals early in the process helps to find a real win-win between consumer excitement and utilities' system opportunities and limitations related to distributed generation.

SECTION 7: The CSP Participant

Subscriber Preferences

We have just discussed some design decisions of the Community Solar developing agency's concern. But there are yet more decisions that have implications for the participant and their level of participation. As was mentioned earlier, Community Solar is an excellent way of bringing solar to those who otherwise do not have access, but program design, and specifically whether the case can be made to potential participants by its design, is of the upmost importance.

Before we continue, it is worth returning to the Solar Electric Power Association's 2015 focus group results to better understand what participants are seeking in a Community Solar Plant. After holding focus groups in four market areas across the United States, SEPA discovered that participants are seeking four very interesting things:

1) Economics are No. 1—Customers said that they would only participate if there was a clear economic case for them. The voice of the advocate who puts "being green" above all else was non-existent.
2) Greater effort is needed to educate the public—Very few focus group participants knew what community solar was prior to the meeting. This was not due to screening. As the business model was explained, preferences shifted quickly from doubt to interest.

3) Length of commitment must be short—Customers were not interested in making a long-term contractual commitment. They gravitated towards the models that had shorter terms, provided transferability of subscriptions, or gave flexibility to drop out. Note that the design option for program length, which is typically 20-25 years, is not a customer commitment, but instead a length of time that benefits can be received.

4) Location is important, but in an unexpected way—There was consensus that customers did not want to see the solar panels and would prefer them to be sited at remote locations. One residential focus group participant likened solar panels to other utility equipment such as substations, which were seen as unattractive, as a reason for preferring remotely located projects to those within their community.[41]

[41] Chwastyk, Dan, and John Sterling. "Community Solar: Program Design Models." (2016): 21. Web.

So What's the Deal for Participants?

While the early pioneering Community Solar programs were largely mission-driven, today's CSPs are more likely to be seen as an investment opportunity. Participants in the City of Ellensburg project, the nation's first, may never see a return on their investment. As the table below illustrates, the simple payback on their initial investment is 34 years, while their owner-lease benefit agreements start at only 20 years. The Ashland Municipal Utility CSP has a similar payback. Without projects like these, however, the concept of Community Solar would not have advanced to its present state.

Participant returns are related to a number of factors. Buy-in participation limits, how much solar an individual can purchase or subscribe to, as does whether their solar output is fixed or variable, determines how much of their current bill is off-set. Program lengths of longer duration also lend to greater returns since benefits are received over a longer term. Lastly the treatment of generated Renewable Energy Credits also impacts a participant's return.

Let's take a quick look at the simple payback of some of the nation's first projects to see where Community Solar Plants originally stood as an investment for participants. The following table is based on a report by the Institute of Local Self-Reliance that compares the simple payback for various CSP programs.

Table 6: Years to Simple Payback

Years to Simple Payback *	
Ellensburg Municipal Utility	34
Ashland Municipal Utility	34
Florida Keys Electric Co-Op	23
St. George Energy and Dixie Escalante Electric	32
United Power	26
Clean Energy Collective	13
University Park Community Solar	5
Seattle City Light	9
Tangerine Power	10

*Figures taken from ILSR Study

Buy-in Limits

While utility-developed Community Solar Plants limit participation levels by an individual's electricity consumption, whether as a percentage of annual use or as a percentage of ownership within the project, other agencies have some flexibility in how they limit an individual's participation. Certain agencies may choose to subsidize or take on completely the cost of specific participants. Since non-utilities does not have to worry about issues like transmission and distribution grid maintenance, they

do not have to pass on such costs to participants. Of course, they still have to follow applicable state and local laws and regulations regarding Community Solar.

As an example, a low-income project sponsor might choose to offer a one-to-one match of funds, limiting a customer to purchasing into the CSP at 50% of annual consumption and matching the other 50% with agency funds. The same could be done on a panel-to-panel basis. Depending on whether an ownership or subscriber model is chosen, the output remains variable or fixed, respectively. Whichever model is chosen, one certain outcome is that the cost of solar is driven down, easing the burden on all participating parties.

The Investment Tax Credit (ITC)

Program designers recognize that in order to make CSPs an attractive endeavor they've got to collect the tax credits to lower the costs. The 30% Federal Investment Tax Credit is crucial. For agencies without any tax appetite, however, in order to receive any ITC benefit they need to partner with a third-party. Third-party developers can effectively push the tax credit to the agency and its participants through a PPA, by a lower rate than they would have paid without the tax credit.

Utility Incentives

Some Community Solar programs are able capitalize on utility incentives in addition to the tax credit. In the State of Washington, Community Solar Seattle participants receive the Washington State Renewable Energy Production Incentive annually through June of 2020. In El Jebel, Colorado, Holy Cross Electric pays participants $0.11/kWh for their share of the output (including the REC) for the life of the system. That pencils out to a rate higher than the full retail rate which is credited to the participant's utility bill. This was a special negotiated rate secured by the Clean Energy Collective on behalf of its CSP participants and it keeps pace with energy price escalation over time.[42]

Some utilities may elect to apply their existing solar incentives to community solar plants, resulting in the same cross subsidy that exists in today's residential and commercial solar markets. A utility that offers $2.00/watt for residential solar systems, for instance, might elect to provide the same incentive to participants of a CSP. Utility incentives have traditionally covered 20-40% of the solar system cost, however many of these incentives are being reduced or going away all together. Where they do still exist, many Community Solar third-party developers are able to bundle these incentives into one transaction making it simple both for the customer and the utility.

Renewable Energy Credits (RECs)

A Renewable Energy Credit represents 1 MWh of electricity generated by a renewable source. Renewable Energy Credits can be retired, retained, traded, or sold. Regulated utilities seek to generate them in order to reach their Renewable Portfolio Standard requirements. Corporations voluntarily buy them to off-set high emission activities. Individual homeowners with a solar system might not even realize they generate RECs. It is likely an individual's utility purchases residential-generated RECs in addition to credits delivered for generated electricity sent into the grid. In some Community Solar models RECs are used to buy down the initial investment.

[42] Spencer, Paul. *Personal Interview.*

RECs are of especial value for agencies with lofty climate goals. Community Solar offers a unique opportunity for agencies to both provide solar electricity to subscribers and also retain the RECs for their renewable energy goals. At this point RECs are a semi-regulated product and subject to the laws and regulations of jurisdictions within which they are generated. In Colorado, for instance, utilities must purchase the RECs from CSP participants, providing owners with an additional $0.03/kWh. In California, the PUC ruled that CSP participants within the three regulated IOU territories must be purchased at $10.00/MWh, only garnering an additional $0.01/kWh. However, also in California, IOU utilities cannot count CSP-generated RECs toward their RPS requirement and must retire all purchased RECs on behalf of participants. RECs in unregulated markets still represent an unclear value.

Environmental Justice Provision

Community Solar Plants might also be oriented to serve specifically low-income and disadvantaged participants. The California Public Utilities Commission has reserved 100 MW for Environmental Justice projects under the 600 MW of mandated Enhanced Community Renewable project development. Agencies might choose to develop projects within disadvantaged neighborhoods or subsidize the costs of CSP participation through such a program.

Another opportunity that comes with targeting disadvantaged participants is that a Community Solar program can be enhanced to offer additional incentives for participants to achieve energy efficiency measures. An agency might offer energy-efficiency surveys or provide further value in the form of solar for participants who perform lighting, HVAC, and/or water retrofits.

SECTION 8: Conclusion / Call to Action

In July, the White House announced a goal of developing 1 GW of low- and moderate-income solar by the year 2020 and Community Solar Plants are primed to be the most effective solution for achieving that goal. How can you help our nation can reach this spectacular goal? One means is to help your constituents gain access to solar-generated electricity they otherwise would not be able to attain.

Community Solar promises to be a success no matter where you operate. As a whole, Community Solar Plants across the country retain subscription levels at 70%,[43] and many have operated fully subscribed since day one. What's especially unique for CSPs sponsored by municipalities and public agencies, however, is that unsubscribed capacity is simply reserved for use by its sponsoring agency's facilities.

Your constituents are ready. Once educated in the concept they are receptive, supported, and motivated to participate. It's also likely that you already own the land or roof space. EcoMotion can evaluate the site, conduct market research, coordinate with the interconnecting utility, and develop a financial plan. We deliver unparalleled feasibility analysis and project development services which will convert your Community Solar dreams into reality.

EcoMotion's in-house team has more than fifty years of experience in solar and energy efficiency-related project and program success working with utilities, municipalities, agencies, educational

[43] Chwastyk, Dan, and John Sterling. "Community Solar: Program Design Models." (2016): 18. Web.

institutions, and commercial businesses. Our consulting stable of designers, engineers, installers, and experts is available 24/7 no matter where your organization or your project is located.

Community Solar is here to stay. Its application is expanding beyond electric utilities and cooperatives. Municipalities, local agencies, and even non-profit organizations are already developing to their benefit and the benefit of their constituents. What's holding you back? Go for it!