



**EcoMotion** -- *Business Greening Solutions*

15375 Barranca Parkway, F-104 • Irvine, California 92618 • (949) 450-7155 • [www.EcoMotion.us](http://www.EcoMotion.us)

# Community Solar Plants

## A White Paper Review of Predominant Design Options for Utilities

January 2012



# Outline

## 1. Executive Summary

## 2. Introduction

- The Genesis of Solar Gardens

  - Solar Gardens: System Basics (Table)

  - Solar Gardens: Participation (Table)

- A Donation-Based Model

- Utility Power Acquisition

- Defining “Community Solar”

- Two Predominate Models of Scale (Table)

  - SolarShares

  - Clean Energy Collective

- Legal and Regulatory Updates

  - Colorado, Delaware, Washington, Massachusetts, California

  - Federal Legislation

## 3. The Utility Benefits of Community Solar Plants

- A New Utility Product

  - Building Relationships

  - Addressing the Regressivity of Solar

  - Providing Affordable Solar to Many More Customers

  - Enabling Smart Consumers Investments

  - Overcoming the Barrier of a Highly Mobile Society

  - Presenting a Substantive Public Relations Dimension

- Lower Cost Solar Model

  - Providing Options for Utility Solar Incentives

  - Halving Customer Solar Installation Costs

  - Lowering Solar Transaction Costs

  - Competitive Pricing for Solar Power Acquisition

- “Centralized” Distributed Generation

  - Effective Monitoring

  - Well Maintained Systems

  - Providing Reliable Solar Power

  - Contributing to the Renewable Portfolio Standards

  - Outsourced VNM and Monthly Billing at No-Cost

  - Potential Distribution System Benefits

- Empowering Customers

  - Enabling the Solar Experience

  - The Potential to Totally Eliminate Cross Subsidies

  - Environmental Justice Provisions

## Partnering in Community Action

- Building Clean and Green Power Infrastructure
- Building Closer Ties with Local Jurisdictions
- Boosting Local Economic Development
- Supporting Local Workforce Development and Jobs
- Proactive Steps in Climate Protection
- Supporting a Sustainable Energy Future

## 4. A Focus on Programs of Scale

### The SolarShares “Subscriber Model”

- Solar Shares at a Glance

### The Clean Energy Collective “Ownership Model”

- Clean Energy Collective Functions
- The Clean Energy Collective Deal
- Mid Valley Community Solar Array
- Garfield County Airport Community Solar Array

## 5. Design Options

- In-house Management vs. Working with a Private CSP Enterprise
- Making it Affordable for all consumers Through Minimal Participation Investment
- Customer Bill Crediting Considerations
- The SEC Lesson and Steering Clear of Shares
- Mini PPA Models
- Location for Community Solar
  - CSP Location Options: Brownfields and Landfills, Reservoirs
- What’s the Deal for Participants?
- Years to Simple Payback (Table)
- Pricing the Product
  - Finding the Balance
- Getting the Tax Credit
- Use of Solar Incentives
- REC Ownership Value
- Potential Environmental Justice Provisions
- Payment to Host Site
- CSP and Efficiency

## 6. Conclusion / Call to Action

*This White Paper was prepared by EcoMotion on assignment for Martifer Solar USA. Its content and assessments are the views of EcoMotion which welcomes comments and information on advances with community solar for subsequent updates. Martifer Solar USA believes in community solar for its multiple benefits, and is proud of its work with the Clean Energy Collective and others in this regard. The concept, we all agree, has tremendous merit in the advance of solar energy for our sustainable future.*

# Executive Summary

Community Solar Plants (CSPs) bring solar to neighborhoods. Your utility has likely done a great job of providing solar incentives to homeowners. Now, instead of your customers owning individual systems, citizens, local businesses, corporate leaders and others, even those without a suitable roof, sunshine or ownership of a building, are able to invest in a green power future, thanks to collective investments. Community Solar Plants are also an affordable way for your customers to go solar. Everyone can “buy a piece of the rock,” photovoltaic panels and dedicated capacity. They combine their panels with others in a community system, just like a community garden.

Today, Community Solar Plants are poised to provide a win-win-win for consumers, communities, and utilities. Consumers have access to local solar production; cities and counties aggregate, promote and achieve their climate protection goals; and utilities not only serve their customers with a new product offering, but provide green services whose fees are recovered directly from participants without utility capital investment. Analysis suggests that CSPs can be more cost effective for utilities than net metering solar, given lower unit and transaction costs as well as more reliable long-term clean power production.

*Two CSP models of scale are presented:  
One is based on subscriptions for green power, the other based on ownership.*

This White Paper provides a review of community solar plants, starting with their evolution from initial “solar gardens.” It presents the robust set of benefits that community solar plants provide for electric utilities, municipal, cooperative, and investor-owned. Two predominant models are presented from working plants in California and Colorado. One is based on subscriptions; the other on direct consumer ownership. The paper concludes with design options for utilities interested in developing CSP activities, drawing lessons learned from the roughly dozen plants that have pioneered the concept.

## 2. Introduction

Community Solar Plants represent a new green power concept, a new and affordable way for utilities to promote solar, and a smart way for customers to “go solar.” As this White Paper demonstrates, Community Solar Plants bring appropriately scaled clean and green power to communities. They have been tested and are desirable, bringing value to consumers and utilities.

For utilities, CSPs are a new means of working with customers – they are a new product – a means to engage and build ties with interested customers, from homeowners without ample roof space, to renters, to corporate and industrial citizens keen on going green and investing in solar power. Rather than servicing hundreds of individual systems, for utilities, CSPs are a reliable green power source.

### **The Genesis of Solar Gardens**

Community Solar Plants were originally known as “community solar gardens.” If your customer doesn’t have a back yard to grow vegetables, or a roof on which to mount panels, the community garden is a great alternative. Both forms of gardens harvest the sun’s energy.

In less than a decade, the solar garden concept has caught on in America. The map below presents early solar gardens that stretch from Washington to Florida, Colorado to Maryland. Two publications – one prepared by the National Renewable Energy Laboratory (NREL)<sup>1</sup> and the other by the Institute for Local Self Reliance in Minneapolis<sup>2</sup> -- provide details on these early, small-scale efforts and contrast their designs. Most were community projects, smaller than 100 kW in size. Several are smaller than 10 kW.

The map below shows their geographic spread.



The Solar Garden Institute in Westminster, Colorado maintains a directory of projects and organizations.<sup>3</sup> This paper will focus on the rapid evolution of “gardens” to “community solar plants” that take advantage of the economies of scale. The tables below frame these early efforts, case studies, and their comparative analyses herein.

The “action” really began in 2006 in Ellensburg, Washington with the construction of a 36 kW ground-mount system. It was the first of nine early community solar plants that were small and ground-mounted and largely lacked the ability to be widely replicated.

Ownership, as discussed in some detail in this White Paper, is interesting. The concept began with direct consumer ownership, and has evolved to encompass limited liability corporations, third parties, leases and utilities. The term SPE, Special Purpose Entities, has crept into the vernacular. As described later, the two key programs evaluated in this White Paper clearly distinguish between a “subscriber” model in which the consumer pays for kWh, and an “ownership” model in which the consumer owns specific panel assets that produce kWh.

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<sup>1</sup> “A Guide to Community Solar: Utility, Private, and Non-Profit Project Development,” Prepared for the National Renewable Energy Laboratory (NREL), of the U.S. Department of Energy, November 2010.

<sup>2</sup> Farrell, John, Institute for Local Self Reliance New Rules Project, “Community Solar Plants: Obstacles and Barriers,” October 2011.

<sup>3</sup> Solar Gardens Institute, Executive Director, Joy Hughes, <http://solargardens.org>

This leads directly to the “participant experience:” Is CSP appealing? How small can one’s investment be? Half a panel? Quarter panel? What does it cost? How is the participant compensated? Generally, community solar plants are flexible, allowing for transferability in the event of a move.

### Solar Gardens: System Basics

	Location	Year Built	Size kW	Term	Configuration
<b>Ellensburg Municipal Utility</b>	Ellensburg, WA	2006	36	20+ years	Ground mount
<b>Ashland Municipal Utility</b>	Ashland, OR	2008	93	20 years	Rooftop
<b>Florida Keys Electric Co-Op</b>	Marathon Key and Crawl Key, FL	2008	120	25 years	Ground mount
<b>St. George Energy and Dixie Escalante Electric</b>	St. George, UT	2008	100	19 years	Ground mount
<b>United Power</b>	Brighton, CO	2009	10	25 years	Ground mount
<b>Clean Energy Collective</b>	El Jebel, CO	2010	78	50 years	Ground mount
<b>University Park Community Solar</b>	University Park, MD	2010	22	20 years	Rooftop
<b>Seattle City Light</b>	Seattle, WA	*2011	24	9 years	Picnic shade structures in park
<b>Tangerine Power</b>	Edmunds, WA	*2011	75	10 years	Rooftop of community center

\*Planned for 2011

### Solar Gardens: Participation

	Min/Max Shares	Cost to Buy-In	Customer Structure	Compensation
<b>Ellensburg Municipal Utility</b>	Monetary contribution with no cap	Voluntary contributions that vary	20 yr lease	Quarterly bill credit at retail rate
<b>Ashland Municipal Utility</b>	1/4, 1/2 and full modules with no cap	\$825 per module.	20 yr lease	Annual bill credit at retail rate
<b>Florida Keys Electric Co-Op</b>	\$999 to lease 175w module output	\$999 per leased module	25 yr lease	Monthly bill credit at retail rate
<b>St. George Energy and Dixie Escalante Electric</b>	Minimum 0.5 kW to Maximum 4 kW	\$6,000 / kW	19 yr lease	Net Metering Economics
<b>United Power</b>	Each 210 module is leased	Initial \$1,050 fee	25 yr lease	Net Metering Economics
<b>Clean Energy Collective</b>	One or more modules up to 120% of annual kWh use	As little as \$525	50 yr Specific Ownership	Net Metering Economics plus REC payment
<b>University Park Community Solar</b>	LLC must have fewer than 35 members	Varies by PPA share	Passive LLC ownership	Proceeds from revenue
<b>Seattle City Light</b>	Minimum 1, Maximum 2 solar units (50 kWh annually)	\$600 per unit	9 year lease	State production credit and kWh bill credit
<b>Tangerine Power</b>	Minimum 1, Maximum 10 "SunSlices"	\$1000 per SunSlice	10 year lease	State production credit and kWh bill credit

## **A Donation-Based Model**

Solar Mosaic is a for profit company developing an interesting grass-roots PPA model. It seeks schools, non-profits, and businesses with good roofs for solar and then through “crowd-funding” it cultivates small investors (donors) willing to buy shares in the project. The power is sold to the host and the donors recoup their money in 7 to 10 years but make no profit. Solar Mosaic earns project development fees and plows any additional earnings into future projects. Solar Mosaic is launching its first solar rooftop project, a 28.8 kW system, at the Asian Resource Center in Oakland, California. The project has sold “tiles”, about 982 solar units, to hundreds of people.<sup>4</sup>

Sometime in 2012, Solar Mosaic wants to take the next steps with its solar loan platform, offering financial products that can provide returns to potential lenders. But to offer those types of money-making financial products, “Solar Mosaic has to become registered to share securities with the public, which is an arduous, lengthy and expensive process.”<sup>4</sup>

## **Utility Power Acquisition**

CSPs can be implemented by any utility that is able to purchase clean power under a Power Purchase Agreement (PPA) or Feed-in Tariff (FIT). CSPs also work in instances in which a 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 that a generating meter can transfer its generation credits to another location within the utility service territory. It is now allowed in eight states: Colorado (via solar gardens), Maine, Massachusetts, Vermont, Oregon, Pennsylvania, Washington, and Rhode Island.

There is precedent in the Golden State: Virtual Net Metering is allowed in California through the MASH program and AB 2466 which allows municipalities and school districts to virtually net meter excess capacity.<sup>5</sup> California’s PUC has recently issued an advice letter/filing considering instructing the State’s investor-owned utilities to establish VNM for all multi-metered apartment buildings.

## **Defining “Community Solar”**

Just what is a “Community Solar Plant?”

Wikipedia defines CSP precisely: “A community solar farm or solar garden is a solar power installation that accepts capital from and provides credit for the output and tax benefits to individual and other investors.”

This White Paper employs a broader definition. There are a number of models of note in the CSP “space.” Many of the early community solar examples presented were instructional, and to be noted as useful and exploratory, clearly stepping stones to the sophisticated CSP program designs presented next that maximize utility and consumer benefit.

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<sup>4</sup> Katie Fehrenbacher, Gigaom.com, October 12, 2011

<sup>5</sup> AB 2466 Local Government Renewable Energy Self Generation Program:  
<http://www.pge.com/b2b/newgenerator/ab2466/>

## Two Predominant Models of Scale

	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

There are two primary community solar models emerging that are explored in this White Paper. One is 1.25 MW and the other is 858 kW, big enough to achieve considerable economies of scale and to engage 350 - 700 customers each. They are indeed scalable. They stand as choices for utilities and communities eager to employ Community Solar Plants to boost energy independence while cutting carbon emissions.

In the Sacramento Municipal Utility District model, the SolarShares program is a 1.25 MW CSP owned by a third party provider that sells output to SMUD through a power purchase agreement (PPA).<sup>6</sup> The utility then arranges for subscribers to buy its capacity. SMUD buys down the rate to make it more palatable for the customer. SMUD is considering additional SolarShares, considering up to 25 MW of CSP capacity.

The second concept, the 858 kW Holy Cross Clean Energy Collective model in Rifle, Colorado is much more akin to an individually owned solar system, but collectively built within the community.<sup>7</sup> In this model, the Clean Energy Collective is able to monetize the ITC tax credits and capture accelerated depreciation benefits, while gathering utility incentives on behalf of participants. The utility also purchased the Renewable Energy Credits (RECs) as a block from the CSP.

The Clean Energy Collective model begins by lowering the cost of each panel, easing the entry to “going solar” with a no-hassle, comprehensive financial service. Then the Clean Energy Collective signs contracts with each participant for a specific number of panels and capacity. The participants benefit further from a direct credit for the power and RECs produced. As utility prices increase over time, their

<sup>6</sup> Coughlin, Jason, Jennifer Grove, Linda Irvine, Janet F. Jacobs, Sarah Johnson Phillips, and Joseph Wiedman. *A Guide to Community Solar: Utility, Private, and Non-profit Project Development*. Rep. 2010.

<sup>7</sup> Farrell, John. *Community Solar Power: Obstacles and Opportunities*. Rep. New Rules Project, 2010.



return will also increase. Furthermore, participants own the underlying panel assets with the ability to resell them at any time to another utility customer.

Clearly, both models have been successful. As this White Paper will show, CSP has 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 metering.

## **Legal and Regulatory Updates**

CSP makes sense for many reasons. It can be a win-win for utilities and consumers alike, and is being promoted across the nation. Utilities that want to pursue this product can often do so without legislation through advice filings, PPAs or FITs. In other cases, regulatory proceedings and/or legislation may be required to allow and require virtual bill crediting.

### **Colorado**

Colorado: HB 10-1342, the Community Solar Gardens Act<sup>8</sup>, 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 a transmission, distribution and rider fees, on the subscribing customer's bill. The PV system size is limited to 500 kW per garden for a yearly total of 3 MW of standard offer capacity and gardens up to 2 MW per garden for a yearly total of 3 MW of open bid capacity. The program has a 6 MW total annual limit (annual program cap for standard offer and bid capacity) on the program for the first three years.

The Colorado law states there must be at least 10 subscribers of the service and that they must be located in the same county or city as the solar garden. If the subscriber's county has a population less than 20,000, they may subscribe in a neighboring county. Subscribers may buy up to 120% of their own power use worth of solar power.

### **Delaware**

According to the Interstate Renewable Energy Council, on April 19, 2011 the Delaware Public Service Commission issued Order 7946, proposing revised net metering rules.<sup>9</sup>

For one, it allows retail customers, through aggregation of accounts or by investment, to obtain 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

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<sup>8</sup> Colorado House Bill 10-1342:

<http://ssl.csg.org/dockets/2012cycle/32Abills/0332a03cocommunitysolargarden.pdf>

<sup>9</sup> Delaware Order 7946: <http://depsec.delaware.gov/electric/reg49%203001%20PSC%20Proposed.pdf>

community-owned generation facilities a customer charge and other applicable charges related to supply, transmission, and delivery costs.

### **Washington**

In May 2009, Washington passed SB 6170, effective July 1, 2009.<sup>10</sup> This legislation allowed community solar projects to receive the State's production incentive. 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.

### **Massachusetts**

In Massachusetts, the Green Communities Act has made community solar a possibility, though there is not significant uptake. The Act allows a group of customers in a neighborhood (described in the bill as a geographic area including and limited to a unique community of interests that is recognized by residents of such area) to construct a renewable facility for net-metering on neighborhood land. Residents in Falmouth and Brewster have expressed intent to create a community solar plant, though no plans have been announced.

### **California**

While California has not yet legislated treatment of community solar plants and/or gardens, new developments with virtual net energy 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 California Public Utilities Commission Advice letter on Virtual Net Metering calls for VNM for all residential rental properties. These developments will require utility administration, with VNM billing one of the key pieces in the CSP equation.

California's pending SB 843 legislation, introduced by State Senator Lois Wolk, is expected to come up for a vote in January, 2012 to allow community solar gardens up to 20 MW to in the state. Customers that have tiered charges will have the kWh credits applied to usage under the highest tier first and to baseline usage last. Time of Use customers will have kWh credits calculated according to time of day they were generated.<sup>11</sup>

The early genesis for the SB 843 legislation is the Davis, California PVUSA array (PhotoVoltaics for Utility Systems Applications). Built originally for Pacific Gas and Electric in 1986 as a test site for PV, it was sold to the California Energy Commission as research facility, then in turn given to the City of Davis in 2001.\* The City wanted to use it to provide power locally and special legislation was passed to allow this. The current leaseholder, Clean Energy Assets, in conjunction with its development partner, CleanPath Ventures, is planning to expand the project to up to 15 MW for a Community Solar Plant.

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<sup>10</sup> Washington SB 16170: <http://apps.leg.wa.gov/documents/WSLdocs/2009-10/Pdf/Bills/Session%20Law%202009/6170-S.SL.pdf>

<sup>11</sup> SB 843: Offsite Solar: [http://www.aroundthecapitol.com/Bills/SB\\_843/20112012/](http://www.aroundthecapitol.com/Bills/SB_843/20112012/)

## Federal Legislation

U.S. Senator Mark Udall (D-Colorado) is currently sponsoring the SUN Act – SB 3137. Re-introduced in May, 2011, the Solar Utility Neighborhoods Act extends the 30% tax credit to solar garden participants.<sup>12</sup>

## 3. The Utility Benefits of Community Solar Plants

Community Solar Plants offer a host of utility benefits. This White Paper presents 25 of them, some applicable to your situation, others not.

For you, Community Solar Plants represent a new product, a lower-cost form of distributed solar generation that adds value to the grid. They are a form of “centralized DG” with long-term monitoring and maintenance benefits, even performance guarantees.

Community Solar Plants expand the universe of customers that can go solar, and they also take the headache and guesswork out of solar for customers. Community Solar Plants can empower consumers while building closer ties to local jurisdictions and partnering in climate protection at the local level.

### A New Utility Product

Building Relationships: A primary utility benefit of Community Solar Plants is meeting consumer demand strategically. CSPs are a means to maintain customers and build the customer connection at no cost. With CSPs, utilities can locate, promote, and enlist participants in a new relationship, with a new product, covering administrative costs and sharing the long-term investment benefits of solar.

Addressing the Regressivity of Solar: Most current distributed generation solar provides little, if any, utility benefit. Beyond that, it has benefitted participants at the expense of all ratepayers. At worst, DG has been regressive, of benefit only to the rich. While the CSP still requires some investment, its smaller investment sizes make it available to a much wider audience, and it is paid for completely by the individual participants themselves.

Providing Affordable Solar to Many More Customers: CSP provides a means for many more customers to participate with smaller solar investments (e.g. a single panel) that have proportionately desirable returns. This expands the customer base that can go solar and be active in climate protection initiatives, potentially by a factor.

Enabling Smart Consumer Investments: Consumers get it: If they aggregate they have buying power. Many customers want clear means to take responsible action for a sustainable future. But many will only move if they can make smart investments. This means lower costs and risk. CSP at scale is a really smart way for your customers to go solar. Megawatt-sized plants can cut solar costs in half. While early adopters bought solar and made significant statements, CSP dramatically expands the field by lowering unit costs and cutting customer risk.

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<sup>12</sup> SUN Act – SB3137: <http://markudall.senate.gov/?p=blog&id=1091>

Overcoming the Barrier of a Highly Mobile Society: Californians, like many Americans, are on the move, shifting every 6 – 7 years on average, deterring a long-term, questionably transferable investment. CSP allows for transfer and sale of ownership, as new members will always be on hand to take ownership of the panels for their own benefit.

Presenting a Substantive Public Relations Dimension: Utilities reap significant public relations benefits from Community Solar Plants. While they are “doing good,” cementing ties in communities served with a strong partnership model, utilities can garner tremendous good will. CSP provides for colorful photo opportunities, a means of fulfilling multiple objectives at no utility cost.

## **Lower Cost Solar Model**

Providing Options for Utility Solar Incentives: Community Solar Plants, as this White Paper will attest, can be structured in different ways. Some utilities may want to apply the same solar incentive to CSP that they do to DG solar. Others may want to pay a lower incentive, given the lower installation costs. Another configuration is that the host utility eliminates solar incentives through CSP. In each scenario, the members pay for the plants and the administration of the CSP program, typically 10 – 25 years at a minimum, 50 years in the Clean Energy Collective model.

Halving Customer Solar Installation Costs: By aggregating consumers together, larger systems can be built, tapping the economies of scale. While typical 2 – 5 kW residential systems cost \$7 – 10/watt depending on the amount of roof and electrical work required, a 1 MW CSP plant can be built for \$4 – 5/watt inclusive of the administrative costs of aggregation. Community Solar Plants will help bring solar to scale, driving down costs to make renewables more affordable.

Lowering Solar Transaction Costs: CSPs can also alleviate the burden on utilities for numerous household solar power systems. Each individual system requires custom design, installation circumstances, metering, permitting with the local government, interconnection approval, rebate processing, etc. A Community Solar Plant requires only one aggregated transaction – versus 200 - 500 -- lessening the transaction costs of solar.

Competitive Pricing for Solar Power Acquisition: A well planned and executed CSP can provide a utility with solar power at a price competitive with even large scale multi-megawatt remotely sited solar farms.

## **“Centralized” Distributed Generation**

Community Solar Plants achieve an economy of scale by aggregating customers. This leads to a host of utility benefits that can be defined oxymoronically: CSP is a centralized form of local, distributed generation, with long-term, managed utility-scale facilities that serve the utility grid well.

Effective Monitoring: A single, larger array is far more cost effective to monitor than 200 - 500 smaller household arrays. In practice, most smaller systems are not monitored at all. Through a larger centralized plant, monitoring is required and instantly flags discrepancies in output.

Well Maintained Systems: A central community solar plant provides for long-term, preventive maintenance and upkeep as necessary to maximize and stabilize production. All connections are

checked with infrared cameras annually; panels are cleaned quarterly or as needed to maintain output within a narrow band of tolerance. Performance guarantees shift the onus for output from homeowners – often operating their solar systems without expertise and thus “in the dark” -- to the CSP operator.

Providing Reliable Solar Power: Community Solar Plants result in reliable solar power for many years, in some cases for as long as 50 years. While CSI incentives are for 25-year systems, a properly maintained system – with strings of new panels added as needed – can have a life of 50 years. Utility system planners can rely on CSP, unlike individually owned, oft randomly maintained, solar systems.

Contributing to the Renewable Portfolio Standard: CSPs can be structured such that utilities get credit for their capacity towards their renewable portfolio standard. This may require that the utility own the RECs, “stripping” RECs from assets in this case.

Outsourced Bill Credits at No-Cost: One of the challenges of CSPs is providing the output benefits of the plant to its owners. This requires bill credits to specific customers, which means either the utility does it manually or invests in creating an automated system. Both options add cost.

Clean Energy Collective has made significant investments to develop RemoteMeter, a software that combines the solar system’s output with each consumer’s actual consumption and rate. RemoteMeter incorporates strategies and firewalls to avoid complications with utility CIS systems and alleviates the monthly responsibility from the utility.

Potential Distribution System Benefits: One of the intriguing aspects of CSPs is whether they can provide “locational benefits.” Can a solar system shore up a sagging circuit? Can it lessen the urgency of a circuit upgrade? These are important issues for utilities with limited budgets for distribution system upgrades.

To make a CSP a robust addition to the utility distribution system, there must be back-up. Ideally, the purveyor of the CSP would provide batteries, flywheels, compressed air, etc. such that power can be held and then released during peak periods. In Pasadena, the early evening peak is hours after the maximum solar output.<sup>13</sup> Using storage, the peak can be covered, making the CSP resource more valuable. Note that prolonged overcast and rainy periods continue to plague all solar systems, even those with back-up. This will be another avenue for CSPs as they evolve in the future.

## **Empowering Customers**

Community Solar Plants are about community. They create local jobs and boost economic development, building and sustaining the green workforce. CSP provides a pathway for community involvement in solar, providing access to those heretofore disenfranchised, driving down costs and building spirit and community energy resilience.

Enabling the Solar Experience: The Interstate Renewable Energy Council (IREC), a non-profit organization accelerating the use of renewable energy, made an important statement about community solar in a recent review of current practices.<sup>14</sup> “As a foundational matter, IREC believes it is important that participants in a community renewables program should have an experience that is as similar as possible to that of customers investing in on-site renewable energy.”

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<sup>13</sup> Personal communications, Joe Awad, Pasadena Water and Power, September 29, 2011.

<sup>14</sup> Wiedman, Joe. *Community Renewables Model Program Rules*. Rep. 2010. [www.IRECU.org](http://www.IRECU.org)

The Potential to Totally Eliminate Cross Subsidies: One feature of CSPs is that the entire cost of solar can be borne by the participants: one hundred percent of the cost of building and operating the plant over 25 or 50 years. (Some utilities will elect to provide the same solar incentives for CSP participants that they do for individual systems.)

Environmental Justice Provisions: Effectively designed “tariffs” for CSP can provide incentives and means for low and middle-income participation, currently excluded from any solar benefit. Community Solar Plants also allow local programs to be tailored for maximum benefit at the least cost.

## **Partnering in Community Action**

Building Clean and Green Power Infrastructure: Through Community Solar Plants, utilities and customers can work together to build clean and green power infrastructure. Few customers are willing to do this independently; CSPs provide a channel for working with groups of customers in lasting partnerships.

Building Closer Ties with Local Jurisdictions: Similarly, CSPs provide a channel for working effectively with local jurisdictions, working to meet energy management and climate protection goals in concert. There is a natural synergy to be grasped: utilities and the communities they serve seeking more and more clean, green power. Utilities can build (or coordinate) and communities will buy.

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

Supporting Local Workforce Development and Jobs: 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.

Proactive Steps in Climate Protection: Through community solar plants, and being engaged in California communities, utilities have the opportunity to be leaders in climate protection. They can rally customers in the cause, gaining respect and securing a lasting place in local communities.

Supporting a Sustainable Energy Future: Similarly, CSPs are a true manifestation of utilities’ support for a sustainable energy future. In such a scenario, energy efficiency will certainly be optimized, and the remaining demands for power generation will be 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.

## 4. Programs of Scale

### The SolarShares “Subscriber Model”



The biggest domestic “solar garden” was developed by Sacramento Municipal Utility District in 2007. SolarShares is based on a 1 MW photovoltaic plant built on a turkey farm southeast of Sacramento in 2008.

SMUD claims that “nobody will be left out” of the solar opportunity due to housing circumstance. SolarShares opens participation to all customers. Now, the program is fully subscribed with 700 residential SolarShares customers. Other customers can join a waiting list and enroll when current customers drop or move out of the territory. SMUD is making plans for expansion up to 25 MW.

SolarShares participants have a special deal with the utility: They buy blocks of solar capacity in increments of a half kilowatt of capacity (from 0.5 – 4 kW) by paying a fixed monthly fee for as many years as they continue to participate. The basic rate or “subscription fee” for 0.5 kW is \$10.75 a month. The capacity then generates energy which is credited to the bill. The energy credit is equal to the full retail rate; the amount of the credit depends on how much the sun shines -- more in the summer, less in the winter.

SMUD’s “solar garden” is essentially a green pricing program model. It protects non-participating ratepayers. In fact, SMUD claims that it was built exclusively in response to customer requests for a voluntary green pricing program. The monthly fee can be adjusted such that any marginal cost of CSP is born by subscribers. While they pay a premium in the program’s early years, since solar costs are fixed, their monthly fees remain flat as utility prices escalate.

SMUD’s conventional green pricing program is called Greenergy, made up of a variety of renewables such as wind, hydroelectric, and solar from a variety of geographic locations. The SMUD SolarShares product offering is 100% local and 100% solar. And it is not utility-owned, but utility-arranged. SMUD buys the plant’s output from a developer (enXco).

## SolarShares at a Glance

- 1.25 MW (DC)
- Built by Premier Power
- Owned by: enXco
- SMUD buys the output which flows directly into the SMUD grid
- 17,172 First Solar thin film modules
- Annual output: 1,820 MWh

SolarShares provides an opportunity for all SMUD customers to choose solar-generated electricity and become ‘virtual solar owners’. All of the system panels and components are made in the United States.

The table below summarizes the pricing structure for the initial 1-MW SolarShares project.<sup>15</sup> This structure will change as additional SolarShares projects join the grid and as the program expands to nonresidential market segments with different rate structures. As the cost of succeeding systems falls, fees for first-generation customers will be reduced to reflect the decreasing average PPA price of the entire SolarShares portfolio. A sliding scale is applied to the purchase cost. The smaller kWh users pay less. Medium and Large users pay more.

		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

<sup>15</sup> Frantz, Stephen, Program Designer, SMUD. *Solar Shares in a Nutshell*.



## The Clean Energy Collective “Ownership Model”



The Clean Energy Collective is the brainchild of Paul Spencer. His company is located in El Jebel, Colorado and is in the business of enabling community solar plants on behalf of consumers. So far Clean Energy Collective has built a 78 kW pilot project in El Jebel, and an 858 kW facility at the Garfield County Airport in Rifle, Colorado, providing consumers with “a piece of the rock.” Clean Energy Collective makes it easy for participants, collecting tax credits for solar and utility benefits (even REC payments), to drive down participants’ “buy-in” price. Through Clean Energy Collective, participants can “go solar” for as little as \$525.

The Clean Energy Collective model provides participants with a valuable consumer investment, while the consumer is making a statement and taking action to protect the climate. At the same time, the Clean Energy Collective model addresses ease in utility implementation and ongoing administration. Participants own individual panels but are not shareholders in the system, avoiding securities issues. Recognizing the challenge in crediting participants for their investments, Clean Energy Collective built RemoteMeter and the “back-office” capability to handle this key billing function. The software automatically calculates monthly credits for members and integrates with existing utility billing systems.

### Clean Energy Collective Functions

Clean Energy Collective arranges the utility PPA or other power agreement, secures land and approvals, facilitates construction and finance, handles all sales and marketing, manages customer contracts and ongoing administration, executes rebate processing, renders RemoteMeter monthly bill crediting, supplies RemoteMeter web and smart phone customer and utility telemetry tools, and manages ongoing maintenance and operations.

Clean Energy Collective makes it easy for consumers to join. They can sign up for as little as a single panel. They then get solar, with a performance guarantee, monitored and maintained for up to 50 years, all for a single initial low-cost payment. Clean Energy Collective has established a third-party operations and maintenance escrow account to assure that funds will be available for these purposes throughout the extended life of the system.

## **The Clean Energy Collective Deal**

The sale price of \$2.15 - \$3.15 / watt includes a number of services:

- Title to solar panel(s) Clean Energy Collective
- Ongoing facilities insurance
- All rebates and application processing
- Value of 30% ITC
- Clean Energy Collective's Total Coverage 50-year extended warrantee
- RemoteMeter Service for bill crediting
- Lifetime My Clean Energy accounts management and tools

Clean Energy Collective negotiated a 3.5 MW contract with Holy Cross Energy. Thus far, it has developed a 78 kW pilot program in El Jebel and an 858 kW plant in Rifle.

### **Mid Valley Community Solar Array: El Jebel, Colorado 77.7 kW**

Clean Energy Collective began discussions with Holy Cross Energy in 2009. A cooperative serving 55,000 customers in Western Colorado including Vail, Aspen, and Rifle, Holy Cross was highly cooperative and the system went on-line with 19 members in August 2010. Members could and did buy as few as one panel; one member bought 87 of the 338, 230-watt panels.

Clean Energy Collective leased the land, and the Mid Valley Community Solar Array was built on otherwise unusable land owned by the local water and sanitation district. The total cost of the installation was \$466,000. Individual members bought modules at \$2.15 - \$3.15/watt and own them for the life of the project. Clean Energy Collective used a) the economies of scale, b) tax credits, and c) utility and county incentives to buy down the cost. As such, each participant bought into this system at \$2.15 - \$3.15 per watt depending on applicable rebates. Participants receive a bill credit worth an initial \$0.11 per kilowatt hour, which Holy Cross and Clean Energy Collective negotiated to escalate with utility rate increases.

Clean Energy Collective model features:

- 50 year system life maintained to performance guarantee by Clean Energy Collective
- Owners keep modules for 50 years, fully transferable to different meter or owner in territory
- Clean Energy Collective developed proprietary RemoteMeter system performs the CSP bill crediting function for the utility
- Ownership can be transferred to another meter (if member moves) or to different owner

### **Garfield County Airport Community Solar Array: Rifle, Colorado 858 kW**

The Garfield County Airport Community Solar Array built on the El Jebel experience. The 858 kW array also serves Holy Cross Energy. It was built by Martifer Solar USA; the system is made up of 3,575 240-watt panels. It is located on 6.5 acres of land adjacent to the Garfield Airport in Rifle. In a ceremony on June 15<sup>th</sup>, launching the system, former governor Bill Ritter noted that it was the largest community owned solar enterprise in the nation. Clean Energy Collective expects 200 – 350 members when membership is complete.

Clean Energy Collective recently announced an additional 1 MW plant in El Jebel, its selection in September (2011) by San Miguel Power Association to develop a 1 MW community solar plant within its service territory, and selection in November (2011) by Colorado Springs Utilities to develop a 500 kW community solar plant within its services territory.<sup>16</sup> San Miguel is a rural electric cooperative in western Colorado that serves 13,000 meters including the City of Telluride. Colorado Springs Utilities is a municipal utility in Colorado Springs that serves several hundred thousand meters.

## **5. Community Solar Plant Design Options**

### **Getting it done...**

#### **In-house Management vs. Working with a Private CSP Enterprise**

SMUDs SolarShares is a prime example of in-house community solar management. On the plant side, SMUD issues RFPs for the development of the third party owned arrays. It then contracts for the energy output of the solar plants with the chosen developer.

Going even further out on the ownership scale, for purposes of discussion, a utility could choose to build and maintain its own community solar plant. 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 tax credits or depreciation write-offs would be over the system life rather than accelerated.

On the customer side of the SolarShares program, all sales, marketing, and administration of the program are handled by SMUD. The utility interfaces with the participants at every level throughout the program: managing the queue of interested potential SolarShare subscribers, assignment of the solar kWh credits, on-bill payments for program participation, and all customer service interaction. The cost of comprehensive administration must be considered by any utility embarking on this path.

The Clean Energy Collective relieves the host utility of administrative burdens with a turn-key utility solution covering all sales, marketing, consolidated rebate processing and customer service for the 50-year life of the project. In this model, the task of assigning kWh bill credits is handled automatically through RemoteMeter. Clean Energy Collective manages to lessen the utility's burdens within its solar rebate administration by providing a consolidated application and allowing the utility to issue a single rebate instead of hundreds of smaller independent rebates.

#### **Making it Affordable for all Consumers through Minimal Participant Investment**

CSPs provide for low-cost solar investments, allowing for lower and middle-income customer participation. Minimum investments range from portions of panels to increments measured in kilowatts. In 2008, in Brighton, Colorado, United Power Sol Partners was formed by 48 individuals. Each purchased the energy from a single panel. Participants paid \$1,050 up front to lease the output of a 210-watt

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<sup>16</sup> San Miguel Power Association announced deal with Clean Energy Collective on September 7, 2011: <http://www.cleanenergycollective.com/docs/3.pdf>

module for 25 years. The utility financed the project using a \$50,000 state grant. Participants receive a bill credit which is slightly higher than the retail kWh rate.

St. George, Utah residents can buy up to 4 kilowatts of capacity in increments of 0.5 kW offered at \$3,000 each, \$6/watt. Ashland, Oregon's Solar Pioneers II, participants can purchase  $\frac{1}{4}$ ,  $\frac{1}{2}$ , or full solar panel increments, and receive payment for the value of the corresponding energy produced for a term of 20 years.

### **Customer Bill Crediting Considerations**

Programs offering full retail net metering are most valuable and enticing to customers. In some states, utility ratepayers will benefit from additional incentives. The State of Washington allows CSP participants to receive the state production credit of \$1.08 per kWh. In the states with healthy SREC markets, like New Jersey, participants will receive additional value.

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.

Utilities that elect to promote CSP must think about what bill credit value to provide. Is it akin to the California Solar Initiative in which participants are credited at the full retail rate at the time of generation and use? Many California utilities are pleased that a hybrid structure of incentives and NEM has spurred the solar market, but they do not believe that paying the full retail value is fair to ratepayers.

Some utilities want to limit the value of the credit to the customer to the value of the generation of the power. Utilities must still provide back-up services. Utilities seek balance between minimizing cross subsidies and providing incentives to spur market transformations to efficiency and solar adoption.

### **The SEC Lesson and Steering Clear of Shares**

A big lesson was learned about community solar in University Park, Maryland, a self-espoused "tree-lined community." It came up with a solar solution by tapping the 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 claimed that the project would have to register as a 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 Church provides a key lesson that CSPs can be considered securities if they are not properly structured. SMUD steered clear of the issue; Clean Energy Collective developed a solution using a hybrid ownership approach. Owners can individually take tax benefits, and can steer clear of shares by earning bill credits.

## Mini PPA Models

Some of the CSP models are actually small PPAs and not really applicable to a utility program of scale. The Tangerine CSP in Edmunds, WA, is a small PPA that will feed its power to a community center. The shares, or Sun Slices, receive a monetary benefit from the sale of power and the state production credit. They offer participants a break even proposition in terms of earning their investment back.

The University Park, Maryland CSP is a small PPA delivering power to a church. The limited number of investors will see an adequate return on their investment. This is a good example of good intentions corralled for specific benefiter and not expected to be a model for large scale community solar.

## Locations for Community Solar

One of the early considerations for nominating cities must be suitable locations. A megawatt-sized plant with adequate room for inverters, security fences, etc. requires 5 - 10 acres of land; using thin-film technology requires more space, and of course, it would be optimal to have room for expansion. Note that CSPs can be modular, with 150 – 200 kW systems in multiple locations, spreading out the rooftop/open space “real estate” requirement.<sup>17</sup>

## CSP Location Options

- 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)

There are a number of options for locating community solar, some private, mostly public. Municipal sites, parks, airports, parking structures and lots, road sides are considered. Utility-owned property can also be considered for CSP.

Government buildings can be used expeditiously and have the added value of already being icons in the community. Santa Monica has had discussions with Caltrans to explore use of rights of way for solar. A solar company is specializing in using cloverleafs of highway interchanges for solar arrays, and this might

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<sup>17</sup> EcoMotion believes that at this time 1 MW may be the critical mass for a CSP, whether one array or multiple arrays. This critical mass is required to offset the administrative costs of a system, spreading these costs to hundreds instead of dozens of customers/participants.

be a suitable location for ground-mount CSP.<sup>18</sup> There is the possibility of leasing commercial space, for instance solar-ports on parking lots at super markets with 50-year leases.

In Santa Monica, the City is exploring installing solar systems – and potentially CSPs -- on top of parking structures. Each of five seismically prepared structures would carry about 175 kW of community solar. Shaded rooftop parking is a spin-off benefit in this arrangement, although height restrictions must be considered. Schools are being used in Germany for community solar. Universities – especially those that might like covered parking – might also be partners.

Brownfields and Landfills: Solar systems are being located in brownfields and landfills and may be appropriate for CSP. New York City is planning 50 MW on covered landfills. Community Solar Plants could be located in these “problem areas.”

The City of Dinuba, California has teamed with Tioga Energy and Chevron Energy Solutions to develop a 1.15 MW solar electric system that will reduce energy costs for operations at the City’s wastewater treatment plant. The ground-mounted system will sit atop a capped landfill near Dinuba’s wastewater treatment facility, which is the City’s largest energy-using facility.

Reservoirs: 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 2011, the City of San Francisco will begin on a 5 MW solar photovoltaic system installation on the roof of the City’s largest reservoir.<sup>19</sup> The solar plant will be developed and operated under a Power Purchase Agreement between the San Francisco Public Utilities Commission and Recurrent Energy. The electricity will go directly into the grid and be distributed to municipal users such as the General Hospital, the airport, the port, municipal light-rails 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 will help to find a real win-win between consumer excitement and utilities’ system opportunities and limitations related to distributed generation.

## **What’s the Deal for Participants?**

Early programs were largely mission-driven. Today, most CSPs are about investments.

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<sup>18</sup> The solar panels will be located on Caltrans property, which is owned by the State of California, and is unusable for other purposes such as residential or commercial development. No part of the proposed project will be on private property. Republic will be paying rent to Caltrans on a long term ground lease. Republic Solar Highways is in discussions with PG&E about entering a bilateral Power Purchase Agreement (PPA) that would establish the pricing, production levels and interconnection points between the solar installations and power grid.

<http://www.cloverleafsolarhighways.com/project-overview/>

<sup>19</sup> The San Francisco Sunset Reservoir Solar Project: <http://www.recurrentenergy.com/resources/sfsunset.php>

The City of Ellensburg, Washington is recognized as the location of the earliest American community solar garden. In 2006, 120 modules were purchased by 73 participants who contributed to the 26 kW, municipal non-profit project.<sup>20</sup> These “solar pioneers” shares of the output have been net metered virtually against their bills, but they may never see a full return on their investment

The following table compares the simple payback for various CSP programs reviewed in their report.

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

\*Figures taken from ILSR Study

## Pricing the Product

Finding the Balance: As stated earlier, utilities that elect to promote CSPs in their service territories will have to find the balance between a) protecting ratepayers from high-cost renewables, and b) giving customers an opportunity for a renewable energy investment with a reasonable rate of return. Fortunately, CSP drives down the cost of solar, easing the burden on all parties involved. Yet the debate continues over the value of the transmission and distribution system, and to what extent a solar plant must contribute to the amortization of these capital costs.

## Getting the Tax Credit

Program designers astute with CSPs recognize that to make CSP pencil, “you’ve got to find a way to collect the tax credits to lower the cost of solar.” Getting the 30% federal tax credit for solar is key to cutting system costs and making CSP pencil for all. Utilities can enable this through outsourced solar production (PPA) or by “pushing” the tax credit to the CSP participant. Clean Energy Collective does this by building the plant, taking the tax credit with tax equity investors, and then selling discounted capacity to participants.

<sup>20</sup> Ellensburg, WA Solar Model:

[http://solaramericacommunities.energy.gov/resources/guide\\_for\\_local\\_governments/2/8/](http://solaramericacommunities.energy.gov/resources/guide_for_local_governments/2/8/)

## **Use of Solar Incentives**

Some CSP programs are able to add extra inducements for utility customers to participate. In the State of Washington, Community Solar Seattle participants are eligible to receive the Washington State Renewable Energy Production Incentive annually through June of 2020. It offers up to an additional \$1.08 per kWh. This is the highest incentive EcoMotion has found.

In El Jebel, Colorado, Holy Cross Electric pays participants 11 cents per kilowatt hour for their share of the output (including the REC) – more than the full retail rate -- crediting it directly to the bill. This rate was negotiated by the Clean Energy Collective and will keep pace with energy price escalation over time.<sup>21</sup>

Some utilities may elect to apply their solar incentives for community solar plants, resulting in the same form of cross subsidy as exists today with individual solar systems and their utility incentives. A utility that offers \$2/watt for residential solar systems might elect to provide the same incentive for the same watt in a community solar plant. Utility incentives have traditionally covered 20 - 40% of the solar system cost. These incentives applied to CSP will have proportionately greater value than when applied to household systems.

At the other extreme, and given their lower unit costs for construction, in some instances Community Solar Plants' economics can "pencil out" without utility subsidies. Naturally, healthy incentives will provide healthy uptake in participation, keeping payback periods within acceptable bounds, perhaps in the 8 – 12 year range. Programs that have 20+ year paybacks seem susceptible to consumer criticism.

## **REC Ownership and Value**

Who owns the Renewable Energy Credits (RECs)? Naturally, many utilities need them and will want to retain them in a CSP situation. In Colorado, utilities must buy the RECs from community solar plant participants, providing CSP system owners with some three additional cents per solar kilowatt-hour. In California, RECs are in a developing market with an unclear value.

## **Potential Environmental Justice Provisions**

A portion of the plant could be set aside for low-income customers. Some customers could be eligible for lower purchase costs and/or higher NEM payments.

## **Payments to Host Site**

Note that a lease payment may be required for the host site. Naturally, the less cost for the use of the site, the lower the overall deal costs, the lower the costs to join the CSP, and thus the more participants and engaged customers.

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<sup>21</sup> Paul Spencer, Clean Energy Collective, personal communications.



## **CSP and Efficiency**

Another program element is efficiency. How can CSP promotion dovetail with each utility's efficiency goals and programs? Utilities might support CSP members with "efficiency points" and other special program portals for engagement. Recognizing that these are the customers who are most engaged, utilities have the opportunity to continue to work with this self selected group. Low-income customers might get a combination of low-cost solar and a host of efficiency measures provided through a direct installation program.

## **6. Conclusion / Call to Action**

Community Solar Plants: Ready, aim, and fire. Your customers, whether they know it or not, are ready!

CSP is potentially a win-win for utilities and consumers. Well-designed programs can serve all parties with low-cost, reliable, green and clean power.

This White Paper covered the brief history of community solar plants, their benefits for host utilities, two predominant models for comparison, and design parameters for all interested in launching such programs.

Fundamental is the ownership model: Is it based on a subscription or ownership. Do your customers want to own solar, or will they be content buying local, green power?

What appetite does your utility have for running a CSP program? Does it have the staff to do so? Would consumers rather have their own systems or "solar gardens?" Do you want to partner with a company like Clean Energy Collective to provide the program administration?

At the end of the day, community solar advocates and their utilities have design options to consider and choices to make. How successful programs will be is a function of the insight of program designers in developing suitable incentives, good customer value propositions, clear guidelines, and robust program marketing.