Community Solar in California: A Missed Opportunity

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California lags behind many other states in efforts to embrace community solar through the programs of its regulated utilities. This is a missed opportunity on two fronts given that well-designed community solar programs can help make access to renewable energy more equitable and allow distributed solar photovoltaics (PV) to work better with the electricity grid.

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Community solar describes a variety of business models.[1] Here, we use the term to refer to programs enabling individual electricity customers to receive credits on their bill for generation from a PV array that they share with other customers. This PV array may be on-site or off-site, depending on the policy or program. Typically, program participants are residential or commercial electricity users. They may either contribute to part of the system's upfront capital costs or pay a rate that finances their share of the power produced over time. In return, participants receive either a specified quantity of kilowatt-hours or a capacity allotment from the facility. Depending on state policy, programs may be set up and administered by an electric utility, a solar developer, a nonprofit organization or another entity.

1 Feldman, D.; Brockway, A.M.; Ulrich, E.; Margolis, R. "Shared Solar: Current Landscape, Market Potential, and the Impact of Federal Securities Regulation." National Renewable Energy Laboratory Technical Report. April 2015. Available at: https://www.nrel.gov/docs/fy15osti/63892.pdf.

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Community solar has several attributes that should intrigue policymakers and grid operators (Table 1). Its siting flexibility is key: unlike rooftop solar, community arrays may not be restricted to a specific customer's roof or property. This means utilities may be able to better steer arrays to desirable grid locations and include these projects in planning for the distribution grid. Since providing a site is not a prerequisite for customer participation, even electricity users who cannot host solar panels, such as renters or owners of buildings not suitable for solar, can benefit. It is well-known among distribution grid planners and operators that it matters where solar PV connects to the grid even within a given neighborhood.[2] Some parties have proposed locational incentives to steer rooftop solar to better sites. However, industry groups have acknowledged that such incentives inherently prioritize some customers over others and may be inequitable.[3] Community solar offers a way to focus PV deployment at certain locations while expanding, not shrinking, the pool of potential participants.

Economies of scale are also important: community arrays can be more cost-effective than single-family rooftop solar and enable a multitude of options for designing, sizing and siting the PV panels and any accompanying equipment (such as smart inverters[4] or community-scale energy storage). If projects are more cost-effective, the cost of participation can be reduced, potentially enabling more low-income community participation. Moreover, a larger pool of participants may make project financing easier by enabling some customers to effectively act as "anchor tenants"[5] and reduce overall project risk.

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Net metering policy in place in California, and elsewhere, enables certain solar customers to be compensated for on-site solar power that is fed back into the electric distribution grid. Customers are compensated by enabling the power sent back to the grid to push the electric meter backwards. As a result, the solar customer is not charged for the full amount of the power they take from the grid. In most locations, net energy metering laws do not apply to community solar participation. This creates an opportunity to instead pay community solar providers at a level that reflects the value that the power provides to the grid, rather than just focusing on the number of kilowatt-hours produced. That value could also reflect other kinds of "grid services" that solar power may provide at certain times and locations, such as frequency control, voltage control and ramping capability.[6] As a result, community solar providers could be encouraged to include in their projects other equipment – such as storage batteries, smart inverters and solar tracking systems – that can improve the ability of the grid to incorporate intermittent solar generation.[7]

2 Walling, R.A.; Saint, R.; Dugan, R.C.; Burke, J.; Kojovic, L.A. "Summary of Distributed Resources Impact on Power Delivery Systems." IEEE Transactions on Power Delivery. 2008, 23(3). pp. 1636-1644.

3 Edge, R.; Taylor, M.; Enbar, N.; Rogers, L. Utility Strategies for Influencing the Locational Deployment of Distributed Solar. Solar Electric Power Association and Electric Power Research Institute Joint Report. 2014.

4 An inverter is a device that converts the direct current produced by PV arrays into alternating current that is compatible with the grid. A smart inverter includes computer capability and two-way communication, making it much better able to deliver power that is of the greatest value to the grid.

5 Anchor tenant(s) – a large entity who can take a large sum of the solar benefits (production or shares) that offers the developer a credit worthy customer who "anchors" the project allowing the developer to seek out and offer participation to other/smaller customers, i.e., homeowners and small business owners who will take a proportional production/shares from the project. The anchor tenant(s) could be a local school, government entity or an established business such as a large box store retailer (note, there has been concern about participation from large box store retailers in AB 327 Alt for DACs) that is likely to be in existence for a long period.

6 https://www.utilitydive.com/news/california-solar-pilot-shows-how-renewables-can-provide-grid-services/506762/

7 The use of storage batteries could enable grid operators to take power from the community solar project when that power is most valuable to the grid. Smart inverters can provide reactive power, an important element in preserving grid stability. Solar tracking systems enable the PV arrays to move as the earth turns, optimizing production throughout the day.

Promising Opportunities

Strategic PV system design and integration at the distribution level has the potential to improve power quality and reliability, extend equipment lifetimes and reduce systemwide power losses. Programs can also be structured and financed to expand the involvement of low-income customers and nonprofit organizations that can't benefit from tax incentives. If participant compensation truly reflects the grid value of well-integrated solar arrays, supporting these projects may become a good economic proposition, even for lower-volume and cost-conscious electricity users. Attractive economics may also steer some solar-curious customers from rooftop options to community solar, creating more demand for projects that are explicitly designed to benefit the grid.

Table 1: Potential Attributes of Community Solar Programs

Attribute	Technical Implications	Social Implications
Siting flexibility	• Utilities can help guide projects to optimal grid locations • This flexibility provides an opportunity for holistic grid integration	• Participation is open to electricity users who cannot put solar on their roofs • In some states, nonprofit organizations have offered rooftop real estate for community-scale projects and become key partners benefiting from renewable energy
Economies of scale	• Projects have the potential to be more cost-effective than smaller arrays • Larger projects can make co-locating energy storage or smart inverters more attractive	• More cost-effective projects mean participation costs can, in theory, be reduced, enabling more low-income customers to participate • Larger or wealthier customers can act as "anchor participants," easing access for lower-income customers who may have lower credit scores
Compensation mechanisms	• Net energy metering laws do not automatically apply, creating an opportunity to value grid services rather than maximum energy production or time of use • Compensation structures that reflect the value of solar to the grid may be more sustainable over time and may encourage greater renewable energy deployment	• New compensation structures can offer an economic proposition even to lower-volume electricity users and nonprofit organizations that can't benefit from tax incentives • More sustainable renewable energy deployment means more customers and stakeholders will ultimately be able to benefit from solar

The California Context

In California, community solar has the potential to bridge the gap between rooftop solar and green tariff programs, such as Pacific Gas and Electric's Solar Choice program. Rooftop solar is exclusive, tends to provide a very good economic proposition for high-volume electricity users paying tiered electricity rates and is designed to appeal to the individual, not necessarily to benefit the overall grid system. Compounded by Renewables Portfolio Standard-compliant utility scale solar, current rooftop deployment has caused concern for distribution grid operators. On the other end of the spectrum, utility-run green tariff programs offer up to 100 percent renewable electricity and are open to all subscribers. However, green tariff programs typically require participants to pay higher rates and often use existing renewable energy facilities resulting in a lack of additionality. The green tariff programs usually rely on larger arrays that benefit from economies of scale, but utilities and developers have not made it a priority to eke out additional social value from these projects and/or use them for distribution-level grid services. As a result, California electricity customers who want to get economic benefits from solar have, to date, been limited to rooftop solar, an inequitable business model that disproportionately benefits homeowners and is sited without regard to system-level needs.

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A recent trend in California is rapidly growing customer interest in community choice energy, also known as community choice aggregation (CCA) programs. Stemming largely from dissatisfaction with affordable utility renewable energy offerings, environmentally minded electricity consumers increasingly see CCAs as an attractive alternative to their local electric utility. A CCA procures electric power for its constituents and relies on the incumbent utility's distribution and transmission grids to deliver the power. CPUC staff recently estimated that CCAs will contribute to as much as 25 percent of customer load in investor-owned utility (IOU) territories being served by non-IOU providers by the end of 2017 and 85 percent by the mid-2020s.[8]

The implications of this shift are not yet clear, and questions remain about how CCAs and other alternative energy providers will fit into the state's overall energy system. For example, while CCAs may enable more local renewable energy projects, it will be important for CCAs to plan such projects jointly with the local distribution utility to maximize the benefits that a well-integrated PV project can provide to the grid.

In addition, utilities seeking to compete with CCAs to retain generation customers may find that community solar provides an additional affordable renewable energy option they can offer their customers. Alternatively, a CCA may also choose to build local renewable projects to serve a portion of its load. In this scenario, CCA administrators would ideally consult with the utility's grid management team to ensure that CCA-spurred developments would be sited in a strategic and effective manner.

8 California Public Utilities Commission. "Consumer and Retail Choice, the Role of the Utility, and an Evolving Regulatory Framework." Staff White Paper. May 2017. Available at: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/Retail%20Choice%20White%20Paper%205%208%2017.pdf.

Thus far, California's lackluster embrace of community solar is preventing the state from enjoying its potential social and technical benefits. The three largest California investor-owned electric utilities are required to procure 600 megawatts of new renewable energy that customers can subscribe to directly, but most of this new capacity is intended to be offered in the form of a green tariff, which requires participating customers to pay a higher price than they would for conventional service. This stands in contrast to rooftop customers who participate in net metering programs and usually realize substantial bill savings. A smaller program component, Enhanced Community Renewables, theoretically enables developers to offer community solar options directly to customers and sell any remaining power directly to an IOU. However, there are no developers currently offering this service. At a recent forum hosted by utilities and policymakers, solar developers blamed this on poor administrative design, restrictive rules and a negative economic proposition.[9] While logistical kinks may be inevitable, a fundamentally negative economic proposition does little to create demand for community solar in California. This approach must be reworked. Otherwise, community solar will remain a second-tier option for PV deployment while access to renewables will continue to be inequitable, rooftop solar will continue to stress distribution grid operations and environmentally conscious customers will continue to turn to CCAs over utilities to procure power on their behalf.

Successful Strategies for Promoting Community Solar

In contrast, the potential benefits of community solar have been recognized and are guiding program design in states such as Colorado, Minnesota, Massachusetts and New York. These states have taken creative approaches to advance their policy goals. Colorado built a low-income carve-out into its state community solar regulations. Minnesota has taken a value-of-solar approach to determining appropriate compensation structures for community solar. Massachusetts offers rate incentives (adders) for power acquired from community solar projects and projects providing other valued benefits, such as serving low-income customers. New York has prioritized community solar projects that are explicitly designed and sited to benefit the grid and/or serve low-income electricity users. Some additional examples of innovative approaches to community solar and successful programs are in Table 2. States with existing community solar policy have primarily set compensation for energy production at or near retail rates.[10] Such generous returns have prompted developer and customer interest and spurred deployment in smaller solar markets. In a more mature PV market like California, attractive returns are still needed to develop a community solar market, but community solar provides an opportunity for policymakers and utilities to experiment with rates that compensate for distribution-level grid services rather than focusing exclusively on energy production. While California is behind on community solar deployment, the state can still burnish its image as an energy innovator by developing creative approaches to compensation that incorporate the technical and social value of PV.

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9 https://www.greentechmedia.com/articles/read/A-Rough-Start-Possible-Reforms-for-Californias-Community-Solar-Program

10 http://www.sharedrenewables.org/

Table 2: Examples of Innovative Community Solar Programs

Program and Location	Description
Mid Valley Solar Array, El Jebel, Colorado Holy Cross Energy (cooperative utility) and Clean Energy Collective (CEC, a solar developer)	This 78-kW array came online in August 2010, and HCE customers (including homeowners, renters, businesses and community organizations) were invited to purchase shares upfront at $3.15 a watt. In return, participants were offered bill credits that were 37 percent higher than those offered for traditional rooftop solar. This project was an early partnership between CEC and a Colorado utility. The community solar developer has now worked with 23 utilities across 11 states to produce more than 75 projects. Most projects are in Colorado and Massachusetts, states with comprehensive community solar legislation, but CEC's partnerships also have made inroads into Kansas, New Mexico, South Carolina, Texas, Wisconsin and Wyoming.[11]
Minnesota Community Solar Garden Program	In March 2014, Minnesota Public Utilities Commission concluded that solar was a more cost-effective option for electricity customers than natural gas and directed Xcel Energy, an investor-owned utility, to meet increasing electricity demand with a power purchase agreement for approximately 20 new arrays.[12] The ruling brought fresh attention to solar in Minnesota. Since then, interest in the state's Community Solar Garden program has been building. In 2013, Xcel expected that customer interest would support about 20 megawatts of community solar. Now, this northern state that is one-seventh the size of California has approximately 400 megawatts of community solar in the interconnection and construction stages. Once these arrays come online, Minnesota's community solar program is expected to be among the biggest in the country. Interested participants include low- and middle-income customers, urban residents, farmers and rural municipalities.[13]
Solar Holler, Shepherdstown, West Virginia and Steele Waseca Coop	Creative financing schemes brought community solar to Appalachia. In West Virginia, a local developer worked with community members to implement a demand response program for residential water heaters and direct the savings to support a solar array for the local Presbyterian Church. The project made national headlines and won the 2015 National Renewable Role Model award from Interfaith Power & Light. Solar Holler continues to pursue community-conscious solar development within the confines of the state's policy landscape. Its projects aim to support community revitalization and provide meaningful access to renewable energy to lower-income electricity customers. Along with continuing to deploy projects that benefit nonprofit organizations, Solar Holler also runs a local solar job training and apprenticeship program.[14] Steele Waseca Coop is another example of a program combining community solar and demand response. Subscribers receive a 90 percent discount on the per panel price if they agreed to take a free electric hot water heater and allow the coop to control it.[15]
SolarShares Program and Community Solar Value Project (CSVP) Sacramento Municipal Utility District (SMUD)	In California, SMUD was an early pioneer in designing a shared solar program that could provide an economic return to participants. The SolarShares Program opened to customers in 2008 and has been persistently supported by about 600-700 subscribers, with a waiting list, ever since.[16] A second installment came online in 2013. In August 2017, the City of Sacramento announced it would begin receiving a portion of its electricity from SMUD's SolarShares Program, which is anticipated to save the city more than $8 million in future rate increases.[17] Beyond giving customers more accessible solar options, SMUD also wanted to prioritize distributed PV arrays over large-scale solar and use strategic design and integration to maximize their value for the distribution grid. SMUD is now a key utility partner with the Community Solar Value Project, an effort powered by the Department of Energy's SunShot Initiative that seeks to "increase the scale, reach and value of utility-based community solar programs by using strategic solar technologies, siting and design and by integrating suitable companion measures, such as demand response (DR) and storage into broad program designs." Through documenting smart integration and program design approaches, CSVP aims to realize the promise of customer-facing solar deployment to serve the overall electricity system.[18]
Leech Lake Indian Reservation, Minnesota	Alliance, which serves the Leech Lake reservation, used a state grant to help fund a 200-kw system to serve a low-income community.[19]
Dairyland Power Cooperative, Wisconsin	This cooperative provides power to numerous distribution cooperatives and municipal utilities. It has pursued construction of several solar energy projects, and distribution cooperatives have piggybacked on the same procurement process to develop community solar projects.[20]

11 http://cleanenergyco.com/projects/
12 http://www.startribune.com/massive-solar-plan-for-minnesota-wins-bid-over-gas/238322571/ and https://www.greentechmedia.com/articles/read/in-bid-against-gas-minnesota-regulators-say-solar-can-proceed
13 http://midwestenergynews.com/2016/06/28/community-solar-exploding-in-minnesota/ and https://ilsr.org/minnesotas-community-solar-program/
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15 http://swce.coop/swce-field-services/renewables/
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18 http://www.communitysolarvalueproject.com/
19 http://www.startribune.com/leech-lake-solar-garden-is-first-in-nation-linked-to-energy-assistance-program/441815673/
20 http://www.dairylandpower.com/article.php?id=4158

Recommendations

Community solar holds promise to bring renewable energy options to a larger number of customers across a broader range of communities and income levels. It also can become a critical element of an effort to improve grid efficiency, reliability and resilience as solar penetration levels continue to accelerate.

While no developer has created a community solar project under the rules currently in place in California, programs have flourished in other parts of the country. California has an opportunity to build on this success.

California has long been a welcoming market for solar PV, but lags behind in community solar. While no developer has created a community solar project under the rules currently in place in California, programs have flourished in other parts of the country. California has an opportunity to build on this success.

The first step is to form a commitment to retool or replace the existing Enhanced Community Renewables (ECR) program. The program should be modified to create an attractive economic proposition for community solar developers and program participants. The second is to hear stakeholder concerns and work with stakeholders to design program improvements. The ECR should offer a meaningful option for low-income customers and nonprofit organizations to benefit from renewable energy. The ECR rules should be structured to compensate for strategic siting of community solar arrays and grid services.

In order to achieve the technical and social benefits of community solar, California must design and adopt compensation structures that can provide adequate and sustainable revenues. California can draw from the success of programs adopted in other states. This may require changes to the law. Well-designed and well-located community solar projects can provide significant value to the grid, and an effective program design should reflect that value. Community solar can be an important tool to promote social and environmental equity and contribute to California's ambitious build out of renewable generating resources.

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