Community Solar Is Potential Resolution for Distributed-Generation Challenges

Becky Campbell and Eran Mahrer

Utilities around the country are experiencing booming interest from customers in distributed solar generation. With this increased interest, utilities are facing unprecedented challenges with distributed-generation integration and rate reform pressures. In 2015, nearly 1.5 gigawatts of new residential photovoltaic (PV) were installed during the first three-quarters of the year,[1] and Pacific Gas and Electric surpassed 175,000 distributed solar interconnections on its grid.[2]

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However, an emerging customer-program option, community solar, may be the utility industry's key to satisfying increasing demands for renewable energy by minimizing distribution system management challenges and promising to mitigate cost inequities for nonrenewable customers.

WHAT IS UTILITY-LED COMMUNITY SOLAR?

Community solar offers an opportunity for any type of electric customer to subscribe to and receive the benefits of a large, centralized solar PV system. These types of programs can be administered both by utilities as well as third-party providers, although the latter typically require an enabling policy framework. Community solar differs from renewable energy credit or green pricing programs because its participants receive a proportional share of the energy benefits associated with the solar project instead of just the environmental attributes.

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Utility-led community solar puts the utility in the driver's seat, initiating the program and leading its administration. The program consists of a solar plant owned or procured by a utility where individual panels are sold or leased to utility customers. The utility operates the system, receives the solar energy, and then passes energy or bill credits to the subscribing customers as compensation for their participation.

MARKET OUTLOOK

Demand for renewable program options is driven by two key attributes. First is the ability of a renewable resource to provide a long-term predictable cost and where that cost is projected to provide the consumer with long-term rate stability and presumably savings. Second are the social/environmental benefits of committing to a renewable resource.

The specific balance of these attributes varies from one region to the next and among specific customer demographics. As of late 2015, there were more than 70 community solar programs operating in the United States (**Exhibit 1**), of which, approximately 60 percent were utility-led.[3] Rapid expansion is expected to continue, with new markets such as California, Minnesota,

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and New York presenting unprecedented growth opportunities.

WHY ARE UTILITIES DOING COMMUNITY SOLAR PROJECTS NOW?

Utilities have largely been responsible for the nation's growth of community solar offerings. In some cases, utility programs have been motivated by legislative or regulatory mandates. However, a large number of utilities have elected to create community solar programs for their customers absent a regulatory/legislative mandate.

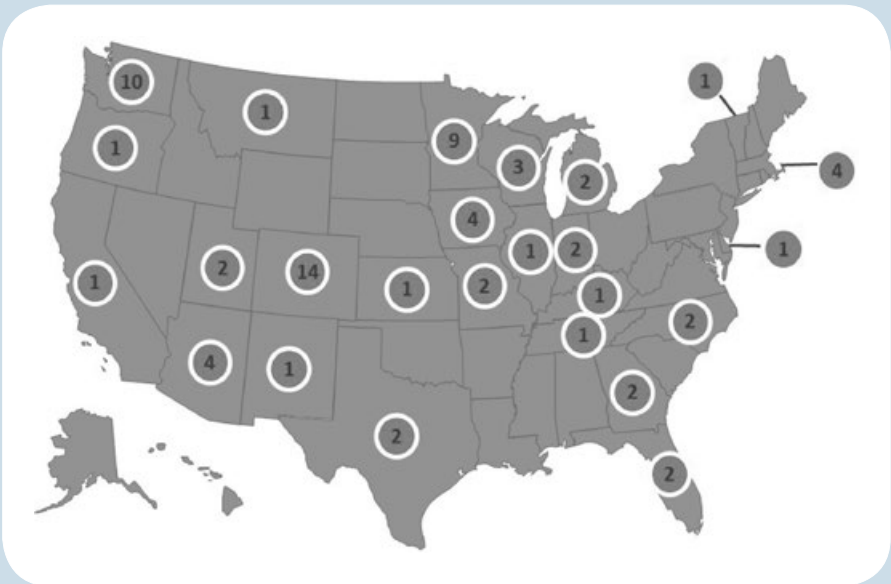
Utility-led community solar avoids many of the challenges presented by the rooftop distributed generation.

1. Community solar allows utilities to maintain and strengthen their long-standing direct and unobstructed customer relationships.
2. These programs empower utilities to design equitable participant credits, avoiding the pitfalls associated with net energy metering and the challenges of reforming rates to accommodate distributed-generation hosts.
3. Community solar puts consumer protection in the hands of utilities.
4. The solar projects can be strategically placed by the utility, enabling the solar generator to provide maximum system benefits, or perhaps simply minimizing challenges imposed on the distribution system by haphazardly deployed distributed generation.

There are many motivators for utilities to offer community solar options to their customers. For example, community solar increases customer choice by offering a broader range of energy programs from which to choose. Also, community solar can be made available to nearly all utility customers, making it one of the most equitable customer program options a utility could pursue. This approach is not limited to customers who own homes and who have specific roof orientations, but can include renters and apartment dwellers. Presumably both choice and broad customer applicability make community solar programs appealing to both utility leadership and regulators.

In addition to increasing customer satisfaction and equity, community solar also serves as a way for utilities to preserve their long-standing customer relationships. Utilities provide a vital service to their customers and have spent decades building trust and relationships within the communities that they serve. By taking a proactive approach to offering solar options, utilities stand a chance of protecting those relationships from the inevitable emergence of third-party providers that will be willing to serve the utility's customers if the utility hasn't

Exhibit 1. Summary of US Community Solar Programs, by State



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advanced its service offerings to accommodate shifting customer interests.

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Perhaps one of the strongest drivers for utility adoption of community solar is the fact that it is the utility's alternative to rooftop distributed generation. Utilities nationwide have decried the unfair cost shifting that is created by retail rate net energy metering policies, a policy that to date has enabled rooftop solar deployment. Community solar presents the opportunity for utilities to design a transaction that acknowledges customer commitments to solar resources, fairly credits customers for participating in the program, and offers the potential to mitigate any cost/value shift to nonparticipants. While working out the program's economics to balance the utility's need to be kept whole and the customer's desire to see either an immediate or long-term cost savings is no small feat, the effort is worth it for the increased customer and stakeholder satisfaction that is achieved by a successful program.

It is the utility's alternative to rooftop distributed generation.

Beyond all of the customer-related benefits that community solar offers, it also provides a means to increase deployment of solar in a more cost-effective and streamlined manner. Community solar programs typically rely on a small number of utility-scale solar assets, meaning that projects are able to capture economies of scale and reduce the number of interconnection points that the utility has to manage. Still, community solar projects can be placed on the electric distribution system, providing the same benefits as distributed generation resources with far fewer imposed complications. Utility-led community solar projects also put control of the asset in the utility's hands so that the utility has the operational oversight to ensure that the system is properly maintained and any future technology advances can be deployed in a manner that will provide the greatest systemwide benefits.

Community solar may also offer utility benefits from a regulatory and policy perspective. In many cases, utilities can use these solar plants to meet the needs detailed by their integrated resources plans, cost-effectively complying with renewable targets while demonstrating to their regulators a commitment to providing efficient and equitable customer solar options.

Simply put, community solar is a cost-effective, efficient, and readily marketable program approach that can be used to enable utility ownership of solar assets.

HOW ARE THE PROGRAMS BEING ADMINISTERED?

Regardless of why a utility elects to offer a program, once the decision is made, there are two options for program administration: internal utility resources or outsourced to a third party.

Utilities that opt for internal administration often choose that option because they have identified the internal resources to do so and prefer to leverage customer engagement as part of a broader array of engagement initiatives. Still, these utilities may need assistance with specific components of the program such as marketing, participant recruitment, billing integration, or legal services, and thus may contract with a partner for supporting program services or software. In this case, the utility would still maintain administrative control of the program but would identify partners for individual aspects of the program's deployment.

Conversely, a utility may prefer to work with a third-party partner for program administration. Many of the utilities that choose this option either lack the internal resources or experience to administer this type of program or would prefer to avoid some of the risks of administering a community solar program. Third-party administrators often white-label the program so that the customer-facing communications make it clear that the utility is leading the initiative. Behind the scenes, the partner often assumes the oversight of major program responsibilities, which can include project siting and development, legal and financial due diligence (including properly designing programs to avoid potential securities violations in cases where customers own the panels), marketing, customer acquisition, and ongoing engagement, billing integration, and operation and maintenance.

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There are several community solar developers that offer this "all-in-one" type of service to utilities.

DESIGNING A PROGRAM TO OPTIMIZE BENEFITS

When considering a community solar program, First Solar challenges utility decision-makers to look beyond the value propositions described above. There are additional considerations of careful program design that can bring significant supplemental benefits to the utility.

SCALE MATTERS

A recent study by the Brattle Group concluded that a 300-megawatt utility-scale PV plant generates power at less than half the cost of a 5-kilowatt residential system (**Exhibit 2**), while also avoiding 50 percent more carbon emissions than 300 megawatts from multiple residential rooftop installations.[4]

While it's unlikely that we'll see a community solar power plant reach this scale in the near term, if utilities design programs to maximize the scale of the solar asset, they will leverage the best design and operational attributes of large-scale solar power plants. This change will bring this increased benefit to all customers, not just to customers participating in the program. Research has demonstrated that consumer interest in clean energy is driven more by economics than environmental motivations.[5] By scaling community solar projects as large as demand will allow, utilities can more easily strike a balance between providing cost savings to customers and offering an unsubsidized customer program. In some instances, this may suggest that utilities should look not only to the observed near-term demand, but rather employ large-scale projects that will meet program demand over a longer timeframe and for, as yet, uncharacterized demand.

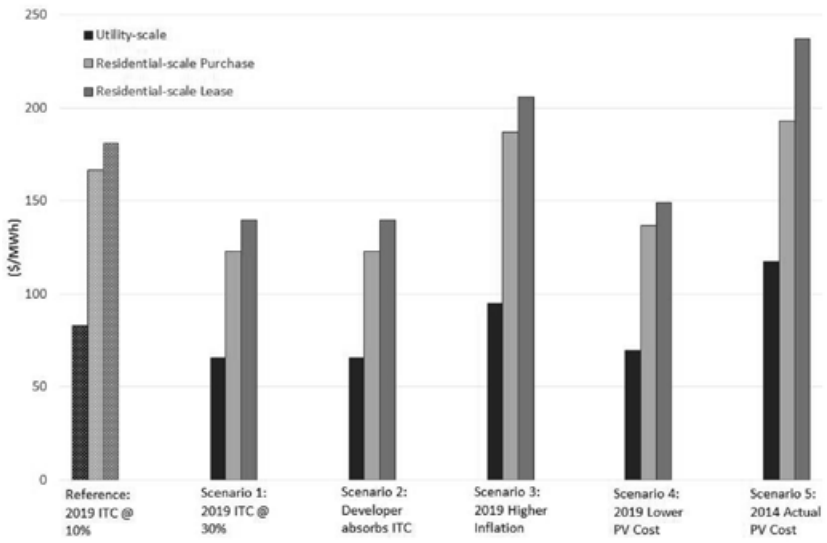
In this way, community solar satisfies the need for both clean and low-cost electricity.

USING COMMUNITY SOLAR AS VEHICLE TO DELIVER OTHER VALUABLE UTILITY INITIATIVES

Utilities tend to think of customer initiatives in silos, often through the regulatory requirements that drive implementation (e.g., for energy efficiency programs, demand response, and load control programs).

When bundled with other initiatives, community solar may be an effective means for utilities to deliver other customer programs that either provide additional benefits to the grid

Exhibit 2. Comparison Between Levelized Cost of Utility- and Residential-Scale PV ($ per Solar MWh)



Source: The Brattle Group.

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or, in some cases, are mandated by regulators. For example, a thoughtful community solar program can incent customers toward time-of-use rates, demand response, or advanced energy efficiency measures. By bundling these offerings into a single program, the utility's benefits will be multiplied, making each of the programs more cost-effective and thereby supporting success with other utility resource goals. This approach may also bring the added benefit of combining marketing and customer acquisition efforts and budgets, which can be significant for most customer programs.

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Requiring community solar customers to also have an energy audit, programmable thermostat and/or be on a "time-of-use" rate aligned with the solar resource can help motivate customers to be more engaged in how they use energy, to benefit themselves and, ultimately, the utility.

SITING COMMUNITY SOLAR TO MAXIMIZE GRID BENEFITS

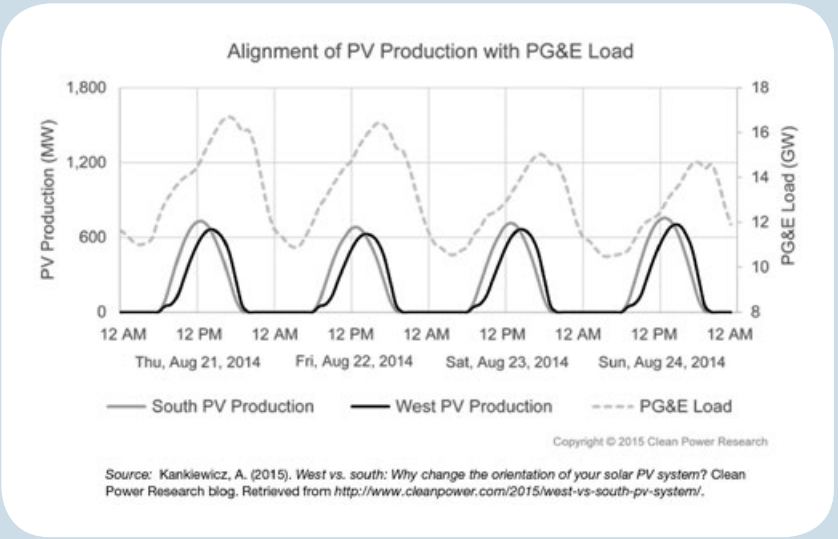
Unlike customer-owned or leased solar, another benefit of utility-led community solar is that the utility maintains control over the project siting. Thus, the system can be sited and configured to maximize the benefits to the utility.

West-Facing Versus South-Facing

Most utility-scale solar assets now include single-axis tracking, which significantly increases system production.

However, in the case where tracking is not an economic solution, system orientation can be adjusted to optimize production. In the Northern Hemisphere, when a solar system is oriented facing south, annual solar production is maximized. By configuring a solar system facing westerly instead of due south, production is maximized during later-afternoon hours of the day, which aligns more effectively with system demand for late-afternoon peaking utility demand. While a west-facing system might produce marginally less on an annual basis, the energy that is produced may be more valuable to the utility if it helps avoid the need to bring online additional (often more expensive) peaking generation plants. Unless a utility offers (and customers participate in) time-differentiated compensation for distributed-generation output, there is little incentive for customers to deploy west-facing solar systems. See **Exhibit 3**.

Exhibit 3. South- Versus West-Facing PV Production Curves Against System Load on Pacific Gas & Electric's Grid



Source: Kankiewicz, A. (2015). *West vs. south: Why change the orientation of your solar PV system?* Clean Power Research blog. Retrieved from *http://www.cleanpower.com/2015/west-vs-south-pv-system/*.

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However, when a utility is building a community solar project, this is an easy request to stipulate as part of the preferences for project development.

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Siting to Fill Load Pockets

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Prices continue to decline for solar power plants and therefore for rooftop solar, diminishing the level of compensation necessary to motive customer deployments. Accordingly, high penetration of distributed generation installed at homes and businesses on various parts of distribution feeders will accelerate as a concern for utilities. In some service territories, it has already reached a point for legitimate technical and operational concern. For example, because of grid reliability concerns, the Hawaiian Electric Company released "Locational Value Maps" in 2013, which were designed to help customers and solar installations have increased transparency into areas of the grid where circuits may require upgrades or detailed studies before approval of additional capacity will be allowed to interconnect.[6] Overcoming this challenge can not only be a customer communications nightmare for utilities, but will also likely frustrate customers who don't fully understand how adding additional "behind-the-meter" solar capacity can risk the reliability of the grid.

Community solar is a potential solution to this hurdle. First, utilities are best-positioned to identify specific locations along the grid that would best benefit from additional capacity or, at minimum, locations where deployment does not further aggravate already challenged system locations, and can therefore strategically site community solar projects. Second, for utilities that have started to reach the point of high penetration, community solar presents an alternative to allow customers to participate in solar.

In other words, if there are customers living along circuits that have surpassed thresholds wherein solar resources can be deployed without significant system upgrades, the alternative to installing an onsite resource could be subscribing to a utility-led community solar program where the utility has opted to locate the resource along a different, more suitable circuit. In doing this, the utility not only creates the benefit of siting the asset where it provides the greatest benefit to the system, but it can also market the program as another option for customers that otherwise would have been unable to receive the benefits of solar without investing in costly upgrades to the distribution system.

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USING COMMUNITY SOLAR FOR GRID STABILITY

Utility-scale solar plants are well-positioned to provide advanced plant-control capabilities. These capabilities include voltage and reactive power regulation and power ramping and curtailment, as well as frequency regulation.

For utility-led community solar, those systems can be leveraged to enable that utility's grid stability requirements. This functionality and resulting benefits are currently difficult to exploit in solar systems that are installed behind the meter, because distribution generators in most cases are under state utility commission jurisdictions, and in most cases their performance requirements are dictated by IEEE Standard 1547. This standard, which governs distributed power generators, does not yet mandate the same interconnection standards as for transmission-connected solar PV systems—although efforts have been underway for some time to modify the standard.

Doing so would also require the deployment of smart inverter functions (typically a firmware upgrade to the inverter) and permission for the utility to control the inverter when it is

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beneficial to grid stability. Even if enabled, grid services provided by distributed generation resources will require increased communication capabilities, alignment of capabilities across a broad range of separately owned and operated devices, and coordinated maintenance for safety and reliability. All costs and challenges are not currently addressed in distributed rooftop solar deployments.

However, as is the case with any utility-controlled solar asset, using community solar for grid stabilization is broadly simplified as the utility can ensure specific characteristics are deployed within the advanced inverters and that those functions are activated and ultimately enabling the grid operators to remotely regulate the inverters as necessary.

COUPLING COMMUNITY SOLAR WITH STORAGE

Increasing resiliency of the grid has been a popular topic of discussion among utilities, especially in the aftermath of catastrophic events such as Hurricanes Katrina and Sandy, both of which resulted in widespread impacts on local power supply systems.

Pairing community solar projects with an energy storage solution provides an opportunity for utilities to not only "firm" the resource, but also increase the electric system's resiliency.

Currently, most residential solar customers don't have an integrated storage system, and if they do, the storage capacity is likely too small to support a prolonged power outage. However, pairing community solar projects with an energy storage solution provides an opportunity for utilities to not only "firm" the resource, but also increase the electric system's resiliency and serve as an opportunity for utilities to "pilot" storage solutions before committing to particular storage technology and scaling efforts. If the utility wanted to maximize the benefits of the storage solution and share them with community solar participants, the project, and its storage system could be sited near critical community infrastructure, such as hospitals, emergency shelters, or at first-responder facilities so that the increased resiliency benefits the entire community in times of critical need.

WHAT TO EXPECT NEXT

Utilities that are seeking to increase customer engagement, create an alternative option for rooftop solar, and develop equitable customer solar programs are playing a growing role in this market segment. Thus far, utility-led community solar efforts have been spearheaded by the municipal and cooperative utility community. While rural electric co-ops and public power utilities will likely continue the adoption of community solar, we expect the investor-owned utilities to play a growing role in this market segment—driving program scale to previously unseen thresholds, thus creating greater cost efficiencies.

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The potential to maximize utility benefits by bundling community solar with other utility offerings, strategically siting community solar projects to fill load pockets, and taking advantage of the project's ability to increase grid stability will inevitably lead to an evolution of program design and increased innovation as this market segment continues its rapid expansion.

NOTES

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