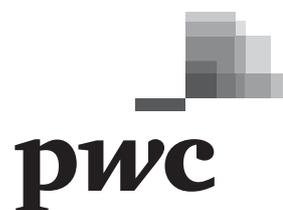


strategy&



Community solar

**Share the sun
rooflessly**



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Executive summary



The power and utility industry is witnessing an unprecedented wave of transformational changes. The rise of solar power is one of the biggest sources of disruption. Driven by a combination of technological advances, increasing customer demands for distributed generation, supportive legislation, and new market entrants, solar power is challenging existing utility business models and driving key market players to find effective solutions to meet changing customer demands.

Community solar is one of the more intriguing components of this burgeoning industry. Historically, if individual residential and commercial customers wanted to use solar energy, they needed to install solar systems on their roofs. With community solar, individual consumers can purchase a piece of a large solar installation built offsite or subscribe to its electricity output. By eliminating the need for a roof and allowing individuals to tap into the benefits of scale, community solar has opened up the solar market to many new residential and commercial customers.

If utilities and other market players are to take advantage of the growth opportunity that community solar presents, they must comprehend how community solar fits into the emerging competitive landscape, grasp key business drivers and challenges, gain a solid understanding of regulatory actions impacting the market, and figure out how to redefine their operational and marketing strategies.

Community solar begins to shine

Technology is disrupting the business models of a group of traditionally conservative companies, many of which have been operating for well over a century: utilities. According to the most recent PwC [Global Power & Utilities Survey](#), 97 percent of utility executives across the globe expect a medium to high level of disruption in their main home markets by 2020. “Today, change is happening faster than ever,” said Tony Earley, executive chair of the board at PG&E Corporation. “Utilities need to take action today to prepare for a future where more of our customers want and have access to these [clean] technologies.”

The rise of distributed generation — i.e., the production of electricity at or close to the point of consumption — is one of the chief sources of disruption. Utility executives in PwC’s survey anticipate that distributed generation — which may harness energy from wind, solar, small hydro, geothermal, or biomass — will account for as much as 30 percent of total global generation by 2030, a significant jump from [less than 3 percent in 2012](#). This growth will impact the business model of utilities, which have historically held monopolies on the provision of power to their customers. In fact, in PwC’s survey, nearly half of utility executives agreed that the growth of distributed generation could shrink the role of power utility companies to providers of backup power.

Notwithstanding the expected broad-based growth, there is a significant limit to the potential for traditional rooftop solar systems. Residential and commercial customers in multi-tenant buildings have limited access to rooftops. Even for those that own roof space, roofs cannot always support solar panels and are often shaded by trees or buildings. With the growing urbanization and expected [rise in renting](#), the addressable market for traditional rooftop solar is capped and may even be decreasing. This development will force utilities and solar companies to adopt alternative solutions to meet the increasing customer demand for solar.

Community solar has emerged as an attractive and increasingly popular solution precisely because it eliminates the need for rooftops. With community solar, developers construct medium- to large-scale solar

installations on offsite locations that may be distant from the point of consumption. Individual retail customers can either subscribe to blocks of electricity or purchase a portion of the solar panels in such installations and receive credits on their bills. As a result, a broader range of customers can benefit from solar energy without installing solar panels on their own rooftops.

Propelled by strong customer demand, technological development, and regulatory support, community solar is expected to grow rapidly in the years to come. To take advantage of the opportunities it presents, as well as to confront the challenges associated with it, utilities must define a clear strategy, establish differentiating capabilities and new operating models, and develop a tight network of partners that can help them harness this new source of power.

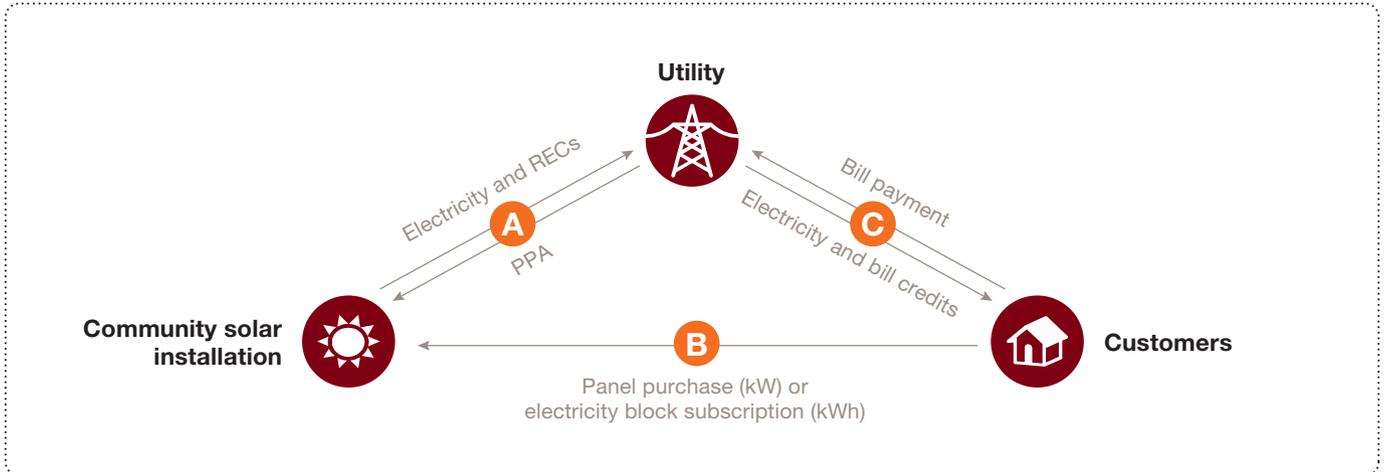
Community solar model

Community solar can be deployed in a variety of ways, depending on the specific business and regulatory circumstances. Exhibit 1, next page, shows a simple three-step mechanism that illustrates how a typical model works.

Because electricity markets are regulated on a state-by-state level in the U.S., the actual design and operations of programs can vary and are filled with nuances when it comes to detailed models, pricing, taxes, and other issues.

Exhibit 1
Utility-sponsored community solar program model

A utility owns or operates a community solar program open to voluntary customer participation



A Solar electricity purchase A utility, in conjunction with a program administrator and/or a developer, designs a community solar program and procures electricity from offsite solar installations through power purchase agreements (PPAs) and claims renewable energy credits (RECs) associated with the production

B Customer pricing model

- Purchase or lease solar panels (kW) Customers purchase or lease solar panels (kW) from offsite community solar installations
- Purchase power generated (kWh) Customers subscribe to specific amounts of electricity (kWh) from offsite community solar installations

C Customer benefits Customers receive credits on their electricity bills based on the amount of electricity they subscribed to or generated by the panels that they purchased, while selling extra electricity back to the grid

Source: National Renewable Energy Laboratory; Strategy& analysis

A shining market

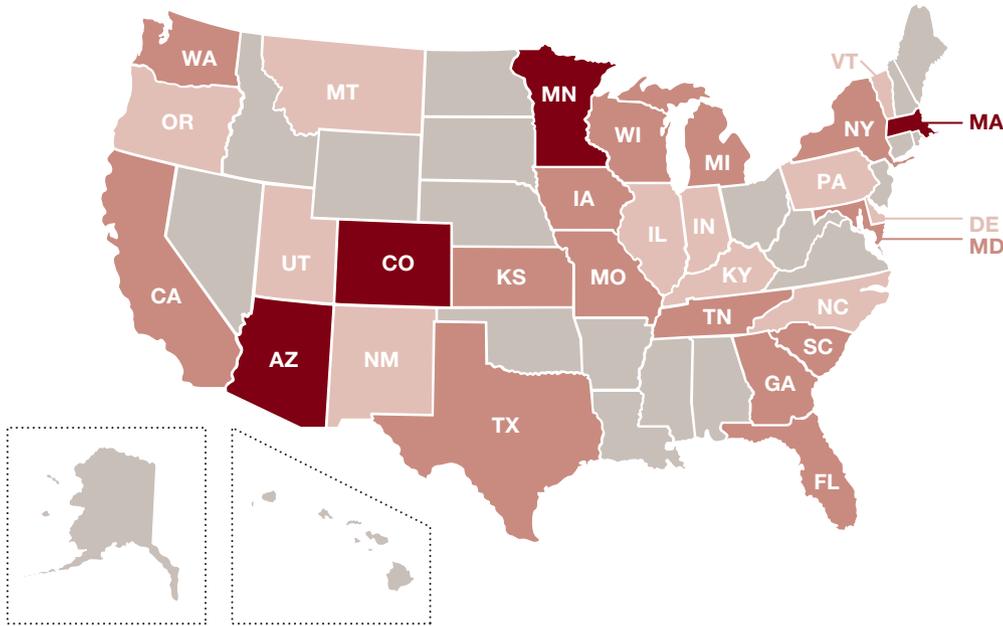
The U.S. community solar market is less than a decade old. One of the first installations, [a tiny project in Ellensburg, Wash.](#), came with a mere 36 kilowatts (kW) of generation capacity and 73 customers. Since then, community solar has experienced significant growth across the nation. As of early 2017, there were more than 180 community solar installations with an estimated combined capacity of at least 250 megawatts (MW) in 29 states (*see Exhibit 2, next page*).

With more than 25MW of capacity each, Minnesota, Arizona, Colorado, and Massachusetts are the clear leaders. Combined, they represent approximately 78 percent of total U.S. installed community solar capacity. Minnesota and Colorado, which boast more than 40 community solar installations each, have a combined capacity of at least 120MW.

The nascent market is poised to grow significantly. The National Renewable Energy Laboratory (NREL) expects the cumulative community solar capacity to reach as much as 11 gigawatts (GW) by 2020. That represents a 44-fold increase from current levels. [NREL also expects](#) that the projected growth in community solar will propel the annual demand of the entire distributed solar market to rise from about 5GW in 2016 to about 9GW by 2020, powered by US\$8.2 billion to \$16.3 billion of cumulative investments.

Exhibit 2

U.S. states with community solar projects, as of early 2017



Approximately 78% of total installed capacity is in Minnesota, Arizona, Colorado, and Massachusetts

More than half (~52%) of community solar installations are in Colorado, Minnesota, and Massachusetts

>25MW capacity
>1MW capacity
<1MW capacity

Note: Exact numbers of programs and capacities differ slightly across authorities depending on exact timing and varying definitions of community solar programs; some programs are expected to come online in early 2017.

Source: Clean Energy Project Builder; Community Solar Hub; National Renewable Energy Laboratory; Smart Electric Power Alliance; utility websites; various news articles; Strategy& analysis

Business drivers and challenges

Community solar provides a unique set of business drivers and benefits for utilities, program administrators, developers, and residential and commercial customers. As shown in Exhibit 3, next page, these drivers span a broad spectrum, from new market opportunities and the imperatives of regulatory compliance to cost efficiency, economies of scale, and the opportunities for strategic deployment and flexibility.

In addition to these macro supply-side drivers, there is also strong customer *demand* for community solar. In a [survey](#) of 2,001 residential and 252 commercial customers conducted by the Smart Electric Power Alliance (SEPA) in 2016, more than 46 percent of residential customers and 39 percent of commercial customers responded that they would consider community solar within the next five years. They cited a range of reasons including avoidance of direct rooftop installations, better financial returns with smaller up-front costs, no need for maintenance, program flexibility, and less uncertainty about property value. Put another way, customers recognize that community solar offers a compelling way to deploy and use solar power without any of the hassles associated with rooftop systems.

As is the case with many industries in their infancy, community solar also presents a series of challenges to utilities. Because it is a relatively new concept, there are high costs related to customer education and marketing. Also, building community solar poses inherent investment and operational risks stemming from the limited standardization in partnership models, contract structures, rate design, and bill credits. Rate design is often one of the most hotly debated topics, as utilities are incentivized to charge customers a fair share of the grid costs associated with transmission and distribution while providing a favorable financial case for ratepayers to participate in the programs. In addition, utilities pursuing community solar must confront the complexity of coordinating multiple partners and systems along with the uncertain applicability of Securities and Exchange Commission requirements and limited legal precedents. Shifting regulatory frameworks present yet another hurdle.

Exhibit 3
Key business drivers for community solar

<i>Type of driver</i>	Program administrator/developer	Utilities	Customers (residential and commercial)
<i>New market opportunity</i>	New solar development projects	<p>Opportunity to generate new revenue streams and shape the new distributed generation trend</p> <p>Ability to meet market demands and enhance customer satisfaction</p>	<p>Solar power without onsite installation or maintenance</p> <p>Long-term financial returns</p> <p>Hedge against rising rates</p>
<i>Regulatory compliance</i>	<p>An additional source of RECs to meet regulations (e.g., renewable portfolio standard, shared energy program mandates)</p> <p>Increasingly supportive regulations (e.g., virtual net metering, ITCs) for community solar programs</p>		Benefits passed on to customers in various forms (e.g., ITCs, reduced long-term costs)
<i>Cost efficiency and economies of scale</i>	<p>Reduced individual site evaluation and development costs</p> <p>Increased scale and efficiency for operational activities (e.g., permitting, interconnection, customer acquisition) compared with small-scale projects</p> <p>“Community pull” for new customer acquisition and expansion</p>	<p>Need for grid upgrades or new plants delayed or canceled</p> <p>Easier monitoring and load estimation of distributed solar systems</p>	<p>Lower up-front costs to join solar programs with higher long-term financial benefits</p> <p>Opportunity to support the local community and environment</p>
	Potential investments from financial institutions across all stages of the program	<p>Lower demand loads during peak hours, reducing blackout risks</p> <p>Additional electricity supply through net metering</p>	<p>Access to financing from local banks/credit unions at lower rates than for projects with a single, smaller offtaker</p>
<i>Strategic deployment and flexibility</i>	<p>Flexible site selection (e.g., municipalities, brownfields)</p> <p>Selection of sites for optimal sunshine</p>	More control over location of facilities than traditional rooftop solar model	<p>Option to sell panels or continue the subscription if moving within the same grid</p> <p>Ability to opt out</p>

Source: Strategy& analysis

Having analyzed a range of community solar programs, we have identified several success factors and potential pitfalls exhibited by programs of various sizes.

Success factors

- Programs with active public education prior to program launch, a clearly defined ownership model, and explicit financial benefits were able to achieve early success and progressive expansion.
- Putting ownership or purchase limits per customer in place to prevent oversubscription by only a few customers and offering flexibility of opt-out/transfer options allowed utilities to maximize customer acquisition.
- Some utilities were able to enjoy additional revenue synergies by cross-offering and bundling the program with existing utility products.

Potential pitfalls

- Local pushback and limited education/awareness of community solar hindered customer acquisition activities and resulted in undersubscription.
- Limited financial benefits discouraged active customer participation.
- Large subscriptions by only a few customers resulted in adoption by a small number of customers.
- Some states placed unfavorable regulatory hurdles (e.g., virtual net metering cap, program size limits) that slowed down expansion capabilities.
- Some solar developers struggled with poorly defined project RFP guidelines from utilities, limited standards for REC pricing, and low expected returns.

Industry landscape and key players

As of early 2017, at least 110 utilities across the nation had partnered with program administrators and developers to champion and offer community solar programs to their customers. Leading the way, the largest utilities in Minnesota, Massachusetts, and Arizona represented almost 67 percent of the total community solar capacity in the United States. Xcel Energy led the nation with 96MW in projects, including installations expected to come online in early 2017. But capacities varied significantly across installations. Nationwide, the average capacity per installation was approximately 1.3MW, enough to power approximately 221 homes, according to Solar Energy Industries Association, or SEIA (see Exhibit 4, next page).

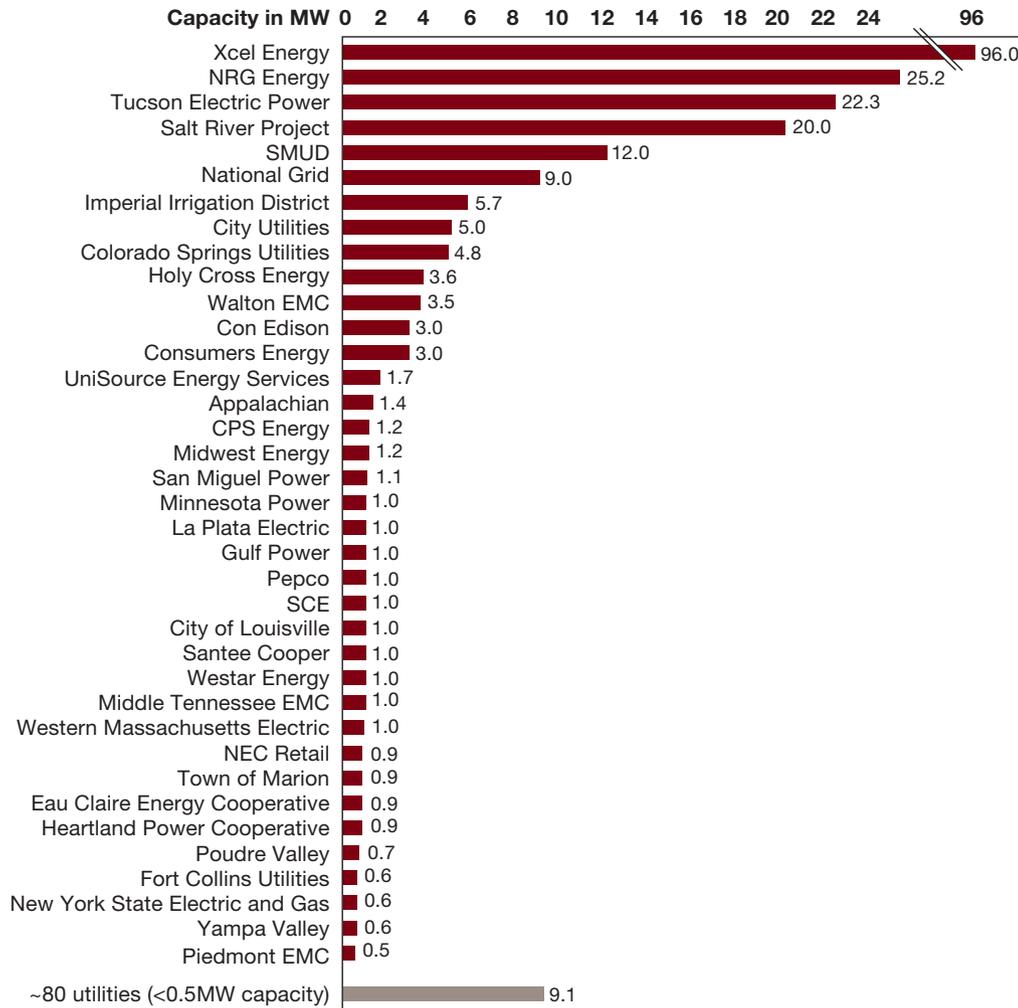
In addition to large-scale installations, there were nearly 80 utilities with more than 80 small-scale installations, which we define as less than 500kW capacity. Though these may seem insignificant at the current time, the long tail represents potential opportunities to scale up and attract more customers.

Broadly speaking, utilities choose to partner with two types of entities to initiate and operate community solar programs: developers and program administrators. Developers such as First Solar or EnterSolar design, build, and maintain community solar installations. Administrators such as the Clean Energy Collective or SunShare provide more comprehensive services and collaborate with utilities to develop program offerings and perform sales, marketing, and customer services to end customers. These administrators often outsource solar installation development and maintenance activities to the aforementioned developers.

There is, however, no single model of partnership. Xcel Energy formed a strong partnership with SunShare and Mortenson to design, develop, and operate community solar programs. In Minnesota alone, Xcel Energy is actively engaging in this type of collaboration on a portfolio of more than 70MW capacity of community solar installations, including those installations expected to come online in early 2017.

Exhibit 4

Utilities are investing in community solar



Note: Exact numbers of programs and capacities differ slightly across authorities depending on exact timing and varying definitions of community solar programs; some programs are expected to come online in early 2017.

Source: Clean Energy Project Builder; Community Solar Hub; National Renewable Energy Laboratory; Smart Electric Power Alliance; utility websites; various news articles; Strategy& analysis

NRG Energy, one of the largest independent power producers in the U.S., also engaged with SunShare in 2015 to build 8.2MW of community solar in Denver and Colorado Springs, enough to power more than 1,300 homes. In this collaboration, NRG provided financing while SunShare managed customer contracts and services. When NRG partnered with Boeing and Sol Orchard in 2014 to develop a 5.7MW community solar installation at San Diego State University’s Imperial Valley campus, Boeing provided engineering, procurement, and construction support, while Sol Orchard developed the installation.

The Imperial Irrigation District agreed to purchase electricity under a 25-year power purchase agreement, offering community solar programs to its customers.

In the [Bright Tucson Community Solar Program](#), Tucson Electric Power (TEP) directly partnered with local developer Solon and the University of Arizona Science and Technology Park to develop an initial 1.6MW solar installation in 2011. This partnership allowed TEP's customers to purchase power outputs at a small premium of \$3 per 150kWh. Bright Tucson is now one of the most active community solar programs in the nation, with a total capacity of 22.3MW. This extensive growth was achieved by proactively educating customers on long-term costs and benefits, developing a strong link with the local community (e.g., new local job creation, use of local resources, development on brownfields), and offering a “no-risk” option, allowing customers to opt out without any long-term commitments.

Con Edison, the New York-based utility, partnered with a leading program administrator, the Clean Energy Collective, in 2016 to offer its customers the option of [purchasing solar panels at offsite installations](#) across the state. The Clean Energy Collective outsourced solar installation development and maintenance to a local developer, EnterSolar, while performing key customer-facing activities (e.g., sales and marketing, customer service).

An increasing number of financial institutions of different sizes and in different locations offer solar project investment and provide loans to customers. For example, Morgan Stanley Solar Solutions Corp. (a subsidiary of Morgan Stanley) partnered with the Clean Energy Collective in 2015 to develop [dozens of solar community installations](#) in Massachusetts, totaling 50MW in capacity. Small community credit unions and banks also provide financial support to program customers. For example, Colorado-based [Sooper Credit Union](#) partnered with the Clean Energy Collective in 2012 to provide low-cost loans to customers of Holy Cross Energy, Colorado Springs Utilities, San Miguel Power Association, and Poudre Valley Rural Electric Association. Similarly, the [National Bank of Middlebury](#), the [Green Mountain Credit Union](#), and the [Vermont State Employees Credit Union](#) provide loans to Vermont residents and businesses for community solar participation.

Though these partnerships benefit from the synergy created by jointly administering programs and attracting customers, it is critical for utilities to carefully structure and manage such a complex network of partners to maximize value and drive successful programs.

It is critical for utilities to carefully structure and manage such a complex network of partners to maximize value and drive successful programs.

Regulatory framework

Utilities are, of course, regulated at the state level. This means developers of community solar must cope with a broad array of regulatory regimes. Various states have adopted virtual net metering (VNM) and/or more comprehensive shared energy program legislation to support and guide community solar programs.

Virtual net metering expands the concept of net metering to virtually allocate electricity credits from offsite or onsite installations to individual subscribing customers, including tenants in multifamily or commercial properties. On the other hand, legislation related to shared energy programs establishes more comprehensive statewide mandates including eligible utilities, territory/capacity limits, VNM caps, on-bill credits, and subscription limits.

As of early 2017, at least 21 states had adopted or proposed legislation that played an important role in spurring the growth of community solar, including legislation providing mandates for both virtual net metering and shared energy programs (*see Exhibit 5, next page*).

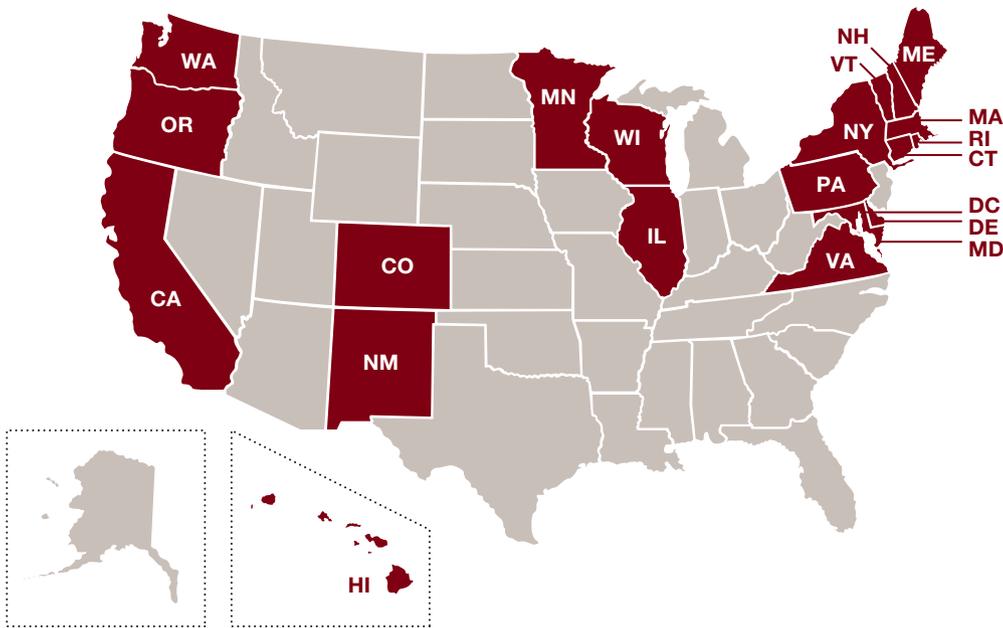
Below are examples that showcase typical components of state legislation that provide guidance and mandates for community solar programs.

- *Minnesota:* The [Solar Energy Jobs Act](#) requires the state's largest utilities to submit a plan for community solar programs of 1MW or less. Each program is required to have a minimum of five customers and credit customers at a retail rate with an option for an alternative solar rate.
- *Colorado:* The [Community Solar Gardens Act](#) requires community solar programs to have a capacity of 2MW or less, a minimum of 10 customers, and subscriptions limited to 120 percent of a customer's average annual electricity demand. It also mandates billing credits to be the same as retail rates, less a reasonable fee for electricity delivery, integration, and program administration.

- *California:* The Green Tariff Shared Renewables Program mandates that as much as 600MW of community solar be installed by 2019, a substantial increase compared with the size of today’s community solar market. The goal is to provide solar energy access to ratepayers currently unable to host onsite generation.

Although legislation that provides mandates and guidance for community solar is an important driver, utilities can still operate community solar programs through billing mechanisms without specific legislative actions. Thus, utilities in states without specific community solar legislation should not be discouraged; rather, they should actively engage with development partners and regulatory bodies to design and offer community solar programs in their respective markets.

Exhibit 5
Twenty-one states have legislation supporting community solar



While community solar legislation provides mandates and guidelines/caps, utilities can still initiate programs in states without any legislative action

Note: Includes proposed legislation.

Source: Database of State Incentives for Renewables & Efficiency; Institute for Local Self-Reliance; Interstate Renewable Energy Council; National Renewable Energy Laboratory; Shared Renewables HQ; Strategy& analysis

Bright opportunities ahead

Community solar presents a large growth opportunity for utilities, empowering them to engage and serve customers in a new way. The market is expected to expand quickly: NREL [projects](#) that, by 2020, community solar will account for 32 to 49 percent of the annual U.S. distributed photovoltaic market demand.

We see utilities of various sizes across the nation at three stages of community solar development: exploring different models to enhance renewable portfolios; evaluating community solar programs; and operating active community solar programs.

To successfully launch and operate community solar programs, utilities must carefully assess and address key questions around strategy, operations, and finance/regulations that are specific to where they are in the journey.

Exploring. Utilities in the exploratory mode must understand what the community solar market is, what its value propositions are, how it could enable their own growth objectives, and how it would impact their go-to-market strategy. They should assess which models and programs would produce the most favorable financial returns and sustainable value for their organizations. They must also consider how community solar will affect their operations. More specifically, they should aim to understand how their business models can be adapted to meet increasing customer demands for renewable energy. At the same time, they need to understand key legislation impacting renewable portfolios and targets as well as explore potential initiatives such as community solar to meet those targets.

Evaluating. Beyond understanding how the market works, utilities must understand what the key differentiating capabilities are that will enable them to execute programs successfully. As they contemplate community solar, they must consider the key design factors (e.g., rate designs, capacities, locations), think through how to procure systems and with whom they should partner, and develop a cohesive sales and marketing strategy. Concurrently, they should actively engage with regulatory

bodies to receive the approvals required to initiate a community solar program, determine the level of financing needed, and decide how to structure ownership of the program.

Operating. Once programs are up and running, utilities must devise strategies to enhance customer value by incorporating new technologies (e.g., more efficient panels, storage systems), determine the systematic methodology for evaluating an expansion, and accelerate customer acquisition and improve retention. From an operational perspective, they should develop a practical framework and mechanism to evaluate value realization from the program, identify and address key pain points, and work to improve operational efficiencies. All the while, they must keep an eye on the regulatory landscape to understand how legislative actions might affect community solar programs and the broader renewable energy ecosystem as well as define appropriate future financing plans.

Though still in its infancy, community solar has gained critical mass and is poised for growth. In the past decade, we have seen, time and again, that sectors of the renewable energy industry have been able to gain scale and acceptance with rapid speed. Thanks to rising consumer demand, improved technologies, favorable regulatory frameworks, and growing sophistication in marketing and operations, that same process is now beginning to happen in community solar.

As that process evolves, utilities must strategize about how they will harness this rising source of power and allow their customers to share the benefits of the sun rooflessly.

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