


# Solar Gardens in the Garden State: Community Solar Recommendations for New Jersey

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**Authors**
Vivian Chang, Cara Goldenberg, Jack Hoskins, Stephen Lassiter, Zhongshu Li, Eri Nakatani, Sheree Oluwafemi, Hannah Safford

**Advisors**
Jeanne Fox, Anne Hoskins

WOODROW WILSON SCHOOL
of Public & International Affairs
PRINCETON UNIVERSITY

## About This Document

This report was prepared by a graduate policy workshop at Princeton University's Woodrow Wilson School (WWS) of Public & International Affairs. WWS graduate policy workshops engage teams of 8–12 graduate students in researching a salient policy issue and providing recommendations to a specific client or expert group. The client for this report was GRID Alternatives Tri-State, Inc., a 501(c)(3) non-profit that seeks to make solar power and solar jobs accessible to underserved communities in New York, New Jersey, and Connecticut.


## Acknowledgements

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## Contents

## List of acronyms

| | |
|---|---|
| ANM | aggregated net metering |
| ARR | applicable retail rate |
| BPU | Board of Public Utilities |
| CBRE | Community-Based Renewable Energy |
| CDG | community distributed generation |
| CESIR | Coordinated Electric System Interconnection Review |
| DCA | Department of Community Affairs |
| DEP | Department of Environmental Protection |
| DER | distributed energy resources |
| DPS | Department of Public Service |
| DSIP | Distributed System Information Plan |
| ECR | Enhanced Community Renewables |
| EJ | environmental justice |
| GW | gigawatt |
| IEEE | Institute of Electrical and Electronics Engineers |
| IOU | investor-owned utility |
| IPP | independent power producer |
| ISO | Independent System Operator |
| kW | kilowatt |
| kWh | kilowatt-hour |
| LMI | low- and moderate-income |
| MW | megawatt |
| MWh | megawatt-hour |
| NEM | net energy metering |
| NJCEP | New Jersey Clean Energy Program |
| NYSERDA | New York State Energy Research & Development Authority |
| PPA | power purchase agreement |
| PSC | Public Service Commission |
| PSE&G | Public Service Electric & Gas |
| PUC | Public Utilities Commission |
| PV | photovoltaic |
| REC | Renewable Energy Certificate |
| REV | Reforming the Energy Vision |
| RGGI | Regional Greenhouse Gas Initiative |
| RPS | Renewable Portfolio Standard |
| RTO | regional transmission organization |
| SBC | societal benefits charge |
| SEJA | Solar Energy Jobs Act |
| USF | Universal Service Fund |
| VNM | virtual net metering |
| VOS | value-of-solar |

## Executive Summary

Solar is booming. The United States achieved more than 30 gigawatts of cumulative installed solar capacity in 2016, up from virtually zero just a decade prior. Yet almost half of American households cannot access solar power because they reside in rented or multi-tenant buildings. Other households have shaded roofs, or lack the capital needed to invest in solar panels. "Community solar" is an emerging opportunity to increase solar deployment and access.

Community solar projects—also known as community solar gardens, community solar farms, and community shared solar—are small- to medium-scale solar-electric systems that provide power and/or financial payback to multiple participants. These systems can enhance electric grid resilience, support economic growth, reduce transmission and distribution costs, lower peak rate spikes, increase low-income uptake of solar, enhance environmental justice, and improve human and environmental health. Additionally, community solar projects are generally small enough to be located close to end users but large enough to achieve economies of scale, making community solar a valuable complement to utility-scale and residential solar.

As the country's most densely populated state, New Jersey stands to benefit greatly from community solar as a new approach to solar expansion. New Jersey has a track record of innovative and effective solar policies. Thanks to its net metering policy, solar Renewable Portfolio Standard (RPS), and Solar Renewable Energy Credit (SREC) market, New Jersey has enough installed solar capacity to power 257,000 homes, and ranks fourth on the Solar Energy Industries Association list of top solar states. Establishing a statewide community solar program would augment consumer choice and unlock a new market for solar development, helping New Jersey remain a national leader in solar energy.

Thoughtful policy design is essential to program success. Community solar can provide multiple benefits to low- and moderate-income and renting households and to the power grid, but it must be implemented carefully to reduce costs. The following recommendations for community solar legislation in New Jersey are based on an extensive literature review, interviews with more than 100 experts and practitioners, and in-depth case studies of three states (California, Hawaii, and Minnesota) that have led efforts to design and implement community solar policies.

**Recommendations for community solar legislation in New Jersey**

*Statute and program design*

(1) Be clear on legislative intent, but delegate program details and technical specifications to the New Jersey Board of Public Utilities (NJ BPU).

(2) Administer the community solar program in two phases: a pilot stage to identify and correct problems, followed by full implementation.

(3) Require utilities to collect and disclose information relevant to project development.

(4) During the pilot stage, use a Request for Proposals (RFP) to process project applications. For full implementation, use a queue-based first-come, first-served process.

(5) Establish transparent cost-sharing procedures for grid upgrades needed to accommodate community solar.

(6) Create a simple, standardized process for community solar permitting.

(7) Develop and ultimately transition to a value-of-solar credit rate. In the interim, use virtual net metering to credit customers at the applicable retail rate.

(8) Set a floor on SREC prices and provide SREC benefits to subscribers.

*Project restrictions*

(9) Cap the size of individual projects at 5 megawatts (MW). Limit participation to customers in the same service territory and county.

(10) Encourage development on low-value land and sites that allow multiple land uses. Require project applications to include decommissioning plans.

*Subscriber base and customer outreach*

(11) Allow participation of residential and small-business customers. Limit the subscription size of any one customer to 40 percent of project capacity.

(12) Require developers to allocate at least 10 percent of subscriptions to low- and moderate-income (LMI) customers, and adopt measures to increase LMI and environmental justice (EJ) participation. Integrate community solar into existing energy assistance programs.

(13) Create and implement consumer-protection measures, including a standard disclosure checklist and an online information portal.

# 1 Background

Solar power is growing rapidly in the United States. In 2016, more than 30 gigawatts (GW) of cumulative solar capacity had been installed across the country, up from virtually zero installed capacity just a decade prior.[1] The bulk of this capacity comes from utility-scale and residential solar installations (Figure 1). Both installations are effective in certain settings, but can have limitations. Utility-scale solar plants, like other utility-scale plants, rely on long transmission lines to deliver power to end users. Long transmission lines result in higher system losses and are more expensive to construct and maintain.[2] In addition, utility-scale plants have large physical footprints, which make them difficult to site.[3] Residential solar can be inaccessible to those who lack sufficient capital or credit, and to residents of shaded, rented, or multitenant buildings.

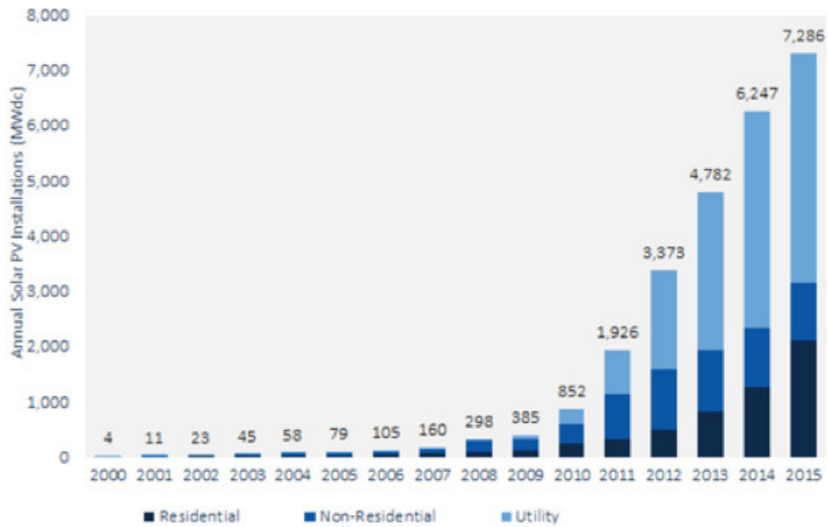



***Figure 1:*** *U.S. solar PV installations, 2000–2015. (Source: Solar Energy Industries Association)*

Community solar projects (also known as community solar farms, community solar gardens, and community shared solar[4]) are becoming an increasingly popular complement to utility-scale and residential solar installations. While the exact definition of community solar varies among states, utilities, and other stakeholders, in this report we define "community solar" as small- or medium-scale solar-electric systems that provide power and/or financial payback to, or are owned by, multiple community members participating in a voluntary program (Figure 2).[5] Typically, community solar projects are located away from their participants. Members own a fraction of the project's panels, or subscribe to a fraction of its electrical output, which is exported directly to the grid. In return, utilities credit members for their share of the electricity exported to the grid, reducing their monthly utility bills.

Community solar projects offer several unique benefits. First, they are generally small enough that they can be located close to end users, but large enough to realize economies of scale. Second, community solar projects enable customers to receive the benefits of solar power without having to finance the purchase or lease of their own system. Third, community solar contracts can be arranged collectively, allowing individual customers to participate without individually undertaking complex financing arrangements.[6] Fourth, community solar provides an alternative to residential solar for customers who cannot host solar installations

[1] Solar Energy Industries Association. (2016). "U.S. Solar Market Insight".

[2] U.S. Energy Information Administration (2016). "How much electricity is lost in transmission and distribution in the United States?" U.S. Department of Energy.

[3] Krannich, R.S.; Robertson, P.G.; Olson, S.K. (2013). *Wind and Solar Energy in the U.S.: Policy Recommendations for Rural Development*. National Agricultural & Development Policy Center, Rural Development Centers Initiative.

[4] These terms are used interchangeably in this report.

[5] National Renewable Energy Laboratory. (2010). *A Guide to Community Solar: Utility, Private, and Nonprofit Developments*. U.S. Department of Energy.

[6] Consumer Federation of America. (2016). *Public Power and Rural Electric Leadership on Community Solar Initiatives*.

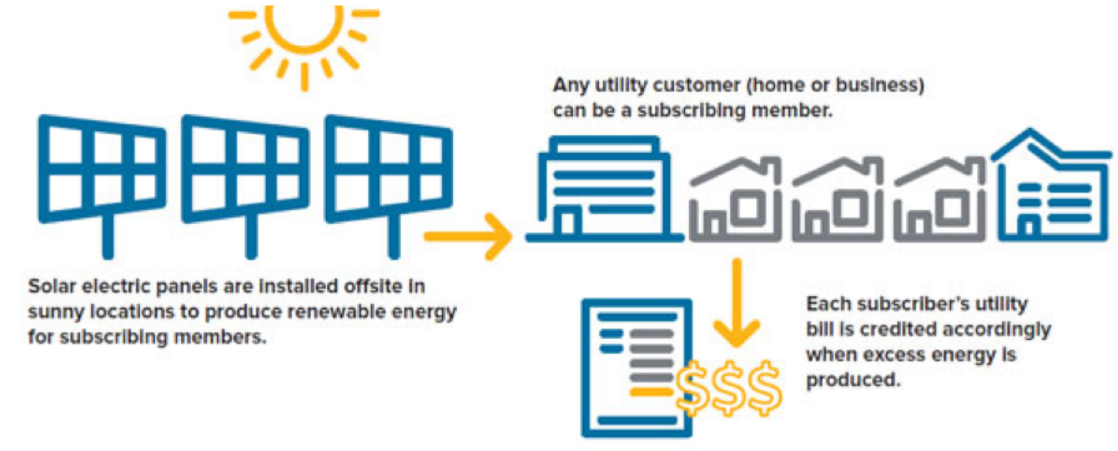



***Figure 2:*** *Community solar infographic. (Source: NYSERDA, Shared Solar NY-Sun)*

on their own properties. This advantage is particularly notable given that 49 percent of households are currently unable to host an individual solar PV system (after excluding households that do not own their building or live in live in buildings with insufficient roof space for solar panels).[7]

In the United States, community solar represents a small but growing segment of the solar market. 1.8 GW of community solar capacity is projected to come online in the next five years, compared to just 0.1 GW of community solar installed through early 2016, and 25 states have at least one operating "community solar" project.[8] Continued expansion of community solar can help accelerate the U.S. transition to a clean energy future, with associated gains in energy security, human and environmental health, and economic growth. Facilitating such growth will require state-specific policies governing the financial, technical, and equity aspects of community solar. To date, just 14 states and the District of Columbia have such policies in place (Figure 3).[9]

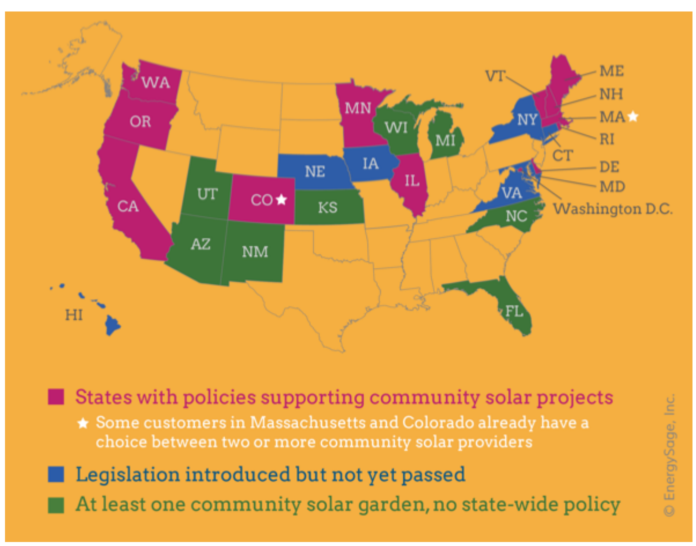



***Figure 3:*** *States with shared renewables policies in place. (Source: Energy Sage)*

7 National Renewable Energy Laboratory. (2015). *Shared Solar: Current Landscape, Market Potential, and the Impact of Federal Securities Regulation*. U.S. Department of Energy.
8 Solar Energy Industries Association (n.d.). "Shared Renewables/Community Solar".
9 Ibid.

This report is intended to inform the development and implementation of effective, successful community solar policy for the State of New Jersey. Although the report is targeted at policymakers in New Jersey, it contains information and analysis that will be useful to policymakers in all states. The report is structured as follows:

- Section 2 provides an overview of the New Jersey energy landscape.
- Section 3 examines the key considerations for community solar and provides policy recommendations.
- Section 4 discusses how the policy recommendations in Section 3 should guide community solar legislation in New Jersey.

The content of this report derives from three sources: (1) a literature review; (2) interviews with more than 100 practitioners and subject-matter experts (Appendix A); and (3) fieldwork in three states—California, Hawaii, and Minnesota—that have already launched efforts on designing and implementing community solar policies (Appendix B).

## 2 New Jersey Energy Profile

### 2.1 State overview

New Jersey has the highest population density of any state in the nation, with nine million residents living across 7,354 square miles (about 1,200 residents per square mile).[10,11] It has the sixth-highest median household income and the 10th-lowest poverty rate of any state (excluding Washington, D.C.).[12,13]

Figure 4 shows the breakdown by power source of New Jersey's electricity market. Natural gas and nuclear power provide more than 90 percent of New Jersey's electricity, with natural gas generating more electricity than nuclear power for the first time in 2015. The small market share of coal in the state is notable. As of September 2016, 62 percent of New Jersey's electricity generation comes from natural gas, and almost all the rest (36 percent) comes from nuclear power.[14]

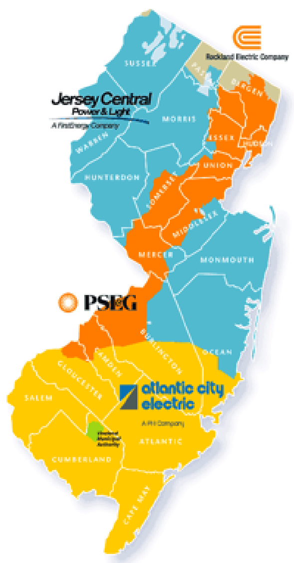

***Figure 4:*** *(Left) New Jersey power plants: natural gas (blue), solar (yellow), petroleum (brown), coal (black), and nuclear (purple). (Right) New Jersey net electricity generation by type. (Source: U.S. Energy Information Administration)*

Solar energy is New Jersey's largest source of renewable power.[15] While there are many solar installations in the state, most are small-scale. New Jersey has the fourth-highest installed solar PV capacity in the United States, but renewable power collectively (including solar as well as other sources of renewable energy) accounts for less than 5 percent of the state's electricity generation.[16] The majority of solar generation in New Jersey comes from distributed resources, and most of the remainder is generated by utility-scale installations, including the state's two largest installations (19.9 MW each).[17] According to the most recent

[10] U.S. Census Bureau. (2015). "QuickFacts: New Jersey". U.S. Department of Commerce.
[11] U.S. Energy Information Administration. (2015). "Profile Analysis: New Jersey". U.S. Department of Energy.
[12] The Henry J. Kaiser Family Foundation (2015). "Median Annual Household Income".
[13] Proctor, B.D.; Semega, J.L.; Kollar, M.A. (2016). *Income and Poverty in the United States: 2015* U.S. Department of Commerce: U.S. Census Bureau.
[14] U.S. Energy Information Administration. (2015). "Profile Analysis: New Jersey".
[15] Ibid.
[16] Ibid.
[17] Ibid.

data available, New Jersey residents pay the 10$^{\text{th}}$-highest electricity prices in the United States.[18] Average retail electricity prices in October 2016 were \$0.15/kWh for residential customers, \$0.12/kWh for commercial customers, \$0.09/kWh for industrial customers, and \$0.13/kWh overall.[19] New Jersey's net summer capacity (the maximum output supplied during peak load in the summer) is 19,399 MW.[20]

New Jersey has four investor-owned utilities (IOUs): Public Service Electric & Gas Company (PSE&G), Jersey Central Power & Light (owned by FirstEnergy Corporation), Atlantic City Electric (owned by Exelon Corporation), and Rockland Electric Company (owned by Consolidated Edison (Con Ed), Inc.) (Figure 5). The state also has several municipal electric utilities, and a single electric co-op, Sussex Rural Electric Cooperative, Inc. Roughly half the state's 21 counties are served by multiple utilities.




| Utility | Customers | Counties |
|---|---|---|
| PSE&G | 2,200,000 | 13 |
| Jersey Central Power & Light | 1,100,000 | 13 |
| Atlantic City Electric | 547,000 | 8 |
| Rockland Electric Company | 72,354 | 3 |

***Figure 5:*** *Service territory map and additional information for electric utilities in New Jersey. (Map source: New Jersey Board of Public Utilities and New Jersey Department of Environmental Protection. Information source: utility websites.)*

## 2.2 Solar policies and programs in New Jersey

### 2.2.1 Renewable Portfolio Standard

In 1999, the Electric Discount and Energy Competition Act established New Jersey's Renewable Portfolio Standard (RPS), requiring the state's independent power producers (IPPs) to generate a certain percentage of their electricity from renewable sources. The RPS established a target of 0.5 percent of state electricity production to come from renewables in 2001 (the year the RPS went into effect), and set a schedule for the target to increase over time, eventually reaching 4 percent in 2012.[21] The Electric Discount and Energy Competition Act also created a "Societal Benefits Charge (SBC)"—an additional charge placed on ratepayers' monthly utility bills to be used in part to subsidize the cost of renewable energy systems.

The legislature has altered the RPS several times since its enactment, including by adding a "solar carve-out" or "solar RPS" in 2004. The solar carve-out initially mandated that at least 90 MW of solar capacity be

[18] U.S. Energy Information Administration. (2016). "Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector". U.S. Department of Energy.
[19] U.S. Energy Information Administration. (2015). "Profile Analysis: New Jersey".
[20] Ibid.
[21] Hart, D.M. (2010). "Making, breaking, and (partially) remaking markets: State regulation and photovoltaic electricity in New Jersey." *Energy Policy.* 38(11).

installed by 2009. The carve-out was later expanded to require that 2 percent of New Jersey's electricity generation come from solar resources by 2020, increasing the state's solar capacity to an estimated 1.5 GW by that year. This target was reached in 2015, five years ahead of schedule.[22] The current RPS requirements are for 20.38 percent of state electricity to come from renewable sources by 2021, and 4.01 percent from solar by 2027. While RPS requirements can be (and often are) met by buying RECs from out-of-state, SRECs can only come from producers connected to the New Jersey distribution system. As a result, while in-state solar generation almost exactly matches the solar RPS requirement, in-state renewables generation is much lower than the REC requirement. See Section 3.1.4. for a more detailed discussion of SRECs.

New Jersey legislators are now considering New Jersey Senate Bill 2276 (S2276), which would establish a New Jersey Solar Energy Study Commission to "study all aspects of New Jersey's solar energy generation industry, and make findings and recommendations to the Governor and Legislature on how the use of solar energy could be expanded in the State."[23] The bill would also modify New Jersey's solar RPS, replacing the schedule described above with a new schedule that requires "electric power suppliers and basic generation service providers to generate a greater percentage of solar energy each year, culminating in 4.1 percent by energy year 2022 and thereafter. The bill would eliminate increased solar energy requirements for energy years 2023 through 2027."[24] The bill was passed by the New Jersey Senate in June 2016 and is now being considered by the General Assembly. Legislators are also considering New Jersey Senate Bill S1707 (S1707), which requires that utilities in the state source 80 percent of their electricity from renewable energy by 2050. Under the bill, utilities would be required to source 11 percent of their electricity from renewables next year. This requirement would increase roughly 10 percent every five years until the "80 percent by 2050" target is met. S1707 was passed by the Senate in February 2016 and is now under consideration in the General Assembly.

### 2.2.2 Clean Energy Program

In 2003, the New Jersey Board of Public Utilities (NJ BPU) established the Office of Clean Energy to administer New Jersey's Clean Energy Program (NJCEP). NJCEP is a statewide program that engages government and industry representatives, energy experts, public interest groups, academics, and others to serve on committees that inform the NJ BPU's clean-energy activities, operations, and stakeholder outreach.[25] NJCEP also oversees a consistent set of energy efficiency and sustainability initiatives in each major utility service territory in New Jersey.[26] These initiatives include the following:

- Solar rebate program. In 2001, the NJ BPU worked with the Natural Resources Defense Council to launch the Customer On-Site Renewable Energy (CORE) solar-rebate program under NJCEP. The program initially offered up to a 70 percent rebate for residents who installed solar energy systems. Although the rebate percentage was rolled back to 50 percent in 2006, CORE remained one of the most generous solar-rebate programs in the country. Indeed, the program was so generous and so popular that its cost ultimately exceeded the revenue from the Societal Benefits Charge. NJCEP gradually reduced CORE rebates over a period of several years, so that the program was completely phased out by 2008.

- Solar Renewable Energy Certificate (SREC) marketplace. In 2004, the New Jersey BPU established an online market through which IPPs could purchase SRECs from residential generators to meet their RPS requirements. For the first few years after the market was established, SREC prices in New Jersey ranged from about \$0.10 to \$0.26 per kWh (2010 equivalent).[27] In 2012, New Jersey Governor Chris Christie signed into law the "Solar Act" to energize the state's deflated SREC market.[28] This legislation successfully stabilized the New Jersey SREC market by boosting New Jersey's RPS for

[22] Ibid.
[23] New Jersey Senate Environment and Energy Committee. (2016). "Statement to Senate, No. 2276". June 6, 2016.
[24] Ibid.
[25] New Jersey Clean Energy Program (NJCEP). (2016). "About NJCEP. New Jersey Board of Public Utilities.
[26] Office of Energy Efficiency & Renewable Energy. (2015). "Energy Incetive Programs, New Jersey". U.S. Department of Energy.
[27] Hart, D.M. (2010).
[28] Volcovici, V. (2012). "Christie signs bill to boost New Jersey's solar industry". Reuters.

several years (balancing the near-term increase in the RPS with a reduction in RPS requirements originally scheduled for later years.)[29] See Section 3.1.4. for a more detailed discussion of SRECs and New Jersey's SREC market.

- CleanPower Choice Program. The CleanPower Choice Program, established under NJCEP in 2005, allows all ratepayers in the state to purchase renewable energy at a premium from energy service companies.[30] As of 2010, only 16,000 of New Jersey's more than three million utility customers had signed up for the program.[31]

- Net metering. Since 1999, New Jersey has had a net electric metering (NEM, also known as simply "net metering" within the state) policy that allows owners of small-scale solar energy systems to sell excess energy back to the grid at the applicable retail rate. (See Section 3.1.1. for a more detailed discussion of NEM). New Jersey's NEM policy has been updated several times since its enactment,[32] but has consistently served to encourage residential rooftop solar. The NEM incentive was particularly strong during the early 2000s, when New Jersey energy prices spiked (increasing by 30 percent from 2002 to 2006).[33] New Jersey limits net metering based on historical usage, avoiding problems some other states have had with generation that exceeds household usage.

- Aggregated net metering. In 2013, the NJ BPU adopted rules authorizing aggregated net metering (ANM) in New Jersey. ANM enables certain customer types—including non-profits, multi-unit residences, school districts, or local governments—to receive the same benefits that residential customers receive under conventional NEM. The rules allow a qualified customer to be credited at the ARR for the aggregate power generated by all solar-energy facilities that the customer owns. The retail credit is limited to the metered annual use of the customer's qualified facilities that are all in the same rate class under the applicable tariff. Any power produced in excess of this amount is credited to the customer at the wholesale rate.[34]

Due largely to these and other state-level policies and programs, the number of solar installations in New Jersey has grown dramatically over the past decade (Figure 6). As of November 30, 2016 (the most recent data available), there were well over 60,000 solar PV installations statewide, with a combined capacity of nearly 2,000 MW—an increase of over 100 times from the 500 installations and combined capacity of 62.7 MW that New Jersey had in 2005.[35,36]

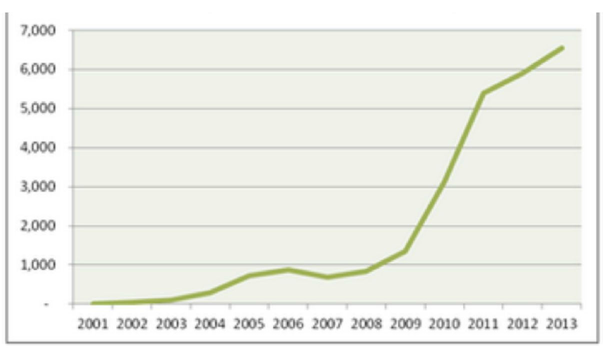



***Figure 6:*** *Number of solar installations in New Jersey, by year. (Source: State of New Jersey Energy Data Center)*

[29] New Jersey Board of Public Utilities & New Jersey Department of Environmental Protection. (2015). *New Jersey Energy Master Plan: Update*.
[30] This program essentially involves participants buying RECs from clean producers in a utility-facilitated exchange.
[31] Johnson, T. (2010). "NJ Residents Still Steering Clear of Clean Energy". *NJ Spotlight*. July 8, 2010.
[32] For an in-depth history of NEM in New Jersey, see the page on this topic maintained by the North Carolina Clean Energy Technology Center at North Carolina State University.
[33] Ibid.
[34] New Jersey Board of Public Utilities. (n.d.) "Solar Act Proceedings, Implementation, and Milestones".
[35] New Jersey Clean Energy Program. (2016). "Solar Activity Reports". New Jersey Board of Public Utilities.
[36] Heavens, A.J. (2005) "A lukewarm reception". *The Philadelphia Inquirer*. July 24, 2005, p. J01.

### 2.2.3 Microgrids

Microgrids are "localized [power] grids that can disconnect from the traditional grid to operate autonomously."[37] New Jersey already has about 45 microgrids, but most are campus microgrids or single building microgrids with one type of distributed energy resource. The state's 2015 Energy Master Plan calls for installation of additional microgrids to improve grid resiliency during storms. In 2016, the NJ BPU allocated $1 million to fund feasibility studies for community microgrids, with particular emphasis on 24 communities in 17 municipalities identified by the state as being at high risk for grid outages. The NJ BPU is expected to announce a second round of funding for engineering work on microgrids at a later date.[38]

### 2.2.4 Benefits of community solar in New Jersey

New Jersey has several attributes that make community solar particularly beneficial to residents. First, the state's densely populated cities have a large fraction of renters (of the top ten U.S. cities with the largest fraction of renters, six are in New Jersey,[39] as shown in Figure 7), meaning there is significant potential for community solar to expand solar access to all state residents, regardless of their housing status.

| Rank | City | Renters | Population |
|---|---|---|---|
| 1 | Bronx, NY | 80.7% | 1,383,871 |
| 2 | Union City, NJ | 79.9% | 68,668 |
| 3 | West New York, NJ | 78.7% | 52,597 |
| 4 | Newark, NJ | 77.9% | 280,579 |
| 5 | Manhattan, NY | 77.2% | 1,621,897 |
| 6 | New Brunswick, NJ | 76.1% | 57,080 |
| 7 | Hartford, CT | 75.6% | 124,705 |
| 8 | Passaic, NJ | 74.6% | 71,509 |
| 9 | San Marcos, TX | 73.7% | 58,892 |
| 10 | East Orange, NJ | 73.4% | 65,078 |
| 11 | Elizabeth, NJ | 73.3% | 128,705 |
| : | : | : | : |
| 17 | Jersey City, NJ | 70.5% | 262,146 |
| 18 | Paterson, NJ | 70.4% | 146,753 |
| 19 | New York, NY | 69.0% | 8,491,079 |
| 20 | Lawrence, MA | 68.6% | 78,197 |

***Figure 7:*** *Percentage of renters in U.S. cities. (Source: Advameg, Inc.)*

Second, New Jersey exhibits dramatic levels of income inequality from neighborhood to neighborhood and town to town, with the poverty rate reaching more than 33 percent in places like Camden, Asbury Park, and Atlantic City.[40] Targeting development of community solar projects to these and other areas with high concentrations of low-income households provides an opportunity to extend solar power to large groups of people who face financial barriers to access.

Third, New Jersey is one of the most urban regions in the country. Sixty percent of New Jersey's land area is urban (more than any U.S. state or territory except the District of Columbia and Puerto Rico), and slightly more than 5 percent of New Jersey's population lives in rural areas (behind only the District of Columbia and California). Community solar could alleviate grid congestion by siting projects in locations that would maximize transmission and distribution benefits.

Fourth, grid resilience during and after storms is a major concern in New Jersey. The vulnerability of New Jersey's power grid became abundantly clear during Hurricane Sandy in 2012. The storm damaged transmission lines and power poles across the state, causing 65 percent of New Jersey utility customers to

[37] Office of Electricity Delivery & Energy Reliability. (n.d.) "The Role of Microgrids in Helping to Advance the Nation's Energy System". U.S. Department of Energy.
[38] Microgrid Knowledge. (2016). "New Jersey to Offer Funds for Community Microgrids".
[39] Advameg, Inc. (2017). "City Data".
[40] Legal Services of New Jersey. (2014). *Income Inequality in New Jersey: The Growing Divide and Its Consequences*. Poverty Research Institute

lose power—many for several weeks.[41] As extreme-weather events in New Jersey and other coastal regions become more frequent and intense due to climate change, community solar and other types of decentralized power production will become increasingly important to ensuring a resilient power grid.

Finally, New Jersey's restructured electricity market and mature solar industry will make it relatively easy to establish a community solar market quickly and efficiently.

[41] U.S. Department of Energy. (2012). "Hurricane Sandy Situation Report #5". Office of Electricity Delivery & Energy Reliability.

## 3 Key Considerations in Community Solar Policy

A number of distinct topics must be considered when designing policies for community solar. These include the following:

(1) Rate design

(2) Financing

(3) Grid integration

(4) Siting and permitting

(5) Project size and capacity

(6) Subscription structure

(7) Developer application process

(8) Community engagement and education

(9) Ensuring widespread access

In the subsections that follow, we examine these topics in turn. For each topic, we summarize the major questions and issues, discuss the advantages and disadvantages of different approaches for resolving them, and provide policy recommendations.

### 3.1 Rate design

| Key Takeaways |
|---|
| • Selecting an appropriate and effective rate design is the most important element of community solar program design.<br>• Value-of-solar (VOS) credit mechanisms can fully and accurately value the energy produced from community solar projects. However, there is not yet a widely used methodology for calculating the VOS rate.<br>• "Adders" can help policymakers ensure that certain objectives are met, but may introduce program inefficiencies. |

The central question facing state policymakers and regulators designing community solar programs is how to credit customers for the electricity projects produce. Whereas electricity produced by residential rooftop solar installations is typically credited at the applicable retail rate and electricity produced by utility-scale solar is typically credited at the wholesale rate, the credit scheme for electricity produced by community solar projects is currently the subject of debate in many states. What policymakers decide will largely dictate the financial benefits participating customers receive, the amount developers can charge for subscriptions, project financeability, and whether states meet some of their renewable energy goals. Most community solar programs opt for one of two valuation schemes: (1) virtual net metering, or (2) a value-of-solar methodology.

#### 3.1.1 Virtual net metering

The most common rate design for community solar is virtual net metering (VNM), an expansion of the widely used net energy metering (NEM) billing mechanism. In NEM, customers who own and operate solar panels or other distributed generation systems on their properties receive on-bill credits for the electricity they deliver to the grid when their production exceeds their demand. VNM allows community solar participants to receive the same benefits as customers with residential rooftop solar (Figure 8). In VNM, the customer's electricity meter does not physically roll backward when the community solar installation generates energy (as it does for some customers participating in conventional NEM programs); instead, the customer receives bill credits per a pre-determined formula. The size of the credit is proportional to the size of the customer's subscription, the energy generated by the community solar project, and the customer's applicable retail rate (ARR). The ARR typically varies by customer class, which the utility regulators determine based on factors such as public policy objectives, socioeconomic status, or annual household level of energy consumption. To date, 12 states and the District of Columbia have developed VNM policies, although only 11 of the 111 active "community solar" projects nationwide are located in those states.[42]

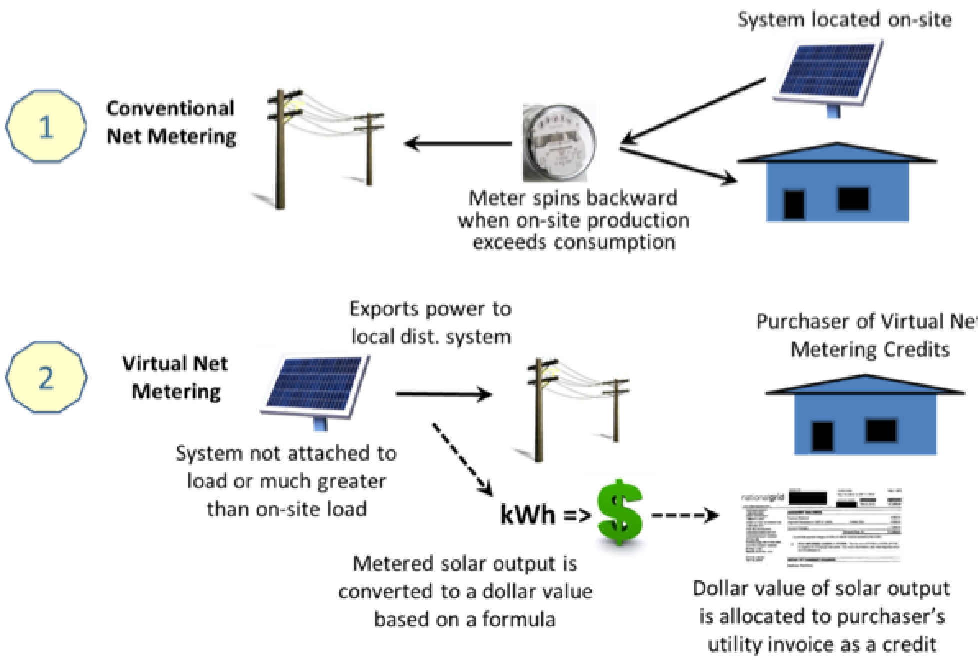



***Figure 8:*** *A comparison of virtual net metering and conventional net energy metering. (Source: Clean Footprint)*

A major advantage of VNM is that it is relatively easy for customers to understand and for utilities with existing NEM programs to implement. However, simply expanding existing NEM programs to include community solar can potentially lead to cross-subsidization. The concern is that the ARR includes not just the cost of electricity generation, but also the costs of transmission, distribution, and grid maintenance. In conventional NEM programs, this is not a major problem: customers generate and consume electricity at the same location and do not impose any additional strain on the grid. In VNM, electricity is typically produced and consumed at different locations, so the distribution and sometimes transmission systems must be used to transport electricity from the source (e.g., a community solar garden) to the end user. While community solar developers pay utilities the fixed cost of any necessary grid upgrade to interconnect their projects, they may or may not compensate utilities for the long-term transmission and distribution costs associated with their projects. Hence applying the full ARR to calculate credits from VNM can potentially subsidize participating customers at the expense of nonparticipants.

Some states have VNM rate rules designed to address the issue of payment for the use of distribution and transmission services. How those rules are set has a significant impact on program participation and effectiveness. Under Delaware's Community Net Metering Provisions, customers on the same distribution feeder as the community solar facility are compensated at the full ARR, while customers not on the same distribution feeder are compensated at a lower rate.[43] In Xcel Energy's community solar program in Colorado, administered under Colorado's Community Solar Gardens Act, certain charges related to use of the transmission and distribution system are excluded from the total ARR credit awarded to program participants. This credit structure accounts for the fact that since the program allows community solar projects and subscribers to be located anywhere within Xcel's service territory, participants nearly always rely on the distribution and

[42] Deloitte Center for Energy Solutions. (2016). *Unlocking the value of community solar*.
[43] Passera, D. (2011). "Delaware PSC issues proposed rules for community net metering. Interstate Renewable Energy Council.

transmission system to some extent. California only credits participants in its shared renewables program for the avoided cost of generation, meaning that participants still pay for the use of the transmission and distribution systems, and other costs incurred by the utility from integrating shared renewables into the grid. This has resulted in customers having to pay a premium for participating in California's shared renewables program, which has impeded participation and presents a major barrier for low-income participation in particular.

### 3.1.2 Value-of-solar

The value-of-solar (VOS) rate design has recently emerged as an alternative valuation methodology to VNM. VOS monetizes the costs and benefits associated with community solar, known collectively as the "value stack." Costs are subtracted from benefits to determine the rate at which utilities credit community solar subscribers. Customers continue to purchase energy from the utility at the ARR, but are credited for the generation produced by their community solar subscription. This is sometimes called a "buy all, sell all" transaction, where the customer is only compensated for the value the project adds to the system. Under a VOS approach, all community solar program participants should receive the same bill credit rate (absent any adders or different values for avoided distribution costs based on locational benefits—see Section 3.1.3), regardless of customer class.

The most important—and most challenging—parts of a VOS credit scheme are (1) selecting the components to include in the value stack, and (2) identifying an appropriate methodology for monetizing each component. Table 1 identifies components that are frequently included in a VOS value stack.[44]

***Table 1:*** *Common components of VOS value stacks for community solar projects.*

| Category | Component | Description/notes |
|---|---|---|
| Energy and capacity | Energy value | Value of energy actually produced by the project. |
| | Capacity value | Value of additional capacity the project provides to the grid. |
| Direct benefits | Lowered transmission and distribution requirements | Community solar projects located close to end users can lower the need for investment in building out or upgrading the transmission and distribution systems. |
| | Lowered line losses and congestion | Community solar projects located close to end users can reduce line losses and grid congestion. |
| | Merit order effect | Since solar facilities have very low operating costs, they can sell marginal power more cheaply into regional transmission organization (RTO) auctions than energy plants powered by fossil fuels, pushing such plants down the "merit order." By expanding solar capacity, community solar projects can reduce the wholesale price of electricity in a given market by cutting the peak demand. This is sometimes called the "price suppression benefit." |

[44] This table is adapted from Bradford, T.; Hoskins, A.; Welton, S. (2013). *Valuing Distributed Energy: Economic and Regulatory Challenges*. Columbia University and Princeton University.

| | | |
|---|---|---|
| | Fuel price hedge | Solar energy has fully quantifiable lifecycle costs, meaning that solar energy prices are much less volatile than fossil fuel prices. Increasing the fraction of solar energy in a portfolio can help guard against sudden price changes of other energy sources. |
| | Resiliency | Community solar, like other types of decentralized power, can increase the resiliency of the power grid to extreme-weather events and other disruptions. |
| Direct costs | Fixed charge coverage | Per-customer share of a utility's fixed costs (e.g., personnel costs, overhead costs, etc.) |
| | Administration and interconnection charges | Cost of integrating electricity produced by community solar projects into the grid (e.g., expenses associated with the physical interconnection process, monitoring expenses, development and oversight of an additional billing process, etc.) |
| | Firming expenses | Cost of maintaining appropriate capacity at central power plants to balance the inherent intermittency of solar power (usually seen with higher solar penetrations). |
| Externalities | Local environmental impacts | By displacing fossil fuels, community solar will have a positive impact on local air, water, and habitat quality. |
| | Greenhouse gas effects | By displacing fossil fuels, community solar will reduce greenhouse gas emissions from the energy sector. |
| | Economic impacts | Developing community solar projects can create jobs, rent payments, and other local economic growth opportunities. |
| | Energy security | By decreasing reliance on imported fossil fuels, community solar can increase U.S. energy security. |
| | Alternative land use | Community solar facilities may need to be sited on land that could be used for another productive purpose. |

Several states and municipalities have already adopted or are in the process of adopting VOS rate designs. Three examples—Austin, Texas; Minnesota; and New York—are presented below.

Example 1: Austin, Texas

Austin Energy was the first utility in the United States to implement a VOS rate design for its rooftop solar customers.[45] Under this design, customer electricity generation and consumption are measured separately. Customers pay their standard bill for electricity consumption, and receive a VOS-based credit for the solar electricity generated by their rooftop installations. To calculate its VOS rate, Austin Energy uses a value stack that includes avoided fuel costs, avoided plant and operating and maintenance costs, and environmental benefits, among other components.[46] When first implemented, the VOS rate was higher than the retail rate, largely due to the inclusion of fuel price-hedge benefits in the value stack.

[45] Austin Energy. (n.d.). "Residential Solar Energy Rate: Value of Solar (VoS)".
[46] National Renewable Energy Laboratory. (n.d.). "Value-of-Solar Tariffs". U.S. Department of Energy.

Example 2: Minnesota

Minnesota was the first state to approve a VOS rate design for IOUs. A series of stakeholder meetings convened by the Minnesota Department of Commerce (DOC) in 2010–2011 revealed that: (1) the state's NEM valuation scheme for renewable energy was likely shifting costs onto ratepayers who did not own renewable energy systems; and (2) the NEM valuation scheme was not accurately capturing the real value of distributed solar.[47] Minnesota's 2013 Renewable Energy Jobs Act accordingly directed the Minnesota DOC to develop a VOS methodology. In 2014, the Minnesota Public Utilities Commission (PUC) approved its first VOS tariff.[48] The value stack used in the Minnesota PUC's VOS methodology includes eight components, of which four are most significant: 25 years of avoided natural gas purchases, avoided transmission capacity, avoided new peaker power plant purchases, and avoided environmental costs (Figure 9).

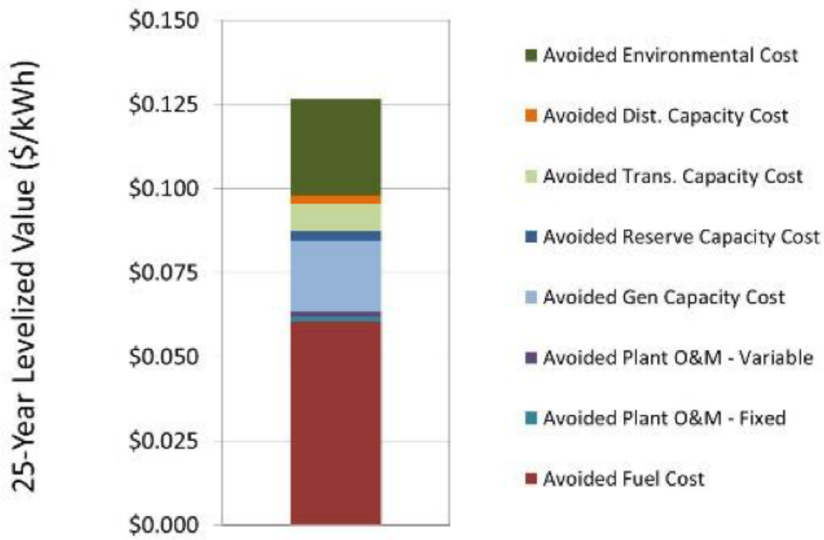



***Figure 9:*** *Minnesota Value of Solar value stack—sample calculation from April 1, 2014. (Source: Minnesota Department of Commerce)*

Utilities in Minnesota have the option of using either the VOS tariff or the NEM tariff for electricity produced by on-site renewable energy systems smaller than 1 MW. In July 2016, the Minnesota PUC issued an order setting a VOS tariff for community solar.[49] This tariff is based on a set 25-year bill credit schedule designed to ensure transparency and reduce risk for subscribers, and is calculated at $0.09950/kWh for the year 2016. (This rate is lower than the rate shown in Figure 9 because the acutal values used in the final 2016 VOS rate have been adjusted in response to Xcel Energy's cost estimates.) The same order also directed Xcel Energy to apply the VOS tariff (rather than the ARR) to any community solar project officially proposed after December 31, 2016. With 400–450 MW of projects under Xcel's community solar program expected to be in service by the end of 2017, Minnesota is poised to be the first state to test the viability of a VOS valuation scheme on a large scale.[50] There is some concern that in the short run the new and significantly lower value-of-solar rate will discourage community solar development. However, advocates are optimistic that by putting a framework in place that properly values the benefits of solar, the VOS will help the sector in the long term. This is especially true given that solar installation costs are widely expected to continue declining.

[47] Hinkle, M. (2015). "Minnesota's Value of Solar: Shining Light of Hidden Value?".
[48] Cory, K. (2014). "Minnesota Values Solar Generation with New 'Value of Solar' Tariff". National Renewable Energy Laboratory, U.S. Department of Energy.
[49] Minnesota Public Utilities Commission. (2016). "Order Approving Value-of-Solar Rate for Xcel's Solar-Garden Program, Clarifying Program Parameters, and Requiring Further Filings". Docket No. E-002/M-13-867. September 9, 2016.
[50] Maloney, P. (2016) "Minnesota first to adopt 'value of solar' approach for community solar". Utility Dive.

Example 3: New York

As part of New York's Reforming the Energy Vision (REV) initiative, the New York Public Service Commission (PSC) has taken several steps to enable more precise valuation and pricing of distributed energy resources. These efforts include the development of a benefit-cost analysis (BCA) framework and utility Distributed System Implementation Plans (DSIPs). The BCA framework was put into place to "ensure 'an accurate and consistent analysis methodology' for comparing potential investments that will enable an animated market at the distribution system level."[51] Along with the framework, the NY PSC ordered the state's IOUs to publish BCA Handbooks that describe and quantify the benefits and costs that the utilities attribute to distributed energy resources (DERs), and how the utilities take these benefits and costs into consideration when evaluating DER development proposals. NY PSC staff identifies four major categories of benefits of DERs as part of the BCA framework: avoided system energy costs, avoided generation capacity costs, delivery costs, and avoided societal damage/mitigation costs. DSIPs are formal filings prepared by utilities that identify system needs and articulate plans for meeting these needs with DERs or other energy resources. Utilities are expected to use the BCA framework in putting together their DSIPs.

A more recent REV effort is the Value of Distributed Energy Resources (DER) proceeding, which will establish a value-based compensation framework for community distributed generation (CDG) projects and other DERs. The PSC released its proposal for the framework in October 2016 and is expected to issue a formal decision in early 2017. To smooth the transition to this new valuation approach, the PSC proposal includes an initial interim (or Phase One) value of DER (VDER) methodology during the development of a Phase Two methodology. The recommended Phase One VDER methodology is designed to ensure that imperfect value calculations do not inadvertently send the wrong price signals about the benefits and costs that DERs provide to the grid. The proposal recommends that each individual kWh of DER must be assigned an individual monetary value based on when and where it is generated, and that this monetary value should then be used to compensate the customer who owns the method of generation. The proposed Phase 1 value stack includes the following components: energy value, installed capacity value, environmental value, demand reduction value, and locational system relief value.

CDG projects in New York may receive lower compensation under the Phase One tariff relative to what they would receive under current NEM mechanisms since the Phase One value stack is somewhat imprecise in terms of total value provided by generators, and does not yet reflect full distribution system values. The NY PSC therefore proposes that these projects receive an additional market transition credit based on a utility's assessment of impact to net annual revenue. This net impact is the calculated difference between a customer's fully bundled volumetric retail rate and a CDG project's value-based rate per the PSC methodology.

### 3.1.3 Other approaches

Policymakers in Hawaii are experimenting with alternatives to both net metering and value-of-solar credit schemes. In October 2015, the Hawaii Public Utilities Commission (PUC) issued a ruling[52] ending NEM for all customers who install new rooftop PV systems on their own properties. New customers can now select one of two tariffs: a "grid-supply" option and a "self-supply" option. The "grid-supply" option is similar to the NEM approach previously used by the state, but instead of allowing customers to offset the electricity they consume from the grid on a one-to-one basis with rooftop PV electricity that they export back to the grid, customers are credited a below-retail rate for the electricity they export. The "self-supply" option allows customers to directly consume the PV electricity they produce, but does not allow them to export any electricity back to the grid, except for small, uncompensated amounts of electricity for a short duration. While the new credit scheme avoids cross-subsidization, many have argued that it is less attractive to customers than net metering, and hence will discourage further expansion of rooftop PV and reduce solar employment.[53]

[51] New York Department of Public Service. (2016). *Staff Report and Recommendations in the Value of Distributed Energy Resources Proceeding*. 15-E-0751.

[52] Hawaii Public Utilities Commission. (2015). "Instituting a Proceeding to Investigate Distributed Energy Resource Policies". Decision and Order No. 33258. October 12, 2015.

[53] Walton, R. (2016). "Hawaii solar industry reports 39 percent drop in employment after the end of retail net metering". Industry Dive.

Hawaii policymakers have developed a separate credit scheme for its Community-Based Renewable Energy (CBRE) program, which is currently in the final stages of development. The proposed CBRE tariff calls for competitive procurement of credit rates for community solar customers. Under this approach, community solar projects would be separated into two tiers: Tier 1, comprising projects with 25–250 kW of capacity; and Tier 2, comprising projects with more than 250 kW of capacity. Project developers in each tier would submit credit-rate bids (below time-of-day rate caps set by the Hawaii PUC), and the winning bid would be used to calculate credits for community solar customers. This process is referred to as a "reverse auction." Many elements of this credit scheme are still under discussion.

The use of "adders" is another option for community solar credit schemes. Adders are extra charges built into a tariff to account for externalities, or to motivate a utility to pursue projects and goals identified by regulators. Adders could be integrated into community solar tariffs to encourage participation of low- and moderate-income customers, reliance on local companies in project development, and other objectives. In Minnesota, for instance, regulators are considering using adders to incentivize the development of community solar projects that serve targeted populations, relieve grid congestion, or are located on low-value land, such as brownfields. Adders offer a direct way for policymakers to promote desired outcomes, but, like any tax or subsidy, they can be controversial and may support or inhibit solar development. Debate over adders is particularly contentious with respect to VOS credit schemes, as the inclusion of adders in such schemes undermines the argument that VOS rates represent the "true value" of solar.

***Table 2:*** *Community solar compensation and valuation schemes by state.*[54,*]

| State | Legislation/incentive | Compensation/valuation scheme |
|---|---|---|
| **California** | Green Tariffs Shared Renewable Programs (SB 43) | Customers are compensated only the wholesale generation value of the electricity. Customers also pay additional program fees. |
| **Colorado** | Community Solar Gardens Act (HB 1342) | Subscribers are compensated the retail rate minus a "reasonable" fee for electricity delivery, integration, and program administration. |
| **District of Columbia** | Community Renewable Energy Act | Participants are compensated via net metering at a standard service offer rate. |
| **Delaware** | Community Net Metering Provisions (Order 7946) | Enables virtual net metering. Customers on the same distribution feeder as the facility are compensated the full retail rate. Customers not on the same distribution feeder are compensated at a lower rate. |
| **Maine** | Net Energy Billing To Allow Shared Ownership | Participants are compensated at the retail rate. |
| **Maryland** | Community Solar Energy Generating Systems (HB 1087) | Value of electricity generated by the solar PV system is credited at the retail rate to its subscribers through virtual net-metering. |

[54] Adapted from National Renewable Energy Laboratory. (2015).

| | | |
|---|---|---|
| **Massachusetts** | Massachusetts Green Communities Act (SB 2768) | Enacts virtual net metering. Participants are compensated at full retail rate. |
| | Neighborhood Net Metering (SB 2395, Section 140) | Participants are compensated at the full retail rate minus default service, transmission, and transmission service charges. |
| **Minnesota** | Solar Energy Jobs Act (HF 729) | Participant compensation transitioned from the retail rate to the value-of-solar rate on January 1, 2017. |
| **Vermont** | Group Net Metering | Participants receive credits at the retail rate. |

*Only includes states that have enacted community solar legislation.

### 3.1.4 Renewable Energy Certificates

Value-of-solar credit rates are often augmented by Renewable Energy Certificates (RECs) or Solar Renewable Energy Certificates (SRECs). RECs are certificates representing the renewable attribute of electricity generation, with one REC representing one MWh of renewable electricity generated and supplied to the grid. Many states have encouraged REC sales by enacting Renewable Portfolio Standards (RPSs), which require that a certain percentage of electricity come from renewable sources. Utilities can meet their RPS requirements either by procuring renewable energy directly, by purchasing the RECs from a renewable energy project owned by a third party, or through an REC aggregator (brokers who trade RECs on the behalf of their clients). Many states try to encourage in-state purchases of RECs without running afoul of the Commerce Clause of the Constitution, which regulates interstate commerce. As a result, there is a wide range of REC prices across states, from under $1 per REC in Texas, to more than $50 per REC in New Hampshire,[55] and more in some cases. Certain states (including New Jersey) include a carve-out in their RPS's specifically for solar generation, and award Solar Renewable Energy Credits (SRECs) for power produced by solar energy systems. SRECs are often much more valuable than traditional RECs, with prices reaching between $100 and $500 in several states.[56]

In designing a community solar program, policymakers must decide who should receive the (S)RECs from a community solar project: the utility, the developer, or the customers. Awarding (S)RECs to the utility makes community solar a more attractive proposition for utilities, which may incentivize them to invest the time, effort, and resources to develop a quality program. Awarding (S)RECs to developers improves the financeability of community solar projects. Awarding (S)RECs to customers increases the financial benefit of subscribing to a community solar project, if customers sell the (S)RECs back to the utility or to another party subject to RPS requirements.[57] If customers do not retain the SRECs for a community solar project, however, then it can be misleading to advertise the project as providing customers with renewable power (since the renewable nature of the project is effectively transferred to whomever does retain the SRECs). This in turn may make it difficult to attract customers, as they often cite their preference to consume renewable energy as an important reason for subscribing to community solar projects.[58]

Policymakers also sometimes use REC pricing strategically in pursuit of certain goals. In Minnesota, the PUC set artificially high REC prices to inflate the price of electricity from community solar above the retail

[55] Office of Energy Efficiency & Renewable Energy. (2016). "Renewable Energy Certificates (RECs)". U.S. Department of Energy.
[56] Ibid.
[57] To simplify the process, many programs that award RECs to customers include a mechanism by which the RECs are automatically sold back to the utility and the profit included as a credit on the customer's electric bill.
[58] Some utilities offer "Green Choice" programs, which give customers the option of greening their power portfolio for a small fee. (New Jersey's CleanPower Choice Program is one example.) While rarely described as such, many of these programs are effectively mechanisms for customers to buy and retire (S)RECs so that they cannot be used for RPS compliance, thereby forcing an increase in total renewable capacity. Few community solar programs in operation today offer this option.

rate, in order to increase developer and utility interest.[59] In Colorado, the PUC asked developers to bid on REC prices as a way of supporting the lowest-cost project. This led to the unexpected result of negative REC prices, meaning that developers were paying to purchase renewable energy from the utility.[60]
New Jersey relies on SRECs as its main state-level incentive for solar. Relatively high solar RPS standards have led to an active SREC market with high prices in the state. Partly as a result, New Jersey has one of the largest residential solar sectors in the nation. However, SREC prices in New Jersey have fluctuated significantly since the SREC market was established in 2009, from an original high of almost $700 to $130 just a few years after. This volatility creates significant risks for developers and can upset customers who install solar with the expectation that SREC prices will remain high over time. This problem is compounded by the fact that while SREC prices are capped in the form of an alternative minimum payment that comes into effect if SREC prices exceed a pre-set threshold, there is no SREC price floor. Furthermore, because SRECs can be banked for up to four years, expected future market conditions can affect current prices.

In 2012, the New Jersey state legislature intervened to stabilize the SREC market by moving up some of the solar requirements from future years. The legislature also significantly decreased the alternative minimum payment. These actions have had moderate success. Since 2012, New Jersey SREC prices have continued to fluctuate, but less dramatically than in the period prior to the intervention. There remains a concern that the SREC market may crater again in the next few years from a sudden plateau in the solar RPS, which the 2012 legislation incidentally created. New Jersey Senate Bill 2276, which has passed the Senate and (at the time of writing) is under consideration in the Assembly, seeks to prevent this market disruption. The bill would create a committee of energy experts to propose future changes or expansions to the SREC program.

## 3.2 Financing

**Key Takeaways**

- A community solar program that limits financial risk for developers and their investors is more likely to succeed.
- Limiting the financial risk of community solar can be achieved by:
  - Establishing a clear, transparent, and predictable credit scheme.
  - Creating mechanisms that mitigate credit risk.
  - Improving the quality and availability of information relevant to project development.
  - Ensuring that developers can easily replace customers who leave and sell unsubscribed energy.
- On-bill financing is an attractive, effective way to increase customer interest and participation in community solar.

While the credit scheme is arguably the most significant determinant of a community solar project's financeability, other factors affect financeability as well. All else equal, a community solar program that limits financial risk offers a much more attractive value proposition for developers and their tax and project investors. Factors that can affect financeability include the predictability of returns, cost uncertainties, internal rate of return for tax equity, interest rate and term for debt, rules regarding unsubscribed energy, the terms of contracts offered to subscribers, and financing options for customers.

### 3.2.1 Predictability of returns

Projects with predictable returns are easier to finance. The simplest way to achieve predictable returns for a community solar project is to secure a credit rate that will apply for the life of the project, typically around 20 years, even if regulation changes. In states that use net metering, pre-set rates may include an annual

[59] Minnesota Public Utilities Commission. (2014). "Order Approving Solar Garden Plan with Modifications". Docket No. E-002/M-13-867. September 17, 2014.
[60] Lacey, S. (2015). "Negative REC Prices Could Create a 'Race to the Bottom". Greentech Media.

escalator, typically 2–3 percent, that increases over time to account for inflation or expected increases in the retail rate of electricity. The State of Minnesota used this approach until transitioning recently to a VOS rate design. VOS rates are periodically recalculated to adjust in accordance with shifts in the economic and regulatory climate. To ensure that these recalculations do not significantly affect the predictability of returns, the VOS methodology in effect at the time a project is approved should apply for the expected lifetime of the project. Furthermore, the VOS methodology should be transparent and consistent, allowing financers to predict how future certain time-dependent variables (e.g., changes in natural-gas prices) may affect future VOS rates.

### 3.2.2 Development uncertainties

Because community solar is nascent, there are often significant uncertainties throughout the development process. Developers often find it difficult to predict how many customers will subscribe to a project, how expensive it will be to acquire those customers, how expensive it will be to integrate a project into the grid, and how likely it is that a project will be approved by the local utility. In Minnesota, uncertainties about interconnection costs presented a serious obstacle to developers: cost estimates provided by the managing utility, Xcel Energy, had uncertainties of 50 percent. Improving the quality and availability of relevant information can help reduce uncertainty that inhibits community solar development.

### 3.2.3 Customer acquisition and attrition

Customer acquisition and attrition are significant concerns for community solar developers. The rate at which developers can sell unsubscribed energy to the grid affects the significance of this risk. While a high credit rate will encourage developers to pursue more community solar projects, it can also decrease the effort that developers put into ensuring that their projects are fully subscribed. Most states purchase unsubscribed energy at the wholesale rate, a rate low enough that projects must maximize subscriptions to be profitable.

Rules governing customer replacement can also affect project financeability. In any community solar program, some subscriber attrition is inevitable. Some states, such as New York, have policies that make it harder for new customers to take over the subscriptions of delinquent customers, thereby increasing project risk. This is especially true for projects with high numbers of low-income customers, who are more likely to face financial shocks that limit their ability to pay subscription fees. Policies that make it easy to transfer subscriptions can help offset the risk of participants with above-average expected default rates. Another way to reduce the risk of default is to allow a large customer, such as a business or government agency, to subscribe to a significant percentage of a community solar project, essentially guaranteeing a minimum revenue stream for the project's investors. Most states allow relatively large share sizes; for instance, Minnesota and New York allow single customers to subscribe to as much as 40 percent of the capacity of a given project.

### 3.2.4 Financing options for customers

Most state PUCs and other policymaking bodies are not involved in customer-developer interactions. Nevertheless, crafting a successful community solar program requires an understanding of the financing options commonly offered to community solar customers, as customers can realize very different levels of benefits depending on the option they select. Customers typically receive greater benefits over the project lifetime if they purchase an ownership share rather than lease. Depending on project design, this can mean either buying a share of the overall project, or buying specific panels in the community solar array. These options are more accessible to wealthier customers and those with high credit scores, who can secure a loan.

However, even consumers with good credit may be reluctant to make such a large investment. A 2016 report produced by the Smart Electric Power Alliance (SEPA), in partnership with the Pacific Consulting Group (PCG), cited the initial investment requirement as the primary determinant of customer participation.[61] A SEPA survey found that when offered zero-down, low-interest financing options, 27 percent of customers

[61] SEPA & PCG. (2016). *Accelerating Adoption of Community Solar*.

who were initially uninterested in participating in a community solar program changed their minds.[62] For this reason, pay-as-you-go financing for community solar subscriptions has become popular. In pay-as-you-go models, customers pay a monthly subscription fee with no long-term commitment. Pay-as-you-go models are particularly attractive because they allow participants to leave if the benefits of participation decrease (e.g., if a community solar project consistently performs below expectations) or their circumstances change. Pay-as-you-go also makes the financial benefits of participation apparent to customers, who can easily compare the monthly costs and credits associated with their subscription on their electricity bill. Finally, pay-as-you-go options can help expand community solar to low- and moderate-income households without the access to capital needed for other financing options. In most states, the developer decides whether to offer pay-as-you-go financing. One exception is New York, where community solar customers must commit to a one-year contract.

A newer option, and one widely recommended by practitioners, is on-bill financing. On-bill financing consolidates a customer's community solar payments and standard utility payments into one bill, which has multiple benefits. First, it is convenient. Second, it allows customers to easily compare the costs and benefits of participation in community solar. Third, evidence suggests that on-bill financing reduces the likelihood of default, reducing risk for developers and financiers. Finally, using on-bill financing allows customers and developers to avoid questions regarding securities law that can arise when credits are paid out to customers separately. Utilities often incur initial costs (e.g., costs of redesigning billing and customer-management systems) in transitioning to on-bill financing, but the low lifetime costs and significant benefits of on-bill financing arguably make these initial investments worthwhile.

## 3.3 Grid integration

**Key Takeaways**

- At low solar penetration levels, community solar projects pose little risk to safe, reliable grid operation.
- At high solar penetration levels, accommodating more community solar projects may require additional variable power plants capable of quickly ramping up generation.
- Improving the quality and availability of technical information about the electric grid enables developers to site projects in areas where interconnection is inexpensive and most beneficial to the grid.

### 3.3.1 Penetration level

One of the greatest challenges in expanding the market share of solar and other renewable energy resources is that such resources are intermittent; that is, their availability varies depending on the time of day and local weather conditions. To understand this issue, it is necessary to understand the structure of electricity markets. Because electricity-storage technologies are generally immature, expensive, and not yet widely integrated into the grid,[63] most electricity markets have little or no ability to capture and save excess power. The grid must always be balanced: all electricity must be consumed at almost exactly the same time as it is produced, and an increase in electricity demand must be met by an almost instantaneous increase in production. To manage this challenge, most electricity markets maintain two types of capacity: base-load and variable. Base-load capacity is typically comprised of steam turbines (which take hours to switch on and off), while variable capacity is typically comprised of fast-response gas turbines (which can be switched on and off within minutes).

Intermittent solar power is relatively easy to integrate into the grid at low penetration levels, as most electric systems have enough variable capacity to compensate for drops in solar output. In New Jersey, there is likely sufficient variable capacity to accommodate expected solar for the next decade, assuming that the state does

[62] SEPA & The Shelton Group. (2016). *What the Community Solar Customer Wants*.
[63] A notable exception is Hawaii, where very high solar penetration levels have accelerated the development and large-scale deployment of battery storage.

not considerably overshoot its solar RPS target. As penetration increases, however, accommodating solar requires a more substantial system restructure.[64] It may no longer be cost-effective to operate base-load power plants given high levels of solar output during the day, and additional variable capacity may be necessary to provide power at night and on cloudy days. System restructuring is already taking place in Hawaii, where the combination of excellent solar resources and high prices for conventional electricity has caused a dramatic expansion of solar capacity. On the island of Kauai, for instance, solar generation accounts for 50 percent of total electricity generation. Much of the remainder comes from variable power plants, and just 10 percent from base-load. One concern of system restructuring is that variable power plants emit higher levels of greenhouse gases than certain base-load power plants like nuclear power, which is the main source of base-load power in New Jersey. Replacing base-load power plants with variable power plants to accommodate additional solar power may therefore offset some of the environmental benefits of transitioning to solar in the first place.

### 3.3.2 Interconnection

Interconnection is the process by which distributed energy resources are connected to the electric grid. Generally speaking, the interconnection process for small residential projects is straightforward and typically takes a few days or weeks. (Once solar installers complete a project, they request permission from the local utility to interconnect it; after conducting any necessary due diligence on the solar system's impact on the grid, utilities grant permission to the installer to activate the system.) The interconnection process for community solar projects can be more complicated, time-consuming and expensive due to the larger sizes of systems and their associated grid impacts. Utilities often require community solar developers to pay for interconnection studies prior to construction. These studies measure the impacts of projects on the grid, often last several months and can cost as much as $100,000.[65] Additionally, an interconnection study may find that an existing circuit or substation is not adequate to accommodate a community solar project. Developers must pay for any necessary upgrades, which could cost hundreds of thousands of dollars and may render the project uneconomical.

There are both federal and state-level standards for interconnection. Interconnection performance, operation, testing, safety, and maintenance at the national level are regulated by the federal government per the Institute of Electrical and Electronics Engineers (IEEE) Standard 1547 (Standard for Interconnecting Distributed Resources with Electric Power Systems). However, most distributed solar PV systems serve demand within a single distribution system, and are therefore subject to state rather than federal regulation. In these cases, IEEE Standard 1547 serves as a guideline instead of a mandate, and state PUCs have the final say over interconnection standards and procedures for distributed PV.

Even if overall solar penetration levels are low, the interconnection process can pose challenges to community solar development. At the state level, developers face two primary challenges. First, relevant grid information, such as information about the age and capacity of the local distribution system, is often not disclosed by utilities. Second, there can be issues with the way that grid upgrade costs are allocated. While the benefits of upgrading a distribution system apply to all parties that rely on the system, many areas simply require the last party that joins a system—the party that pushes the system past its existing capacity to the point at which an upgrade is required—to bear the marginal upgrade costs. The marginal cost of interconnection can sometimes create a market failure by discouraging solar developers from pursuing a project on a congested circuit, even if local demand for additional electricity is high. Policymakers in New York are currently considering a proposal to allocate grid upgrade costs across all developers benefiting from the upgrade.

It is critical to have a fair, efficient process for resolving interconnection disputes. In the early stages of Minnesota's community solar program, delays in project development led to interconnection disputes between utilities and solar project developers. In response, the Minnesota Public Utilities Commission modified rules

[64] Although the penetration level at which the integration of renewable energy resources becomes problematic is highly system-specific, 40 percent is sometimes cited as a reasonable estimate.

[65] NYSERDA & New York Department of Public Service. (2015). *Interconnection of Distributed Generation in New York State: A Utility Readiness Assessment*.

on interconnection in August 2015 so that the Department of Commerce would hire independent engineers to evaluate disputes and issue recommendations. Under this structure, a project developer that disagrees with a utility's assessment of grid capacity or other technical parameters may request review by an independent engineer. The developer that brings the dispute must assume 50 percent of the costs of review.[66]

## 3.4 Siting and permitting

| Key Takeaways |
|---|
| • Requiring community solar developers to site projects close to subscribers can minimize transmission and distribution costs, but may impede customer acquisition and the use of optimal project locations.<br>• Community solar programs should encourage projects with high locational value; i.e., projects located in areas of low solar penetration and/or constrained grid capacity.<br>• Community solar programs should encourage projects located on low-value land, as well as projects designed to allow multiple land uses.<br>• Streamlining state and local permitting processes facilitates community solar development. |

In determining where to allow and encourage community solar projects, policymakers should consider three factors: the project's proximity to subscribers, the locational value of the project on the grid, and alternative land uses. Policymakers should also consider ways to streamline the permitting process.

### 3.4.1 Proximity to subscribers

Policymakers should specify how close a community solar project must be to its participants. Proximity rules vary by state. In Minnesota, Xcel Energy's Solar Rewards Community program requires that participants be located in the same or adjacent county as the community solar project to which they are subscribed.[67] The geographic requirement in New York is less restrictive. There, participants must be within the same utility zone and within the same New York Independent System Operator (ISO) zone as the project.[68] Similarly, in Massachusetts, participants must be located within the same utility service territory and the same New England ISO load zone.[69]

More geographic flexibility allows developers to site projects in areas with cheaper land, better solar resources, and greater economies of scale,[70] resulting in savings that can be passed on to customers. However, locating projects further away from subscribers can increase transmission and distribution costs and line losses, and may be seen as incompatible with the spirit of a "community" solar program.

### 3.4.2 Locational value

Policymakers may consider designing a community solar program to encourage the development of projects with higher locational value on the grid. These are projects sited "in areas of either low solar penetration or high grid resiliency in a utility's service territory... [areas that] are better able to (1) integrate an intermittent power resource at a lower cost due to minimal network upgrades or (2) benefit from solar generation."[71] Although there is not yet consensus around a single metric for assessing locational value, several states and utilities are working to integrate locational-value assessments into their planning and approval processes for

[66] Minnesota Public Utilities Commission. (2015). "Order Adopting Partial Settlement as Modified". Docket No. E-002/M-13-867. August 6, 2015.
[67] Xcel Energy. (2016). "Solar Rewards Community".
[68] NYSERDA. (n.d.). "NY-Sun Brings Shared Solar to Your Community".
[69] Commonwealth of Massachusetts. (2013). *Community Shared Solar: Implementation Guidelines for Massachusetts Communities*.
[70] San Francisco Department of the Environment. (2012). "Community Shared Solar".
[71] Edge, R.; Taylor, M.; Enbar, N.; Rogers, L. (2014). *Utility Strategies for Influencing the Locational Value of Distributed Solar*. SEPA & Electric Power Research Institute.

distributed energy resources. For example, the Hawaiian Electric Company maintains a freely accessible Locational Value Map for the islands of Maui, Lanai, and Molokai. This online tool displays the amount of distributed generation (as a percentage of minimum and peak loads) deployed on a distribution system at any time. Under Maryland's pilot community solar program, utilities are expected to publish information online about areas for which interconnection is constrained, and to help developers identify potential project sites with high locational value.[72] In New York, state utilities maintain online "red zone" maps that illustrate congested areas on the grid. In addition, Central Hudson Gas and Electric, in partnership with Nextant, is piloting an approach to assess locational value. The approach is based on a "load carrying capacity factor" indicating how much a distributed energy resource effectively reduces the peak load in a certain location.[73]

### 3.4.3 Alternative land use

Most jurisdictions already have regulations governing the placement of solar installations, including regulations related to zoning, safety, aesthetics, and environmental impact. These regulations can often be applied, with little or no modification, to community solar projects. In addition, policymakers should consider giving preference to community solar projects located on low-value sites (e.g., brownfields), and to projects designed to enable dual usage of land (e.g., projects located on parking lots or on the rooftops of municipal buildings).[74] Such projects are also more likely to attract public support.[75]

### 3.4.4 Permitting

Once a site is selected for a community solar project, developers must obtain permits, such as a building permit, an electrical permit, and/or a permit from the local fire department.[76] The permitting process can be time-consuming for developers, particularly if the process varies considerably across jurisdictions.[77] Streamlining the permitting process across jurisdictions can reduce costs to developers and the administrative burden on public officials, thus expediting and encouraging project development.

Vermont is an example of a state that has successfully simplified solar permitting. Until 2011, solar developers were required to apply for and receive a Certificate of Public Good from the Vermont Public Service Board. The Board then deliberated on each project's environmental, economic, and reliability impacts, and held a 30-day public comment period. Any issues raised during this period had to be resolved through a series of public hearings.[78] Even approval for residential systems took up to six weeks or longer.

Vermont became the first state to implement a statewide solar permitting system with the passage of the Vermont Energy Act of 2011.[79] Under this new system, customers seeking to install a solar PV system of 5 kW or smaller must (1) complete a one-page registration form describing the proposed system; (2) complete a self-certification of system compliance and informational accuracy; and (3) send a copy of the registration form to the governing utility. If no interconnection issues are raised by the utility within 10 days of customer filing, the system is automatically approved.[80] The bill has since been revised to include residential systems under 10 kW, and results have been notable. The number of solar installations in Vermont quadrupled within the first three years of the bill's passage. Solar developers have seen significant reductions in project costs,[81]

[72] Maryland Public Service Commission. (2015). "Admin Docket Number: RM56. Revisions to COMAR 20.62 – Community Solar Energy Generation Systems".
[73] SEPA & Nextant. (2016). "Addressing the Locational Valuation Challenge for Distributed Energy Resources".
[74] Massachusetts Institute of Technology. (2015). *The Future of Solar Energy.*
[75] Association of New Jersey Environmental Commissions. (2012). "Solar Siting and Sustainable Land Use".
[76] Coughlin, J.; Grove, J.; Irvine, L.; Jacobs, J.F.; Phillips, S.J.; Sawyer, A.; Wiedman, J. (2012). *A Guide to Community Shared Solar: Utility, Private, and Nonprofit Project Development*. U.S. Department of Energy: National Renewable Energy Laboratory.
[77] Stanfield, S.; Schroeder, E; Culley, T. (2012). *Sharing Success: Emerging Approaches to Efficient Rooftop Solar Permitting*. Interstate Renewable Energy Council, Inc.
[78] Wesoff, E. (2011). "Has Vermont Solved the Solar Permitting Problem?". Greentech Media.
[79] Savage, A. (2015). "Is Standardized Solar Permitting the Next Industry Breakthrough?". Solar Energy Industries Association.
[80] Vermont Public Service Board. (2013). "Harmonizing Permitting".
[81] Savage, A. (2015).

and the Vermont Public Service Board has reported that the new process allows staff to use their time examining larger, more complex solar projects instead of processing routine approvals for small-scale projects.[82]

Other states have also had success with standardized permits. The New York State Energy Research and Development Authority (NYSERDA)'s Clean Energy Communities Program recently implemented a Unified Solar Permitting process for small-scale solar installations of 12 kW or less. Under this process, applicants must submit (1) an eligibility checklist; (2) a set of plans that includes a description of the solar installation, an electrical diagram, and component specification sheets; (3) a two-page application form; and (4) a permit fee.[83] This process enables municipalities to "efficiently handle large numbers of solar permits, help applicants get in and out quickly, and support the local solar industry."[84] NYSERDA provides resources to help guide municipalities through the permit-adoption process, including on-site training, model ordinances, and decision-making support. Municipalities that adopt the Unified Solar Permit process are eligible to receive grants up to $5,000, and gain access to additional funding opportunities through the Clean Energy Communities program.[85]

## 3.5 Capacity and co-location

**Key Takeaways**

- Capacity limits and co-location restrictions encourage equitable distribution of community solar project benefits, but can also impede solar development.
- Overall capacity limits on community solar programs can ease technical and administrative burdens, but may also restrict program benefits. Strategically designed caps can help strike a balance.

### 3.5.1 Project limits

Some community solar programs restrict the capacity of individual projects or include co-location restrictions, which limit the total capacity of projects within a designated area (e.g. a parcel of land). Whether to include capacity and co-location limits as part of a community solar program depends on the overall program goals. If the primary goal of a community solar program is to expand solar access across a broad area, it may be useful to impose capacity and co-location limits that prevent developers from concentrating projects in a few areas. Such limits can also help prevent developers from using community solar programs to build large amounts of solar without going through standard regulatory and review processes.[86]

If the primary goal is to increase overall solar capacity, then capacity and co-location limits may prove detrimental. Minnesota provides an informative case study in this regard. Appendix C.3. contains an in-depth description of the development of Minnesota's community solar program. In short, a 5 MW total capacity cap per parcel of land was applied to all co-located community solar projects proposed before September 25, 2015, and a 1 MW cap applies to all co-located projects proposed thereafter. Many stakeholders have contended that this limit makes it difficult to realize economies of scale that improve project financeability and profitability. The evidence shows, at least in the short term, that the implementation of capacity and co-location limits discouraged community solar development in Minnesota. In October 2015, project applications in the queue for Minnesota's community solar program had reached a peak of 2,000 MW in total capacity. After the co-location limit was passed in September 2015, developers withdrew many applications, and the rate of new applications decreased significantly. By July 2016, total capacity in the queue had dropped to 855 MW. Minnesota's experience suggests that policymakers should carefully consider whether

[82] Vermont Public Service Board. (2013).
[83] NY-Sun. (n.d.). "New York State Unified Solar Permit: Expedited Solar Permit Process for Small-Scale Photovoltaic Systems".
[84] NYSERDA. (2016). "Unified Solar Permit".
[85] Ibid.
[86] Minnesota Public Utilities Commission. (2016). "Order Approving Value-of-Solar Rate for Xcel's Solar-Garden Program, Clarifying Program Parameters, and Requiring Further Filings". Docket No. E-002/M-13-867. September 9, 2016.

the benefits of capacity and co-location limits outweigh their detrimental effect on developer enthusiasm for community solar.

### 3.5.2 Program limits

Several states have caps on the total capacity of their community solar programs. Other states, such as Massachusetts and Vermont, have caps only on the amount of net-metered community solar.[87] Program capacity caps can limit the potential technical and administrative challenges of deploying community solar, but will also limit potential benefits. In deciding whether to set a capacity cap, policymakers should consider four factors:[88]

(1) the approximate number of people currently lacking access to solar energy who would gain access under a community solar program;

(2) the estimated current and future market demand for community solar;

(3) the state's RPS; and

(4) the amount of solar power the electric grid can absorb without significant safety or reliability concerns, and the expected time and resources required for upgrades that would enable the grid to accommodate additional solar.

Caps are less appropriate for programs with high potential to expand community solar access, where estimated current and future demand for community solar is high, and when the state requires additional capacity to meet its overall and/or solar-specific RPS targets. Caps are more appropriate in regions where the electric grid is heavily burdened.

States can compromise on program capacity caps by establishing separate caps for different types of community solar projects or by establishing caps that phase out over time. In Maryland, the Public Service Commission (PSC) is piloting a community solar program with three program caps: one for small projects under 500 kW, one for larger projects between 500 kW and 2 MW (the maximum allowable project size), and one for projects that primarily serve low- and moderate-income households.[89] These cap structures are intended to allow sufficient opportunities for investment in community solar, while giving state regulators and other stakeholders time to identify and address problems in program design before the program grows too large. Through the cap and categorization mechanism, this pilot program is designed to generate sufficient interest from solar developers while allowing the PSC and other stakeholders time to learn and study the differential impacts of project size and market segment.

## 3.6 Subscription structure

| Key Takeaways |
|---|
| • A minimum requirement for residential participation or "residential carve-out" may help prevent commercial customers from crowding out residential customers.<br>• Similarly, implementing a maximum subscription size can help ensure the subscriber base is not dominated by a small number of high-consuming members. Also, rules mandating a minimum subscription size can lessen the administrative burden of the program. |

Most community solar programs allow residential and commercial customers to purchase subscriptions. However, relying too heavily on commercial customers may run counter to the spirit of a "community"

[87] Bergan, S.E.; Moratzka, A.P. (2015). "Proof Of Concept: Community Solar Is Ready to Soar Despite Complications".

[88] Coalition for Community Solar Access. (2016). *Community Solar Policy Decision Matrix: Guidance for Designing Community Solar Programs*.

[89] Skulnik. G. (2016). "A Few Highlights from the New Maryland Community Solar Program". Neighborhood Sun.

solar program, and may result in a few larger businesses crowding out residential customers by buying up large fractions of the available community solar capacity. Accordingly, some states have requirements designed to ensure a balance of residential and business participation. California specifies that "at least 50 percent (by number of customers) and at least 1/6th (by load) of the demonstrated community interest in [a given community solar] project is from residential subscribers."[90] States also have rules ensuring that the community solar subscriber base is not dominated by a small number of individuals and/or institutions. California mandates that no customer can subscribe to more than 20 percent of the capacity of a given project (although there is an exemption for public institutions like universities and hospitals). Minnesota limits the maximum subscription size to 40 percent of a project and requires each project to have at least five subscribers. Both states cap the subscription size of an individual customer to 120 percent of the customer's annual energy consumption. Finally, community solar program designers may wish to set a minimum subscription size to lessen the burden of program administration. The California PUC suggests a minimum size of 50 percent of a customer's annual energy demand, while several developers in Minnesota have set the minimum size at 200 watts.

## 3.7 Developer application process

**Key Takeaways**

- Community solar project applications are typically managed by one of two processes:
  - A competitive Request for Proposals (RFP) or reverse-auction process.
  - A first-come, first-served interconnection queue process.
- Queue-based processes are relatively simple to administer but can give rise to several major challenges if not designed and managed properly.

There are two main approaches states can use to evaluate and approve applications for community solar projects. These are (1) a competitive Request for Proposals (RFP) or reverse-auction process; and (2) an interconnection queue in which utilities process applications on a first-come, first-served basis.

In a competitive RFP process, the state PUC or another managing entity authorizes utilities to issue an RFP for community solar projects representing a designated amount of generation capacity. Developers submit project applications in response to the RFP, the utility evaluates applications based on project cost and other relevant criteria, and the winning project(s) enters a power purchase agreement with the utility. A reverse auction is comparable to the RFP process. Project developers make increasingly lower bids to win the rights to develop community solar projects. A competitive approach is under consideration in Hawaii, where the Hawaiian Electric Company will likely oversee an RFP for 32 MW of community solar capacity in the first phase of the state's program. One advantage of a competitive process is that it allows the managing entity to give preference to projects that offer the greatest locational benefits. Disadvantages of a competitive process include higher administrative costs, greater uncertainty for developers, and arguably a slower development timeline, which could delay the fulfillment of a state's renewable energy goals.

Under an interconnection queue system, state utilities process community solar projects on a first come, first served basis, following the process and timeline established in the state's community solar order. To prevent developers from "flooding the queue" with early-stage projects (in order to secure an optimal position on the grid), the managing authority should set appropriately stringent minimum requirements for project applications. Additionally, developers must be required to reach project development benchmarks by specified deadlines, or be removed from the queue to allow developers behind them to proceed. New York is perhaps the most prominent state with an operational community solar program that uses a queue-based application system. Queue-based application processes are relatively simple to administer but can pose challenges. First, the cost of carrying out due-diligence measures can be quite high. For example, the cost of a Coordinated

[90] PG&E. (2016). "Regional Renewable Choice / Enhanced Community Renewables: Bidders Webinar".

Electric System Interconnection Review (CESIR)—the interconnection study required for community solar project applications in New York—can be as much as $100,000 [91] and is usually borne entirely by the developer.

Second, it is often difficult for developers to access information needed to assemble a robust project proposal, or indeed, to determine whether it is even worth submitting a proposal at all. For instance, if developers do not know which substations have available capacity to accommodate load from community solar projects, then the developers risk expending effort and resources on nonviable proposals for projects that would connect to overburdened substations. Solving this problem will require investment and cooperation by utilities, and may also require regulatory proceedings to determine how to make necessary information available to developers without violating privacy, security, or proprietary-information constraints. New York and California are among the states making progress on disclosing information relevant to project development. In 2016, utilities in New York began providing preliminary interconnection data via publicly available "Redzone Maps". California is currently undertaking a Distribution Resources Plan regulatory proceeding to require the state's utilities to identify the optimal locations for distributed energy resources.[92] Working with utilities to provide grid information will facilitate the smooth and efficient development of community solar projects.

Third, because a queue only advances when the application in the first slot has been processed, it is easy for a complex project or poorly prepared application to hold up the development process for all subsequent projects in the same queue. This has been particularly problematic for New York's community solar program. To resolve the bottleneck, NYSERDA convened a working group of industry stakeholders that produced an interconnection queue management proposal in September 2016. The proposal recommended strict project-development milestones that developers must meet to maintain their place in the queue, as well as a proposal for community solar developers to share the costs of necessary grid upgrades. As of this writing the proposal is before the New York Department of Public Service (DPS).

## 3.8 Community engagement and education

**Key Takeaways**

- Consumer outreach and education is essential to increasing demand for and participation in community solar projects.
- Policymakers should implement consumer protections against overly aggressive or misleading marketing claims about community solar.

Limited awareness and understanding of community solar can make it difficult for developers to acquire customers. A SEPA survey found that only 20 percent of respondents were familiar with the concept of community solar. When respondents were given clear information about how a community solar program works, however, nearly half were interested in participating.[93] Consumer education is essential to achieving the full potential of community solar.

At the same time, it is also important to protect consumers from overly aggressive marketing and misleading information. It can be difficult for customers to compare the costs and savings of participating in community solar, as both costs and savings are dependent on a variety of factors—including contract terms, federal, state, and local subsidies, the estimated increase in the customer's cost of electricity, and the performance of the solar panels themselves. As a 2016 report prepared for the Maryland Office of People's Counsel observed, it is therefore "easy for a consumer to be misled into a purchase based on exaggerated assumptions about future savings. Indeed, consumer complaints have prompted states to take action in the courts, and

[91] NYSERDA & New York Department of Public Service. (2015).
[92] California Public Utilities Commission. (2016). "Distribution Resources Plan (R.14-08-013)".
[93] SEPA & The Shelton Group. (2016).

propose consumer protections to address actual and potential abuses and misconceptions."[94] Consumer protection is of particular importance in low- and moderate-income communities, where customers may not have information needed to fact-check advertising, or may lack resources to seek restitution for false or misleading advertising from the operator of a community solar project.

## 3.9 Ensuring widespread access

| Key Takeaways |
|---|
| • Community solar projects can expand solar access to disadvantaged groups, including low- and moderate-income (LMI) households and environmental justice (EJ) communities.<br>• To facilitate LMI and EJ participation in community solar, policymakers should consider:<br>– Targeting the specific barriers that inhibit these groups' access to solar energy.<br>– Approaches to easing capital and credit constraints.<br>– Mandating a minimum level of LMI and EJ involvement.<br>– Incentives to encourage developers to include LMI and EJ customers. |

Community solar has the potential to reach two groups that often lack access to solar energy. These are:

- Low- and moderate-income (LMI) households. The term "LMI households" refers to households with below-median family income, a threshold that can be defined differently depending on the state, region, or program. It is important to recognize that there is income stratification within the LMI designation, and that barriers to solar access will vary across LMI income levels. In general, LMI households are more likely to lack access to credit and capital, rent rather than own their homes, live in multifamily units without individual energy meters, and experience predatory lending, making them skeptical of solar developers. These characteristics cause LMI customers to be less able and less willing to take advantage of participation in solar programs.

  For the purposes of the community solar program receiving loan assistance, we recommend defining the LMI threshold as 100 percent or below the statewide area median income, which was $78,900 for a three-person household in 2016.[95] For determining eligibility for community solar subsidies, we recommend using the criteria set by the New Jersey Universal Service Fund, which provides ratepayer assistance to very low-income customers.[96]

- Environmental justice (EJ) communities. New Jersey defines EJ communities as those whose residents are predominantly persons of low-income and persons of color who have experienced or experience discrimination and a disproportionate share of the impact of pollution and other threats to public health and quality of life.[97] These residents are particularly vulnerable to the impacts of climate change and are less likely to have access to solar energy.

Expanding solar access to LMI and EJ customers is important for several reasons. First, expanding solar access is critical to increasing public support for a clean energy transition and to avoiding the most harmful impacts of climate change. Bringing solar energy to LMI and EJ communities not only helps green the energy market in and of itself, but also changes the perception that solar energy is for only high-income consumers, thereby accelerating the deployment of clean energy nationwide.

[94] Alexander, B.R. (2016). *Solar Power on the Roof and in the Neighborhood: Recommendations for Consumer Protection Policies*. Prepared for the Maryland Office of People's Counsel, with the assistance of J. Briesemeister.
[95] U.S. Department of Housing and Urban Development. (2016). "FY 2016 Income Limits Summary".
[96] New Jersey Board of Public Utilities. (n.d.) "Universal Service Fund".
[97] New Jersey Department of Environmental Protection. (2004). "NJ Governor's Executive Order on Environmental Justice".

Second, distributed energy resources such as rooftop and community solar can improve grid resilience, which is especially important in a coastal state like New Jersey. By shortening energy transmission and distribution distances, and by spreading the risk of failure or physical damage from extreme weather events across a greater number of facilities, community solar installations will reduce the negative impacts of another storm like Hurricane Sandy. EJ communities are often located in the areas most vulnerable to climate change, due to higher exposure and weaker infrastructure, making EJ access to solar energy even more important.

Third, low-income households face the highest energy burden, often spending almost 10 percent of their incomes on utility bills (Figure 10). The price of solar electricity in the medium- and long-term is more affordable and less volatile than the price of electricity generated from fossil fuels. Transitioning to more predictably priced power is particularly valuable for LMI customers, who have less capacity to absorb sudden increases in their electricity bills.

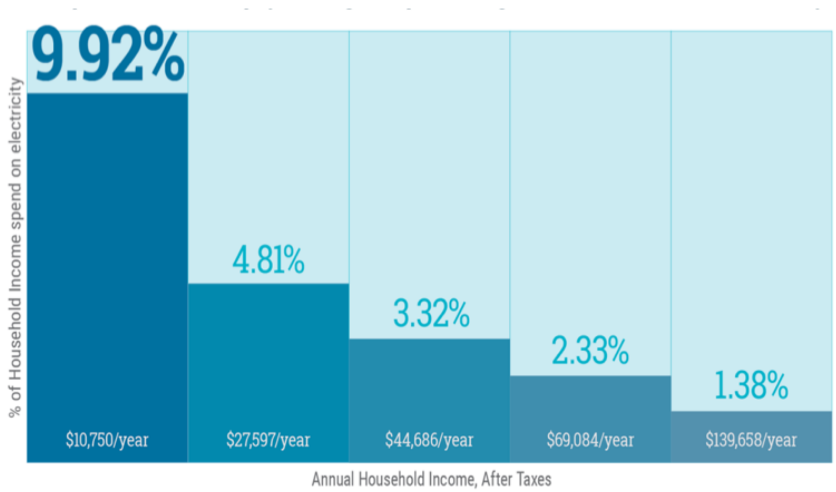



***Figure 10:*** *Percentage of income spent on electric bills, by income quintile. (Source: U.S. Bureau of Labor Statistics)*

Fourth, all customers, including LMI and EJ customers, support local, state, and federal solar initiatives through tax payments and by serving as part of the rate base. In the interest of equity, there is a moral imperative to ensure that all customers, including LMI and EJ customers, have access to solar energy. The remainder of this section discusses options for increasing LMI and EJ participation in community solar.

### 3.9.1 Easing capital and credit constraints

Because LMI customers often lack access to capital or are perceived as credit risks by lenders, it can be difficult for them to finance the high up-front costs of purchasing or even leasing a rooftop solar PV system. On-bill financing, as discussed in Section 3.2.4, has emerged as an effective way to circumvent these constrains and enable LMI participation in community solar. Since most on-bill financing programs exhibit very low default rates (between 0–3 percent, according to one review[98]), lenders may be more willing to extend credit through these programs to LMI customers they perceive as credit risks. On-bill financing also lessens the paperwork burden associated with community solar participation.

Another way to address financing constraints is to underwrite loans and provide subsidies for LMI participation. New Jersey currently provides ratepayer assistance in the form of subsidized electric and gas payments to low-income households through its Universal Service Fund (USF). New Jersey also underwrites loans to LMI customers for rooftop solar. Many LMI households are unable to participate in solar projects that

[98] Bell, C.J.; Nadel, S.; Hayes, S. (2011). *On-bill Financing for Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities, and Best Practices*. Report Number E118. American Council for an Energy-Efficient Economy.

require an upfront buy-in (either community or rooftop) because their credit scores are too low to get loans. State underwriting addresses this barrier directly by shifting some of the risk from loan providers to a government fund that guarantees the loans if customers default. This allows a broader pool of potential customers to access solar loans, and potentially leverages a pool of private capital much larger than the government fund. This approach is used in Connecticut, which created a Green Bank to provide more than $60 million in solar financing for multi-family and commercial property owners through affordable, fixed-rate loans.[99] The Green Bank is funded by Connecticut's participation in the Regional Greenhouse Gas Initiative (RGGI).

A third important structure for LMI participation is the anchor or backup subscriber. The anchor subscriber is a local institution, such as a hospital, school, or municipal government that buys a large portion of a community solar project. If one or more low-income subscribers default, the backup subscriber can easily assume these subscriptions by increasing its consumption of the project's electricity. These institutions can also leverage greater access to capital and overcome credit barriers, which are critical for broadening LMI access and engaging a diverse customer base.

### 3.9.2 Carve-outs and incentives

Some states have adopted a "command and control" approach to broadening solar access, establishing a carve-out in community solar legislation that requires a minimum level of LMI or EJ participation. Colorado requires a minimum of 5 percent LMI participation in any community solar project. New York prioritized LMI participation by allowing projects with at least 20 percent LMI participation to interconnect before all other projects.[100] While California has not set an LMI or EJ threshold that applies to all projects, it has mandated that 100 MW of community solar capacity be sited in EJ communities. A disadvantage of this approach is that it does not motivate developers to go above and beyond the required minimum, meaning that developers tend to treat the carve-out level more as a ceiling than a floor. Strict carve-out requirements can also discourage or slow down the development of community solar projects. Other states such as New York have created incentives for developers who secure high levels of LMI and EJ customer participation.

[99] Ibid.

[100] New York Public Service Commission. (2016). "Proceeding on Motion of the Commission as to the Policies, Requirements and Conditions for Implementing a Community Net Metering Programs [sic]". Case 15-E-0082. August 15, 2016.

## 4 Policy Recommendations

Section 3 provided a general discussion of topics that should be considered when designing community solar policies. This section offers specific recommendations for legislation to establish a statewide community solar program in New Jersey (although many of the recommendations are applicable to other states as well). Thirteen major recommendations are presented, along with explanations and supporting recommendations.

### 4.1 Statute and program design

| Recommendation 1 |
| --- |
| Be clear on legislative intent, but delegate program details and technical specifications to the New Jersey Board of Public Utilities (NJ BPU). |

While "community solar" projects exist in several states without a specific statute authorizing them, a community solar statute signals legislative intent and state support for a community solar program. However, an overly prescriptive statute is likely to stifle business innovation and makes fixing problems that may arise very difficult, requiring an act of the state legislature. We therefore recommend that the statute specify key elements of the program, including goals and intent, intended beneficiaries, and major milestones in the implementation timeline, but remain broad enough to delegate authority for determining program details and technical specifications to the New Jersey Board of Public Utilities (NJ BPU). This will allow for greater flexibility in adjusting the program to meet demonstrated needs.

We further recommend that the BPU direct utilities to manage the day-to-day implementation of the program and the application process. Utilities are best positioned to ensure that community solar is well integrated into the grid and to flag potential problems as they arise. Utilities should be allowed to recover program oversight costs, but these costs should be carefully limited by the BPU to limit the effect on non-participants.

| Recommendation 2 |
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| Administer the community solar program in two phases: a pilot stage to identify and correct problems, followed by full implementation. |

Even carefully designed programs are likely to encounter unanticipated challenges. In Minnesota and New York, for instance, policymakers were caught off-guard by unexpectedly high numbers of project applications shortly after the launch of their programs. In California, by contrast, statutory language mandating "non-participating ratepayer indifference" significantly curtailed developer interest. Building a one- to two-year pilot phase into New Jersey's community solar program would give the NJ BPU the opportunity to identify and correct problems before they become severe. A pilot phase also enables customers, developers, and other stakeholders to begin experimenting with—and reaping the benefits of—community solar sooner rather than later. To manage the size of the program during the pilot, the NJ BPU should set an appropriate cap on the aggregate amount of community solar capacity. This cap could be phased out as the program transitions to maturity. The NJ BPU should have the authority to implement additional pilots as appropriate.

| Recommendation 3 |
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| Require utilities to collect and disclose information relevant to project development. |

Information relevant to project development (e.g., information on available substation capacity or traffic patterns in the electric grid) is often held by utilities and is difficult for developers to access. We recommend that the NJ BPU direct utilities to perform a locational value assessment that identifies areas on the grid that would benefit from additional capacity provided by community solar. The assessment's results should be publicly accessible and enable developers to site projects optimally. The BPU may wish to use the results of the locational value analysis to inform its value-of-solar calculation (see below). We also recommended that the locational value analysis and its results be included in New Jersey's Energy Master Plan (EMP).[101] This will help integrate community solar and other distributed energy resources into New Jersey's long-term goals of expanding in-state electricity resources and supporting cost-effective renewable resources.

| Recommendation 4 |
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| During the pilot stage, use a Request for Proposals (RFP) to process project applications. For full implementation, use a queue-based first-come, first-served process. |

There is no perfect system for processing community solar project applications. Both queue-based systems, like those used in Minnesota and New York, and Request for Proposals (RFP) systems, like the one used in California, have experienced challenges. The NJ BPU must carefully consider which system is likely to be the most successful in New Jersey. RFP systems generally require more time to set up and more effort to oversee. However, we believe an RFP process may be more beneficial for the pilot stage because it will allow the managing authority to partner with utilities and account for the locational value of proposed projects. This would not be possible with a queue-based system since project developers do not yet have access to grid data. The NJ BPU should explore the feasibility of transitioning to a queue-based process once it has required utilities to disclose information relevant to project development and once it has established a value-of-solar methodology (see Recommendation 7). Before implementing the queue-based system, the BPU must ensure that developers have access to all information needed to assemble a complete, informed project application (see previous recommendation). The BPU should also set demanding project maturity requirements and aggressive development milestones to ensure that developers do not "flood the queue" with mediocre applications and that projects in the queue continue to move forward at a reasonable rate.

| Recommendation 5 |
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| Establish transparent cost-sharing procedures for grid upgrades needed to accommodate community solar. |

A transparent procedure for sharing grid upgrade costs addresses a systemic obstacle to community solar. We recommend that New Jersey consider the cost-sharing approach developed by policymakers in New York. Under this approach, when a project requires a grid upgrade, the first developer to build a project utilizing that circuit or substation will pay the utility the full upgrade cost. All future developers that build projects that benefit from the upgrade will be required to reimburse the first developer in an amount proportional to the capacity of their project.

[101] New Jersey Board of Public Utilities & New Jersey Department of Environmental Protection. (2015). *New Jersey Energy Master Plan: Update*.

| Recommendation 6 |
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| Create a simple, standardized process for community solar permitting. |

New Jersey has more than 500 municipalities,[102] which could each have unique permitting processes for community solar. We recommend that a simple, standardized permitting process be designed by the New Jersey Department of Community Affairs (DCA), with input from the BPU, to streamline planning, zoning and construction timeframes. Where possible, the process should align with processes in neighboring states to make it easier for developers to operate across the mid-Atlantic region. While adoption of the process should remain voluntary for municipalities, we recommend that the NJ BPU and the NJ DCA explore ways to encourage uptake. Options include drafting a model land use ordinance that local authorities can adopt, offering grant funding to support municipalities that adopt the standardized process (an approach used in New York), and offering training workshops to familiarize municipal employees with the elements and advantages of the standardized process.

| Recommendation 7 |
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| Develop and ultimately transition to a value-of-solar credit rate. In the interim, use virtual net metering to credit customers at the applicable retail rate. |

As discussed in Section 3.1, most community solar programs credit subscribers using either (1) virtual net metering (VNM) at the applicable retail rate (ARR), or (2) a "buy all, sell all" approach in which customers purchase electricity at the ARR, but are credited for produced power at a calculated value-of-solar (VOS) rate. VNM is easier to understand and generally easier for utilities to implement. Because the ARR includes the costs of maintaining distribution networks that a community solar project may utilize, there is sometimes concern that crediting at the ARR could result in overcompensation of community solar power. Utilities may attempt to recoup distribution expenses by raising rates for customers not participating in community solar. A VOS credit rate solves this challenge in theory by valuing all the costs and benefits provided by community solar projects, but can be difficult to apply in practice because there is not yet widespread consensus on what components should be included in the VOS "value stack", or on how to value certain components, such as avoided environmental cost. Because the VOS includes both costs and benefits, it is unclear if it will be higher or lower than the ARR before an analysis is completed.

Given the merits of VOS, we recommend that the NJ BPU begin developing a transparent, well-informed methodology for calculating a VOS rate. VOS methodologies already in place in Minnesota and Austin, Texas, will provide a useful starting point in determining which components to include in the VOS value stack, and how they should be valued. Components may include:

- Fixed-charge coverage
- Administration and interconnection fees
- Firming expenses
- Transmission and distribution capacity
- Line losses and congestion
- Merit order effect
- Fuel price hedge
- Resiliency
- Local environmental impacts

[102] New Jersey State Library. (2016). "Municipalities by County in New Jersey".

- Greenhouse gas effects
- Economic and job impacts
- Locational value
- Energy security

Once the VOS methodology has been developed, reviewed, and made public, the NJ BPU should specify a date by which utilities must transition to crediting customers at the VOS rate. In the interim, the NJ BPU should require utilities to use VNM to credit customers at the ARR, potentially with an appropriate adjustment to account for fixed network costs.

| **Recommendation 8** |
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| Set a floor on SREC prices and provide SREC benefits to subscribers |

Additional measures to limit volatility in the New Jersey SREC market will improve the financeability of solar projects and reduce customer risk. We therefore recommend that New Jersey set a floor on SREC prices. Although a floor could distort the market long term, in the short term it gives the legislature and regulators time to react to market conditions without hurting the growth of the sector. We also recommend that the NJ BPU either assign ownership of SRECs from community solar projects to project subscribers, or require utilities to credit customers for the SRECs at the appropriate market value. Either option will ensure that customers realize the full benefit of participating in community solar.

## 4.2 Project restrictions

| **Recommendation 9** |
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| Cap the size of individual projects at 5 megawatts (MW). Limit participation to customers in the same service territory and county. |

Capping the size of community solar projects helps make certain that projects serve distinct communities and do not simply give developers an alternate way to install utility-scale solar arrays. It is important, however, to ensure that developers can still realize economies of scale and enroll enough participants to limit the risk of customer default. We recommend 5 MW (about 30 acres) as a project cap to balance these competing concerns. We do not see a mandate on minimum size as necessary. To be effective in practice, the cap on maximum project size must be combined with a restriction on co-location: for instance, a restriction that prevents the same developer from siting multiple community solar projects on one parcel of land.[103] The NJ BPU can further ensure that community solar remains "within the community" by requiring that community solar subscribers be located within the same service territory and county as the project to which they are subscribed, as is the case in Minnesota.

We emphasize that any restrictions on project size, co-location, and customer proximity should be set by the NJ BPU rather than mandated by statute. This allows easier modification should these restrictions prove too discouraging to developers. The NJ BPU may also consider waiving or easing restrictions for projects that advance other program goals. Examples include projects located on priority sites (Section 3.4) or projects that primarily serve underprivileged communities (Section 3.9). If this option is pursued, the NJ BPU must be very clear about the types of projects that are eligible and the criteria by which eligibility will be determined.

[103] A parcel of land is generally defined as an area of land legally authorized for development or ownership as determined by the relevant state or municipal land use authority.

| Recommendation 10 |
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| Encourage development on low-value land and sites that allow multiple land uses. Require project applications to include decommissioning plans. |

As the most densely populated state, New Jersey's open space is precious. Voters and policymakers in New Jersey have recently taken steps to protect the state's open space from unchecked development. In 2014, voters approved a constitutional amendment that dedicated 6 percent of annual corporate tax revenues to fund the Green Acres and Blue Acres Programs and to support "open space, farmland, and historic preservation" from 2016 until 2045.[104] In 2016, legislators passed the Preserve New Jersey Act, which details how these funds will be allocated.[105] Given the broad support for land preservation across New Jersey, policymakers should take steps to ensure that community solar will not encroach on the state's open space. The NJ BPU should coordinate with the New Jersey Department of Environmental Protection (DEP) to manage the aesthetic and environmental impact of community solar projects. We recommend that the NJ BPU encourage development of community solar on low-value land, such as brownfields, and at sites that allow multiple land uses, such as public roof space, parking lot canopies, and other built spaces. To do so, the NJ BPU may consider offering developers incentives such as exemptions from size, co-location, and customer-proximity restrictions for projects located on low-value or multiple-use sites.

We further recommend that the NJ BPU and DEP identify and publish a list of these priority sites, preferably including information on other parameters relevant to project development (such as solar insolation levels, soil and roof conditions, interconnection specifications, etc.). The NJ BPU and DEP should explore options for integrating this list with existing resources, such as the NJ-Geo web mapping application. The NJ BPU should also consider requiring that community solar project applications include decommissioning plans. These plans should specify who is responsible for any environmental remediation or site restoration needed once a project has reached the end of its useful life.

## 4.3 Subscriber base and customer outreach

| Recommendation 11 |
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| Allow participation of residential and small-business customers. Limit the subscription size of any one customer to 40 percent of project capacity. |

We recommend that the subscriber base include small businesses in addition to residential customers. The numerous small businesses in New Jersey are integral members of their local communities, and their inclusion fits well within the ethos of community solar. The participation of small-business customers will also help ensure the success of a community solar program in the state, helping to make the installations more financeable and diversifying the risk profiles the projects. Similarly, limiting subscription size to 40 percent ensures that multiple customers from each community will have the opportunity to participate in community solar. This limit is in line with other community solar programs, including those in Minnesota[106] and Oregon,[107] and prevents large customers from "crowding out" smaller subscribers for any one project.

[104] Ballotpedia. (n.d.). "New Jersey Open Space Preservation Funding Amendment, Public Question No. 2".
[105] Ensslin, J.C. (2016). "N.J. Open Space advocates expect $70M to be available next year for projects". *Daily Record.*
[106] Xcel Energy. (2015). "Solar*Rewards Community Minnesota Subscriber FAQs".
[107] Oregon Department of Energy. (n.d.). "Community Solar".

**Recommendation 12**

Require developers to allocate at least 10 percent of subscriptions to low- and moderate-income (LMI) customers, and adopt measures to increase LMI and environmental justice (EJ) participation. Integrate community solar into existing energy assistance programs.

A major benefit of community solar is that it can help expand solar access to low- and moderate-income (LMI) households and to environmental justice (EJ) communities. To ensure that this benefit is realized, we recommend that New Jersey's community solar program require a carve-out of at least 10 percent for LMI customers. Under this scheme, each developer participating in the program would need to ensure that LMI subscribers account for at least 10 percent of the aggregate community solar capacity offered by that developer. This structure would allow developers to pursue projects in communities with small LMI populations, as long as those projects were balanced by projects in communities with large LMI populations. For the purposes of this program, we recommend defining LMI households as households at or below the statewide area median income. In 2015, this was equivalent to an annual income of $61,000 for a one-person household, or $79,000 for a three-person household.[108]

We also recommend that policymakers take two steps to encourage developers to seek LMI and EJ participation beyond the 10 percent minimum mandated by the carve-out. First, the NJ BPU should require utilities to offer on-bill financing for community solar subscriptions, a practice that significantly reduces barriers to participation that LMI and EJ customers commonly face. Second, we recommend that the State of New Jersey underwrite loans for LMI and EJ participation and subsidize the participation of qualifying low-income customers through the Universal Service Fund. Additional subsidies for LMI participation could be funded by New Jersey's Clean Energy Program (NJCEP). Policymakers should also consider rejoining the Regional Greenhouse Gas Initiative (RGGI) and using a portion of the funds to support community solar. When NJ was previously a member of RGGI, it received more than $100 million in revenue from 2005 to 2011.[109] Given that greater LMI and EJ access to solar will reduce the need for ratepayer assistance, allocating funding to community solar could achieve cost savings in the long run.

Finally, we note that to maximize the impact of solar energy on climate change and poverty reduction, New Jersey should integrate its community solar program into existing energy-efficiency initiatives. Major goals of LMI and EJ participation in solar include reducing electricity costs and decreasing greenhouse gas emissions. By coupling community solar with a whole-building approach to energy efficiency, LMI and EJ residents will realize greater economic and environmental benefits.

**Recommendation 13**

Create and implement consumer-protection measures, including a standard disclosure checklist and an online information portal.

The NJ BPU should work closely with the New Jersey Division of Rate Counsel to ensure that New Jersey's community solar program includes sufficient consumer outreach and consumer-protection measures. One recommended measure is creating a standard disclosure checklist to be incorporated in customer contracts. This checklist would include information on recurring and nonrecurring charges, terms and conditions of early termination, and other items central to customer interest. Such a checklist is currently a mandated

[108] U.S. Department of Housing and Urban Development. (2016). "FY 2016 Income Limits Summary".
[109] Baussan, D. (2014). "How Leaving RGGI Leaves New Jersey Behind". Center for American Progress.

component of Xcel Energy's Community Solar Garden Program in Minnesota.[110,111] A standard disclosure checklist could also be implemented to ensure all customers receive information in plain language on key contract terms.[112] We also recommend creating an online portal that allows customers to easily compare, enroll in, and manage their subscriptions to community solar projects. This type of portal is a component of the Hawaii PUC's proposal on community solar.[113]

## 5 Conclusion

A clean energy future in the United States will increase energy security, improve human and environmental health, and support long-term economic stability and growth. Solar energy, as the most abundant renewable power source in the world, is a critical pillar of this future. Community solar can help expand solar power capacity and access in the United States by serving as a complement to utility-scale and residential solar. A statewide community solar program in New Jersey would empower developers to build solar projects on urban and suburban brownfields, vacant lots, and other low-value sites. It would give the estimated 49 percent of households currently unable to participate in residential solar programs an alternate way to become solar customers. Finally, it would ensure that New Jersey continues to be a national leader in solar. The information and recommendations provided in this report serve as a resource to assist state officials in crafting community solar legislation that builds on New Jersey's rich, successful history of using policy to grow the solar sector in a way that delivers the greatest benefits for all.

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110 Minnesota Public Utilities Commission. (2015). "Order Rejecting Xcel's Solar-Garden Tariff Filing and Requiring the Company to File a Revised Solar-Garden Plan". Docket No. E-002/M-13-867. April 7, 2014.

111 Another, more prescriptive, example of a standard disclosure checklist can be found in Alexander, B.R. (2016).

112 Coalition for Community Solar Access. (2016).

113 Hawaii Public Utilities Commission. (2016). *Draft Hawaii Public Utilities Commission Staff Proposal for Community-Based Renewable Energy Program*.

# A Model Legislation

****This section contains model legislation for establishing a statewide community solar program in New Jersey. It is based on a section of New Jersey Senate Bill (SB) 2275, sponsored by Senator Bob Smith, that also proposes such a program. The authors of this report have enriched the relevant text in SB 2275 with additional detail according to the recommendations presented in the main text.****

**SENATE, No. xxxx**

**SYNOPSIS**

Establishes "Neighborhood Solar Energy Program."

**An Act** concerning solar energy projects, and amending P.L. 1999, c.23.

**Be It Enacted** *by the Senate and General Assembly of the State of New Jersey:*

1. Section 38 of P.L.1999, c.23 (C.48:3–87) is amended to read as follows:

y. (1) The board shall establish the "Neighborhood Solar Energy Program" to permit customers of an electric public utility to invest in solar energy projects for the purposes of:

(a) expanding access to solar power for low- and moderate-income residents, especially those residing in multi-unit dwellings.

(b) expanding access to solar power for renters and residents with roofs that are not suitable for solar.

(c) furthering New Jersey's status as a leader in renewable energy and meeting State climate goals pursuant to The New Jersey Global Warming Response Act of 2007, N.J.S.A 26:2C–37.

(d) advancing the green economy and workforce development in New Jersey.

(e) increasing the resiliency of New Jersey's power supply.

(2)[A1]

(a) The board shall permit electric public utility ratepayers to subscribe to a solar energy project in a manner and at a price that is determined by the owner of a solar energy project, provided that the solar energy project is connected to the electric grid and located in the same county and service territory as the electric public utility which services that ratepayer. A ratepayer who participates in a solar energy project ("subscriber") shall be permitted a credit on their electric public utility bill for the value of energy produced by their subscription. Subscription size shall be limited to an amount expected to generate electricity that is less than or equal to the customer's annual electric usage in the energy year prior to initial subscription. A customer shall be compensated for any surplus credits each billing period or at the end of the annual billing period.

(b)[A2] Within twenty-four months of the passage of this act, the board shall initiate a proceeding to determine a Value-of-Solar (VOS) rate at which to credit subscribers for electricity generated. The VOS rate shall quantify the value and costs of solar energy to New Jersey ratepayers, including the value of energy produced, increased capacity, reduced transmission and distribution costs, fuel price hedging, grid resiliency, administration charges, avoided air pollution, environmental benefits, and any other costs or benefits the board deems relevant. In developing this rate, the board shall consider the best-available science as well as similar methodologies that have already been developed in other states and localities. Estimated placeholder rates may be used if exact subcomponent values are not yet calculable. The board may also include a temporary additional charge to encourage participation if the initial VOS rate is too low to incentivize development. The board shall hold

[A1] see Section 3.1 for a discussion of crediting mechanisms for community solar.

[A2] see Section 3.1.2 for a discussion of Value-of-Solar rates.

biennial hearings to revisit and improve the accuracy of the VOS rate and subcomponent values. To the extent possible, the VOS should account for differential costs and benefits based on a solar energy project's location and current market conditions.

(c) Prior to the adoption of a VOS rate, subscribers shall be credited at the full applicable retail rate for their customer class and service territory.

(d)[A3] Unsubscribed energy from a solar project registered under the Neighborhood Solar Energy Program may be sold to utilities at the wholesale rate.

(e) The board shall require the owner of a solar energy project to: provide a copy of its agreement with its subscribers to the subscriber's electric public utility; report the amount of energy produced by a subscriber's share each billing period to the subscriber's electric public utility; notify the subscriber's electric public utility once the agreement between the owner of the solar energy project and the subscriber has been terminated; and provide other information as determined by the board.

(3) The board shall make available on its Internet website information on solar energy projects whose owners are seeking subscribers.

(4) The board shall establish standards for solar energy projects that are eligible to be included in the Neighborhood Solar Energy Program. These standards should be reviewed every twenty-four months, or more regularly at the discretion of the board. The standards for the Neighborhood Solar Energy Program, shall include, but not be limited to:

(a) a verification process to ensure that solar energy projects are producing an amount of energy that is greater than or equal to the amount of energy that is being credited to its subscribers' electric utility bills pursuant to paragraph (2) of this subsection.

(b)[A4] a cap on total aggregate generation capacity for projects that qualify under this subsection, as well as a process for raising and eventually removing this cap. This cap shall be independent of limitations on grid-connected solar described in NJSA 48:3-87 section r, although the board should consider the effect of additional solar capacity on the grid in setting the Neighborhood Solar Energy Program cap.

(c)[A5] restrictions on project co-location and a cap on individual project size, such that utility-scale projects cannot apply for the Neighborhood Solar Energy program.

(d)[A6] a requirement that each project have at least 3 subscribers, and that each subscriber subscribe to at most 40 percent of a project's total capacity.

(e)[A7] a carve-out of at least 10 percent for low- and moderate-income residents. The carve-out will apply to the aggregate capacity of projects registered under the Neighborhood Solar Energy Program by an individual developer. The board shall authorize a higher carve-out, or sector-specific carve-outs, if it determines that these measures would improve low- and moderate-income participation without significantly impeding solar development. The carve-out(s) should be reconsidered every 24 months. New and/or modified carve-outs, if implemented, shall apply only to applications submitted after the date the new and/or modified carve-outs goes into effect.

(f)[A8] a standard disclosure checklist with items that participating solar projects are required to disclosure to subscribers, including information on charges, financial benefits, and terms and conditions of early termination.

[A3] see Section 3.2.3 for a discussion of unsubscribed energy credits.
[A4] see Section 3.5.2 for a discussion on total program size limits.
[A5] see Section 3.5.1 for a discussion of project size limits and colocation.
[A6] see Section 3.6 for a discussion of subscription structure.
[A7] see Section 3.9 for a discussion of the inclusion of disadvantaged groups.
[A8] see Section 3.8 for a discussion of community protection and education.

(5)[A9] The board shall establish an application queue or RFP process for owners of solar energy projects who wish to be included in the Neighborhood Solar Energy Program. This application process shall allow for fair competition and timely construction of solar energy projects. Prior to the adoption of the value-of-solar rate the process should favor applications located near their subscribers with the aim of encouraging projects that will minimize costs to the grid.

(6)[A10] With reasonable limitations based on what is technically feasible, the board shall direct utilities to begin providing data to solar developers about the locations where solar energy projects are likely to yield the greatest reductions in grid distribution costs and greatest improvements in grid resiliency.

(7)[A11] The board shall begin proceedings to establish a transparent cost-sharing mechanism for grid upgrades necessary to accommodate solar projects applying for the Neighborhood Solar Energy Program. All upgrade costs shall be borne by the owners of participating solar energy projects.

(8)[A12] Subscribers to solar energy projects are eligible to apply for and receive Solar Renewable Energy Credits (SRECs) for each megawatt-hour of electricity produced by their share of a solar energy project pursuant to subsection r. of this section. The board shall consider the possibility of allowing groups of subscribers (e.g., homeowners' associations) to aggregate their SRECs.

(9) Participation in a neighborhood solar project shall not affect subscriber eligibility for ratepayer assistance from the Universal Service Fund.

(10) As used in this subsection:

> "Subscribe" means a utility customer that purchases shares in a qualifying solar energy project located within the same utility jurisdiction and county,
>
> "Solar energy project" means a system containing one or more solar panels and associated equipment.
>
> "Solar panel" means an elevated panel or plate, or a canopy or array thereof, that captures and converts solar radiation to produce electric power, and is approved by the board to be included in the Neighborhood Solar Energy Program.
>
> "Solar power" includes flat plate, focusing solar collectors, or photovoltaic solar cells and excludes the base or foundation of the panel, plate, canopy, or array.

[A9] see Section 3.7 for a discussion of application procedures.
[A10] see Section 3.4 for a discussion of locational pricing.
[A11] see Section 3.3.2 for a discussion of interconnection and cost-sharing challenges.
[A12] see Section 3.1.4 for a discussion of the New Jersey REC and SREC markets.

# B Community solar policy in California, Hawaii, and Minnesota

## B.1 California

With the largest economy and population in the nation, California's energy demand is necessarily high (second only to Texas), and dominated by the transportation sector. Yet due largely to state and local policies, California also has one of the lowest per capita total energy consumption levels in the nation, and has extensively developed its solar resources. Today, California is the national leader in installed solar capacity, and solar continues to expand in the state.[B1] The San Francisco Bay Area is home to an unparalleled number of solar companies, including the top two largest residential solar installers in the country (Solar City and Sunrun), and both the workshop client (Grid Alternatives) and the primary solar advocacy organization in the country (Vote Solar).

California is also pushing the envelope on community solar. In 2008, the Sacramento Municipal Utility District launched a community solar program in 2008, and in 2013, California Governor Jerry Brown signed into law Senate Bill (SB) 43, which authorized the creation of a "Green Tariff Shared Renewables" (GTSR) program.[B2,B3] The program has two parts: a Green Tariff component and an Enhanced Community Renewables (ECR) component. The Green Tariff component provides ratepayers the option to pay a premium and receive 50 percent or 100 percent of their electricity from renewable energy sources. Utilities cannot claim RECs generated by participating customers and must procure additional renewable generation to meet program demand.[B4] The GTSR component authorized 600 MW of shared renewables projects—such as community solar—statewide, and required California's three largest utilities to design community solar programs and submit them to the California Public Utilities Commission for approval. The GTSR further specifies that 100 MW of the 600 MW authorized must be located in EJ communities.[B5] SB 43 enabled third-party solar developers to build shared renewables projects and sign power purchase agreements (PPAs) with ratepayers. Projects as large as 20 MW are eligible to provide electricity to the utilities at an established rate.

Attempted implementation of the GTSR program has revealed several problematic aspects. Chief among these is SB 43's requirement that the GTSR program "be implemented in a manner that ensures nonparticipating ratepayer indifference." This language has been the source of significant discontent. Critics argue that the strict "ratepayer indifference" clause forces developers to raise the prices of community solar subscriptions such that customer participation has been low. In addition, the compensation offered to developers under the ECR program is relatively modest (compared to states like Minnesota and New York), meaning that an unusual number of developers have declined to respond to utilities' requests for community solar proposals.[B6]

## B.2 Hawaii

Hawaii has been cited as a "postcard from the future" in terms of energy generation and consumption, especially with respect to renewable energy. As an island nation, Hawaii has historically been dependent on imported oil, meaning that energy price levels and volatility in the state are usually well above the national average.[B7] These energy challenges have served as catalysts for change, motivating Hawaii to rapidly develop its renewable energy capacity. In June 2015, the Hawaii state legislature updated Hawaii's Renewable Portfolio Standard (RPS) to require that all of the state's electricity come from renewable resources by 2045, making Hawaii the first state in the nation to set a target of 100 percent renewable energy.[B8]

B1 U.S. Energy Information Administration. (2015). "Profile Analysis: California". U.S. Department of Energy.
B2 California State Legislature. (2013). "Senate Bill No. 43 Electricity: Green Tariff Shared Renewables Program". September 28, 2013.
B3 Energy Policy Initiatives Center. (2015). *Community Solar in California*. Prepared for the Center for Sustainable Energy.
B4 Ibid.
B5 Office of Senate Floor Analyses. (2013). ""Bill Analysis:SB 43". California Senate Rules Committee.
B6 Clean Energy Collective. (2016). Personal interview. November 3, 2016.
B7 U.S. Department of Energy. (2008). *Assessment of Dependence of State of Hawaii on Oil*.
B8 U.S. Energy Information Administration. (2015). "Profile Analysis: Hawaii". U.S. Department of Energy.

Solar energy is a major part of Hawaii's ambitious renewable energy plan. Solar power already provides nearly a third of Hawaii's renewable energy, and Hawaii's capital, Honolulu, has more solar capacity installed per capita than any other U.S. city.[B9] Hawaii is currently looking at how to best deploy community solar projects as part of the state's renewable energy mix. The 2015 update to Hawaii's RPS required each electric utility in the state to file a proposed community-based renewable energy tariff with the Hawaii Public Utility Commission (PUC) by October of that year.[B10] The Hawaii PUC used the draft tariffs to inform its Community-Based Renewable Energy (CBRE) proposal, which was released for public comment in June 2016 and is expected to be finalized in the near future. The proposal includes a call to use time-of-use rates to set bill credit value for program participants—a first for a community solar program. Under this structure, generation sent to the grid at peak demand periods will be more highly compensated, which will likely create a market for energy storage. The proposal also calls for a phased implementation approach. The CBRE tariff ultimately issued by the Hawaii PUC will be in effect for one year. The Hawaii PUC will then have an opportunity to issue a revised tariff that addresses lessons learned and incorporates new technologies developed during the first year that the CBRE program is in effect.

## B.3 Minnesota

Minnesota was one of the earliest states to actively support community solar. In 2013, Minnesota's Solar Energy Jobs Act (SEJA, Minnesota statute §216B.1641), required Xcel Energy, the state's largest investor-owned utility (IOU), to submit, by September of that year, a plan for a community solar garden program for Xcel customers. SEJA stipulated that a customer's subscription size was capped at 120 percent of the customer's average electricity consumption in one year, and that no one participant could subscribe to more than 40 percent of the capacity of a single project.

Xcel's proposed program, Solar* Rewards Community (S*RC), was approved by the Minnesota Public Utilities Commission (PUC) in 2014. In December of the same year, the company began accepting applications from solar developers wishing to build community solar gardens within the purview of the program. Response to the program was tremendous. Just a month after the program launched, applications representing 431 megawatts (MW) of community solar capacity had been submitted, and by June 2015, this figure had increased to 1,000 MW. A considerable portion of proposed capacity came from applications for co-located projects overseen by larger developers. In these cases, developers proposed constructing multiple—in one case, as many as 50—1-MW solar gardens (the maximum size allowed under SEJA) immediately adjacent to each other, effectively establishing a utility-scale solar installation.

In February 2015, Xcel filed comments arguing that co-location violated the spirit and intent of the statute, and in August 2015, the Minnesota PUC agreed, issuing an order that limited developers' ability to co-locate solar gardens in large groups resembling utility-scale projects.[B11] In December 2015, the Minnesota PUC approved[B12] Xcel's final community solar garden tariff, which placed a 5-MW cap on the aggregate capacity of co-located projects proposed prior to September 25, 2015, and a 1-MW cap on co-located projects proposed afterwards.[B13] The co-location limit caused many developers to withdraw their applications. As of July 2016, 370 kW of community solar garden capacity was operational through the S*RC program, and the total capacity of applications in the queue had decreased to 855 MW.[B14] Xcel expects 200 MW of solar capacity to enter service by the end of 2016 and plans to double that capacity by the end of 2017.

[B9] Ibid.

[B10] Governor of the State of Hawaii. (2015). "Act 100, SB1050 SD2 HD3 CD1, 06/08/2015". June 10, 2015.

[B11] Minnesota Public Utilities Commission. (2015). "Order Adopting Partial Settlement as Modified". Docket No. E-002/M-13-867. August 6, 2015.

[B12] Minnesota Public Utilities Commission. (2015). "Order Approving Tariffs as Modified and Requiring Filing". Docket No. E-002/M-13-867. December 15, 2015.

[B13] In its December 2015 order, the Minnesota PUC defined co-located projects as projects that "exhibit characteristics of a single development, such as: i. common ownership structure, ii. an umbrella sale arrangement, iii. shared interconnection, iv. revenue-sharing arrangements, and v. common debt and equity financing."

[B14] Minnesota Public Utilities Commission. (2016). "Order Approving Value-Of-Solar Rate for Xcel's Solar-Garden Program, Clarifying Program, and Requiring Further Filings". September 6, 2016.

A key part of the community solar discussions in Minnesota centered around the rate design for community solar. By statute, Xcel Energy was required to purchase all energy generated by community solar gardens at a value-of-solar (VOS) rate. However, until the approval of such a rate, the company was to compensate subscribers at the applicable retail rate. In transitioning to the VOS rate, one of the major concerns of the Minnesota PUC was whether the new rate would be high enough for community solar projects to be financeable, as required by statute. Following its calculation of the VOS rate, Xcel Energy's position was that using the rate could "overincentivize" participation in community solar gardens and shift costs onto nonparticipating ratepayers. Generally, supporters of the VOS rate argued that the rate provided greater predictability and transparency than the applicable retail rate—sufficient conditions for financeability.

In late 2015, the PUC sought comments on the transition to the value-of-solar rate. After a period of public comments and oral arguments, the PUC determined in September 2016 that Xcel Energy would be required to purchase energy at the VOS rate from community solar projects submitted to the S*RC program after December 31, 2016. While Xcel Energy is the only power provider in Minnesota that has been mandated by the Minnesota PUC to offer a community solar garden program, other entities in the state have initiated their own community solar projects in various forms. The Wright-Hennepin electric cooperative (co-op) developed Minnesota's first community solar garden, a 40 kW array, in 2013, and has since pursued several additional community solar projects.[B15,B16,B17] Other co-ops that have established community solar gardens include Great River Energy, Lake Region, and Connexus Energy, the latter of which completed a 245 kW community solar garden in 2014.[B18] Moorhead Public Service, a consumer-owned utility that serves customers in the Moorhead/Fargo area of western Minnesota, has developed three community solar arrays since 2015 and is planning to complete construction of a fourth array in 2017.[B19] Minnesota Power, an IOU based in Duluth, constructed two community solar gardens in 2016 with a total capacity of 1.4 MW. Although the utility is awaiting Minnesota PUC approval of the rate structure for the projects, the projects have generated significant interest among potential subscribers.

[B15] Drake, T. (2013). "Wright-Hennepin kicks off community solar in Minnesota". Clean Energy Resource Teams.
[B16] Clean Energy Collective. (2016). "Wright-Hennepin Cooperative Electric".
[B17] Trabish, H.K. (2015). "Wright-Hennepin: A case study in utility transformation". Utility Dive.
[B18] Jossi, F. (2014). "In Midwest, rural co-ops taking a lead on community solar". Midwest Energy News.
[B19] Eisenbraun, D. Personal interview. October 17, 2016. Moorhead Public Service.

## C Individuals Consulted

The following persons provided input that informed the development of this report. However, the views and recommendations presented in this report are the sole product of the authors and are not attributable to any of the organizations or individuals listed.

**American Public Power Association**
Meena Dayak

**Americorps VISTA**
Erica Bjelland

**Arizona Corporation Commission**
Elijah Abinah; Terri Ford;
Barbara Keene; Eric Van Epps

**Blue Planet Foundation**
Richard Wallsgrove

**California Public Utilities Commission**
Rajan Mutialu

**California Solar Energy Industries Association**
Kelly Knutsen

**Center for Sustainable Energy**
Sachu Constantine

**Clean Energy Collective**
Eric Steinhofer

**Clean Energy Resource Teams**
Trevor Drake; Lissa Pawlisch; Dan Thiede

**Coalition for Community Solar Access**
Jeff Cramer

**Community Power**
George Crocker; Timothy Den-Herde;
Alice Madden

**EarthJustice**
Isaac Moriwake; Kylie Wager

**Fresh Energy**
Allen Gleckner; Michael Noble; Ben Passer

**Gabel Associates, Inc.**
Pamela Frank

**GRID Alternatives**
Seth Cauman; Tom Figel;
Lia Papazoglou; Tim Sears

**GRID Alternatives Tri-State**
Ben Cuozzo; Peter Mandelstam;
Michael Moomjy

**Hawaii Division of Consumer Advocacy**
Catherine Awakuni; Rene Kamita;
Dean Nishina

**Hawaii Public Utilities Commission**
Lorraine H. Akiba; Dave Parsons

**Hawaii State Energy Office**
Veronica Rocha; Chris Yunker

**Hawaiian Electric Company**
Alona Bozhchenko; Keiki-Pua Dancil

**Hunt Electric**
Todd Lyden

**Institute for Local Self Reliance**
John Farrell; Karlee Weinmann

**Isles, Inc.**
Martin Johnson

**Kauai Island Utility Cooperative**
Mike Yamane

**Midcontinent Independent System Operator, Inc.**
David Boyd

**Minnesota Department of Commerce**
Lise Trudeau

**Minnesota Power**
Katie Frye; Paul Helstrom;
Tina Koecher; Jennifer Peterson

**Minnesota Public Utilities Commission**
Beverly Heydinger; Nancy Lange;
Susan Mackenzie

**Minnesota Rural Electric Association**
Jim Horan; Darrick Moe

**Minnesota Solar Energy Industry Association**
Lynn Hinkle

**Moorhead Public Service**
Dennis Eisenbraun

**National Rural Electric Cooperative Association**
Pam Silberstein

**New Jersey Board of Public Utilities**
Mike Winka

**New Jersey State Legislature**
Linda Greenstein; Bob Smith

**New York Department of Public Service**
Scott Weiner

**NRG Energy**
Julia Zuckerman

**Pacific Gas and Electric Company**
Molly Hoyt
Will Quinn

**PAR Energy Solutions, LLC**
Phyllis Reha

**Pegasus Capital Advisors**
David Crane

**Princeton University**
Ted Borer; Robert Socolow

**Public Service Electric & Gas Company**
Ed Gray

**Recurrent Energy**
Michael Wheeler

**Rural Renewable Energy Alliance**
BJ Allen

**Saul Ewing LLP**
Stephen Genzer

**Solar City**
Shaun Chapman; Adam James;
Stephanie Paw; Jon Yoshimura

**Solar Energy Industries Association**
Brandon Smithwood

**Solstice Initiative**
Steph Speirs

**Stanford University, Precourt Energy Efficiency Center**
Dian Grueneich

**State of New Jersey, Division of the Rate Counsel**
Stefanie Brand

**SunPower Corporation**
Riley Saito; Sandra-Ann Y.H. Wong

**SunRun**
Amy Heart

**Sustainable Jersey**
Randall Solomon

**Tucson Electric Power**
Carmine Tilghman

**UBS Investment Bank**
Julien Dumoulin-Smith

**U.S. Department of Agriculture, Rural Utilities Service**
Gerard Moore

**Ulupono Initiative**
Kyle Datta

**University of Hawaii at Manoa**
Shalanda Baker; John Cole; Jay Griffin

**University of Minnesota Duluth, Sun Delegation**
Bailee Coughlin; Aiden Fawcett;
Cassie Ortberg; Randall Sedlachek;
Madelaine Sinclair

**University of Minnesota, Humphrey School of Public Affairs**
Matthew Grimley

**Vote Solar**
Susannah Churchill; Melanie Santiago-Mosier

**Xcel Energy**
Holly Hinman

**Unaffiliated**
Michael Champley; Minh Le

## D About the Authors and Advisors

## Authors

**Vivian Chang** is a second-year Master of Public Affairs (MPA) student at Princeton, receiving a certificate in the Science, Technology and Environmental Policy (STEP) program. Vivian researched cities' engagement in the Clean Power Plan at the Center for Climate and Energy Solutions (C2ES) and worked on public education and volunteerism for AmeriCorps VISTA. She holds a Bachelor of Science in biological physics and a Bachelor of Arts in Hispanic Studies from Carnegie Mellon University, with a minor in environmental science.

**Cara Goldenberg** is a second-year MPA student, receiving a certificate in STEP. Cara spent close to four years working as a senior regulatory and policy analyst focusing on energy efficiency, renewables, the smart grid, and climate change. Cara also provided research assistance for Stanford University's "Next Level of Energy Efficiency" initiative, and for the Rocky Mountain Institute on electric vehicle policy. Cara holds a Bachelor of Science degree in environmental economics and policy from UC Berkeley.

**Jack Hoskins** is a Boren Fellow and second-year MPA student. He recently returned from a year in India working with renewable energy startups and investors. Jack has worked on economic crime investigations with the Manhattan District Attorney and as an intern with the State Department's extremism task force. His international experience includes living and working in India, Nepal, China, Bulgaria, and Peru. Jack holds a bachelor of arts degree in government from Wesleyan University.

**Stephen Lassiter** is a second-year MPA student, and currently works with the NY-Sun team at the New York State Energy Research and Development Authority (NYSERDA) on building a self-sustaining solar industry in New York State. Stephen served as the foreign policy director for the presidential campaign of former Maryland Governor Martin O'Malley, and as the foreign policy and national security adviser to U.S. Congressman Keith Ellison (D-MN). He has also worked for Sen. Kay Hagan (D-NC), led the State Department's CLS Arabic program in Jordan, and taught at a Quaker high school in the West Bank of Palestine. He is a proud 11th-generation North Carolinian UNC-Chapel Hill graduate.

**Zhongshu Li** is a second-year STEP PhD student. His research interests include climate change and atmospheric air pollution, and how trade policy influences the renewable energy industry, especially between the United States and China. Zhongshu holds bachelor's degrees in environmental science and economics from Peking University.

**Eri Nakatani** is a second-year MPA student. Eri started her career in the field of nuclear energy policy at the Ministry of Economy, Trade and Industry of Japan, amid the Fukushima nuclear crisis in 2011, where she led the launch of an advisory committee to reform attitudes towards safety in the nuclear industry. More recently, Eri represented Japan at the 40th Session of the Intergovernmental Panel on Climate Change and the 20th Conference of the Parties to the United Nations Framework Convention on Climate Change in Lima, Peru. Eri holds a master's degree in nuclear engineering from the University of Tokyo.

**Sheree Oluwafemi** is a second-year MPA student. Sheree spent two years as a US Peace Corps Volunteer teaching English in rural Armenia and working with community partners on youth development initiatives. She has held financial analysis and human resources roles at Intel Corporation. This summer, Sheree was a graduate intern on the Power & Energy Utilities team at the European Bank for Reconstruction and Development. Sheree holds a bachelor's degree in business administration from Howard University.

**Hannah Safford** is a second-year MPA and Master of Engineering (Environmental Engineering and Water Resources) student, receiving a certificate in STEP. Hannah took a leave of absence from graduate school to complete a two-year fellowship in the Environment & Energy Division of the White House Office of Science and Technology Policy. She has worked at the U.S. Forest Service, the San Francisco (SF) Department of the Environment, the SF International Airport, and the SF Zoo. Hannah holds a bachelor of science in chemical and biological engineering and a certificate in public policy from Princeton.

## Advisors

**Jeanne Fox** is the former President of the New Jersey Board of Public Utilities and was a member of the Governor's cabinet from January 2002 to January 2010. Under President Fox's leadership, the NJ BPU became a leader in developing cutting-edge clean energy policies, and in promoting renewable energy and energy efficiency. Jeanne served as President of the Mid-Atlantic Conference of Regulatory Utilities Commissioners, as Deputy Commissioner and Commissioner of the New Jersey Department of Environmental Protection and Energy, and as Administrator for Region 2 of the Environmental Protection Agency. She is currently on the Board of Directors for GRID Alternatives Tri-State. Jeanne graduated cum laude from Douglass College, Rutgers University, and received a Juris Doctor from the Rutgers University School of Law–Camden.

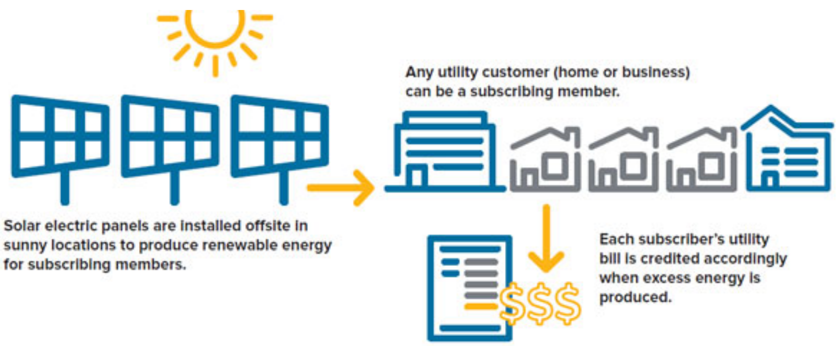
**Anne Hoskins** is the Chief Policy Officer of SunRun, and a former Commissioner of the Maryland Public Service Commission. Anne served as Chair of the NARUC International Relations Committee and as a board member of the Organization of PJM States (OPSI). Anne has also served as an officer at PSE&G and as a Visiting Research Scholar at Princeton University's Andlinger Center for Energy and the Environment. Anne is a graduate of Harvard Law School, the Woodrow Wilson School of Public and International Affairs at Princeton University, and Cornell University.

# Solar Gardens in the Garden State:
## Community Solar Recommendations for New Jersey

## Why community solar?

Solar is booming. The United States achieved more than 30 gigawatts of installed solar capacity in 2016, up from virtually zero just a decade prior. Yet almost half of households cannot access solar because they reside in rented or multi-tenant buildings. Other households have shaded roofs, or lack the capital needed to invest in solar panels. As the country's most densely populated state, New Jersey stands to benefit greatly from new approaches for solar expansion.

**How does community solar work?**




Source: NYSERDA, Shared Solar NY-Sun Program

**Community solar** is one such approach. Community solar systems are small- to medium-scale solar-electric systems that provide power and/or financial payback to multiple participants. These systems can:

- ✓ Enhance electric grid resilience
- ✓ Support economic growth
- ✓ Reduce transmission & distribution costs
- ✓ Increase low-income access to solar
- ✓ Improve human & environmental health

Community solar systems are generally small enough to be located close to end users, but large enough to realize some economies of scale.

## Community solar in New Jersey

New Jersey has a track record of innovative and effective solar policies. Thanks to its net metering policy, solar Renewable Portfolio Standard (RPS), and Solar Renewable Energy Credit (SREC) market, New Jersey has enough installed solar capacity to power 257,000 homes, and ranks 4th on the Solar Energy Industries Association list of top solar states. Community solar would be a valuable complement to the state's robust utility- and residential-scale solar industries. Establishing a statewide community solar program would augment consumer choice and unlock a new market for solar development, helping New Jersey remain a national solar leader.

Thoughtful policy design is essential to program success. The below recommendations for community solar legislation in New Jersey are based on an extensive literature review, interviews with more than 100 experts and practitioners, and in-depth case studies of three states (California, Hawaii, and Minnesota) that already have community solar policies and programs in place.

## Recommendations

- Be clear on legislative intent, but delegate details to the New Jersey Board of Public Utilities (BPU).
- Administer the program in two phases: a pilot stage followed by full implementation.
- Require utilities to make information relevant to project development transparent and easily accessible.
- During the pilot stage, process project applications via a queue-based system.
- Establish transparent cost-sharing procedures for grid upgrades needed to accommodate community solar.
- Create a simple, standardized permitting process.
- Use virtual net metering to credit customers for power. Eventually, transition to a value-of-solar methodology.
- Set a floor on prices for Solar Renewable Energy Credits (SRECs) and provide SREC benefits to subscribers.
- Cap project size at 5 MW. Limit participation to customers in the same service territory and county.
- Encourage projects on low-value land and sites that allow multiple land uses.
- Allow participation of small businesses. Limit individual subscription size to 40% of project capacity.
- Require developers to allocate at least 10% of project subscriptions to low-income households. Take action to reduce participation barriers.
- Create and implement appropriate consumer-protection measures.