Community Solar 101

National Renewable Energy Laboratory

Jenny Heeter
Kaifeng Xu
Emily Fekete

What is Community Solar?

Community Solar is Defined as…

Community solar, also known as *shared solar* or *solar gardens,* is a distributed solar energy deployment model that allows customers to buy or lease part of a larger, offsite shared solar photovoltaic (PV) system and receive benefits of their participation.

Other definitions include:

- A solar power plant whose electricity is shared by more than one property
- Community-owned projects as well as third party-owned plants whose electricity is shared by a community.

"Community Solar: What Is It?" EnergySage, January 16, 2020. https://www.energysage.com/solar/community-solar/community-solar-power-explained/.

NCSP Defines Community Solar as…

"We broadly define community solar to include any solar project or purchasing program, within a geographic area, in which the benefits flow to multiple participants (individuals, businesses, nonprofits, etc.)."

"National Community Solar Partnership." Energy.gov. U.S. Department of Energy. https://www.energy.gov/eere/solar/national-community-solar-partnership

Why Do Definitions Matter?

The definition we use allows us to have a common understanding of community solar, and to provide clarity on exactly what is meant when the terms *community solar*, *shared solar*, or *solar gardens* are used.

A common definition also facilitates market tracking and cost benchmarking.

Community Solar Structure Design

Three Common Business Models

Utility-led:
Orlando Utility Commission

- 400 kW PV Project
- OUC buys the electricity at $0.18/kWh under a PPA from private solar developer
- Subscriptions: 1 to 15 kW
- Cost: $0.13/kWh

  (avg. $14.56/month per kW)
- Solar rate roughly $0.015-0.025/kWh more than retail rates but fixed for up to 25 years
- $50 up-front fee
- 2-year minimum participation.

http://www.ouc.com/environment-community/solar/community-solar/community-solar-faq#cost

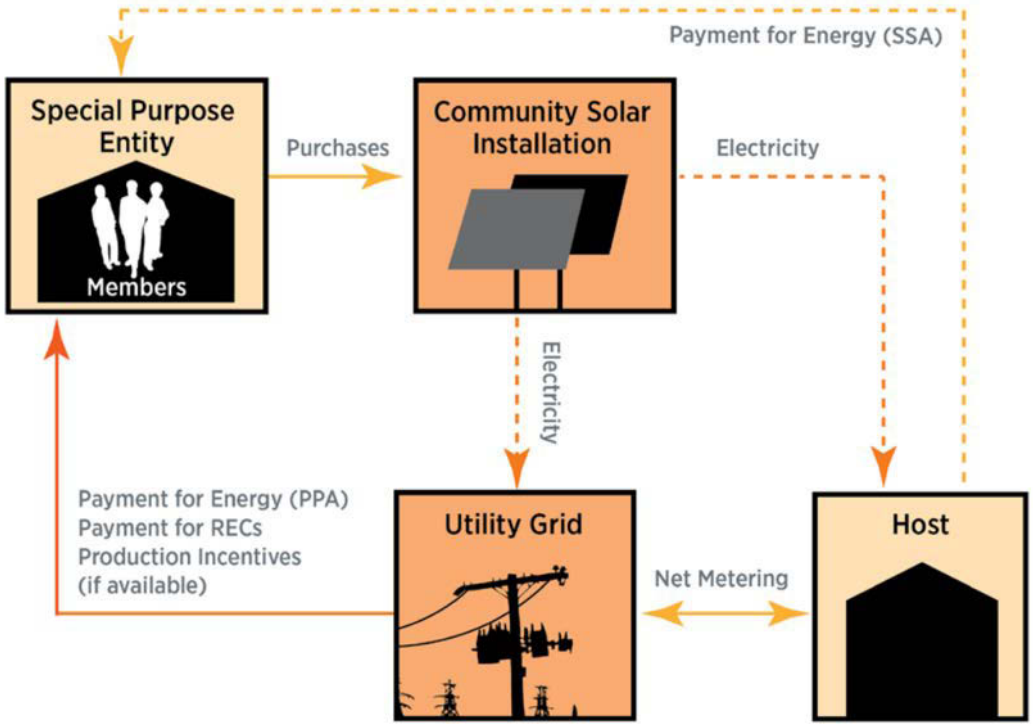
Third-party Led:
Clean Energy Collective

- Origins in Colorado but expanding to MA, NY, and other states
- Currently, there are 110 community solar projects within 33 utility service territories across 11 states.

https://www.communitysolarplatform.com/

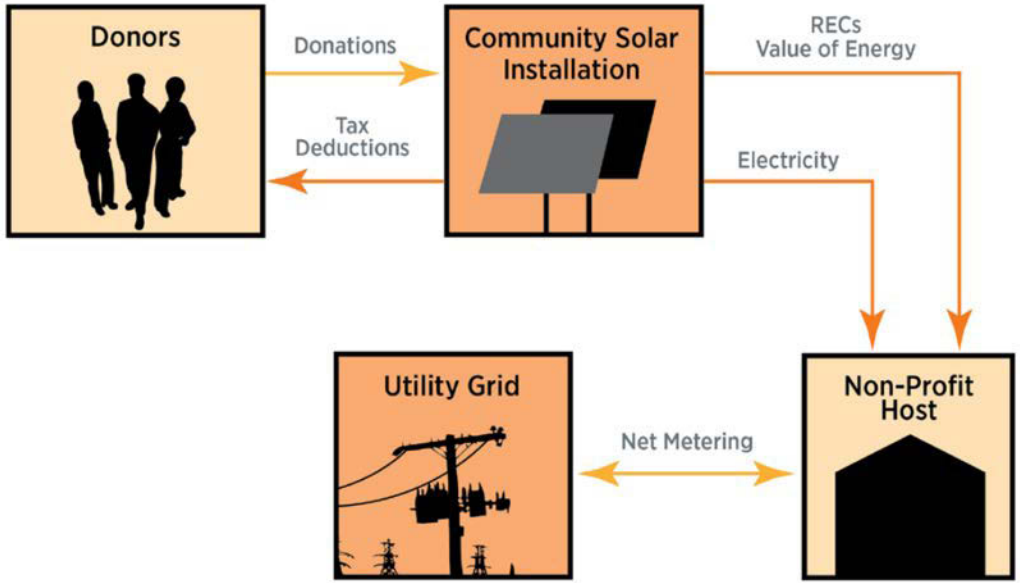
Special Purpose Entity Model

- In some cases, in order to fully use the investment tax credit (ITC), organizations form a Special Purpose Entity (SPE) as the owner of community solar project
- Customers still receive credit reflected on their utility bills.

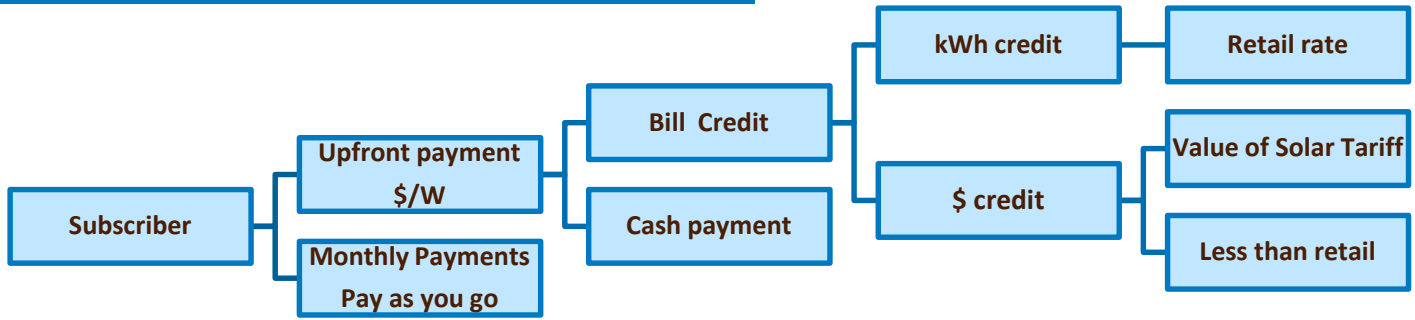


Nonprofit Donation-Based Model

- In nonprofit model, community solar system will be paid for by donors who do not receive benefits from the electricity generation
- The solar system is typically sited on a nonprofit or government building, adding to the "community" nature of the project.



Subscriber Perspective



Typical subscriber questions

- What if I move within utility district?
- What if I leave the state?
- How long do I have to be a member?
- What's my payback?
- Do I get a tax credit?
- Do I own my panels?
- Will I save money?

CEC: Vermont

Community Solar for Low- and Moderate-Income (LMI) customers

Defining LMI

- LMI refers to “low-income” or “low-to-moderate income” populations, which is generally determined as a percentage of area median income (AMI)
- The U.S. Department of Housing and Urban Development defines very low income as 50% of AMI and low-income as 80% of AMI
- Both low-income and LMI populations face challenges with respect to solar access they are often considered together.

What is LMI Community Solar?

- LMI community solar refers to community solar projects that are inclusive of or incentivize LMI participants
- These projects can include specific LMI carve outs or other incentives to generate LMI participation.

Why is LMI Community Solar Important?

- LMI households have the most to gain because electricity costs make up a larger fraction of their budgets compared to more affluent households
- LMI customers face more obstacles to obtaining solar energy such as lower credit scores and insufficient tax burden to be eligible for state and federal solar tax incentives
- Historical business models required home ownership, a suitable roof, and good credit ratings, while much of the LMI community are renters living in multifamily units with limited access to capital.

"National Community Solar Partnership (FY2016)." Energy.gov. U.S. Department of Energy. https://www.energy.gov/eere/solar/national-community-solar-partnership-fy2016.

State Context

15 states and Washington, D.C. have a policy or program supporting some type of LMI community solar program.

California, Michigan, Texas, South Carolina, and Florida have new voluntary programs.

Carve-out

Incentives/Grants

Multifamily housing

To be determined

Voluntary Program

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. “Design and Implementation of Community Solar Programs for Lowand Moderate-Income Customers.” National Renewable Energy Laboratory. National Renewable Energy Laboratory, December 2018. https://www.nrel.gov/docs/fy19osti/71652.pdf.

Summary of LMI Projects and Subscribers (1)

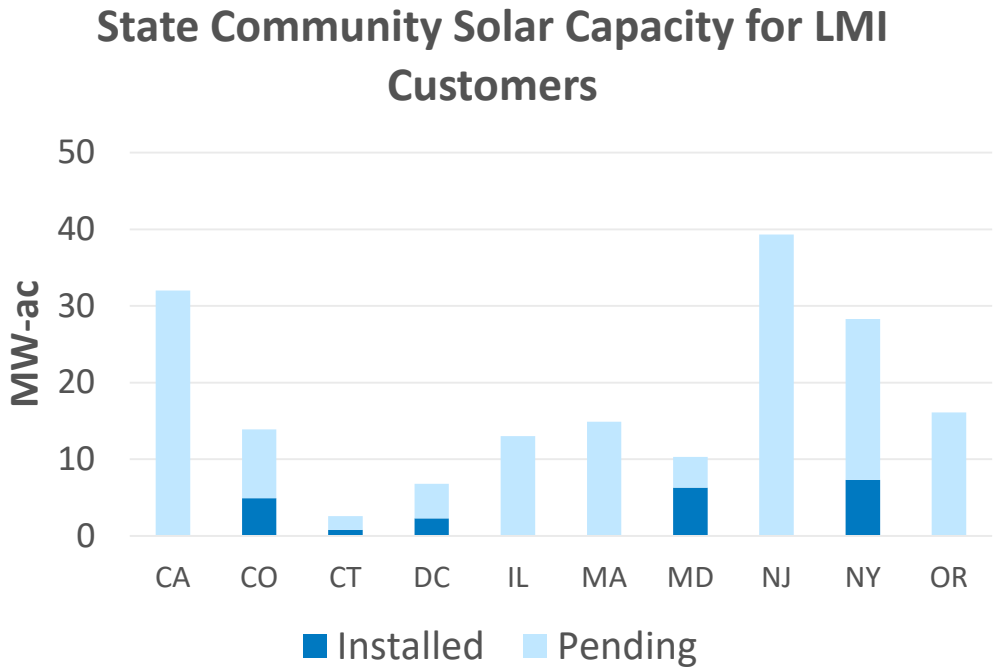
State	Installed LMI MWac	Pending LMI MWac	Average Subscription Size (Household/MWac)	Potential Subscribers (if all pending LMI MW are installed)
Colorado	4.9	9	170 (R-C)	2480
Connecticut	0.8	1.8	170 (E)	442
Maryland	6.3	4	170 (R-C)	1730
Washington, D.C.[a]	2.3	4.5	910 (R-C)	6246
New York	7.3	21	150 (R-C)	4245
California[b]	-	32	380 (R-C)	12300
Illinois	-	13	170 (E)	2210
Massachusetts	-	14.9	170 (E)	2533
New Jersey	-	39.3	170 (E)	6681
Oregon	-	16.1	170 (E)	2737
Total	**21.6**	**155.6**		**41604**
Rhode Island[c]	3.3	22.2	NA	NA

Notes:

***State**:[a],[b]: the capacity does not specify DC/AC; [c]: Rhode Island installed LMI and pending LMI refer to total community solar capacity;*

***Average Subscription Size**: R-C: data are collected through reported data and then calculated; E: data are estimated as 170 household/MWac. The potential subscriber numbers may be different due to rounding/multiple programs, see following state slides and the appendix for details.*

Summary of LMI Projects and Subscribers (2)



Based on the most recently available data, 21.6 MW of community solar serving LMI customers are in operation, and 155.6 MW are planned. This LMI capacity will benefits over 40,000 LMI households, once in operation.

How are Community Solar Programs Designed to Include LMI Subscribers?

- **LMI carve-out:** A fraction of a project's capacity or generation is reserved for LMI customers
- **LMI-only project:** Projects developed exclusively for LMI customers
- **Anchor Tenant:** Project developers can seek a single creditworthy non-residential anchor tenant to subscribe to a large portion of the project's capacity
- **LMI participation incentives:** Some states and programs are developing added incentives for LMI community solar subscribers. For example, if the state already has a solar renewable energy certificate (SREC) program, it may decide to award LMI community solar projects or subscribers a higher SREC rate. The incentive could be structured so that a community solar project would receive a higher SREC rate, for example, if half of the subscribers are LMI.

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. "Design and Implementation of Community Solar Programs for Lowand Moderate-Income Customers." National Renewable Energy Laboratory. National Renewable Energy Laboratory, December 2018. https://www.nrel.gov/docs/fy19osti/71652.pdf.

Sites for LMI Community Solar Projects

- **LMI Neighborhoods:** Siting within LMI communities may increase a sense of ownership in local communities, improve the visibility of the project, or allow engagement of local communities through volunteer labor and/or job trainees
- **Brownfields:** Repurpose urban contaminated sites such as landfills, mine sites, and Superfund sites
- **Public or donated land:** Could reduce the overall project cost by utilizing public or donated land
- **Rooftop:** Projects could be utilized on multiple affordable housing units or on mixed income housing developments.

Figure 1. A 2-MW solar PV system on a former landfill at Fort Carson in Colorado. *Source: NREL 17394*

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. "Design and Implementation of Community Solar Programs for Lowand Moderate-Income Customers." National Renewable Energy Laboratory. National Renewable Energy Laboratory, December 2018. https://www.nrel.gov/docs/fy19osti/71652.pdf.

How are LMI Community Solar Programs Financed?

Up-Front Costs

- **On-bill financing:** Customers pay community solar subscription fees through ongoing payments on utility bills
- **Lower interest rates loan for a large up-front payment:** In some states, LMI customers are eligible for lower interest rates under loan programs. This can be used for community solar subscriptions that require an up-front payment
- **Prepaid subscriptions:** Prepaid subscriptions would use external funding for an up-front payment of the subscription. This funding could be provided via state funds, grants, or other options. In a prepaid subscription, the LMI subscribers, using external funding sources, would be subscribed for set time (e.g. 15 years) and receive credits on their electricity bills for that duration.

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. "Design and Implementation of Community Solar Programs for Lowand Moderate-Income Customers." National Renewable Energy Laboratory. National Renewable Energy Laboratory, December 2018. https://www.nrel.gov/docs/fy19osti/71652.pdf.

How are LMI Community Solar Programs Financed?

Billing and Credits for Subscription

- **Utility billing and crediting:** Billing and crediting often occurs on the customer's existing utility bill
- **Payment to a third party and credit on utility bill:** LMI customers can pay developers directly for their share of the community solar project through a separate billing mechanism, with the bill credit applied through the utility
- **Payment and crediting through building owner or aggregator of LMI subscribers:** LMI customers in master-metered buildings generally cannot be billed and credited directly for community solar subscriptions. In this context, the building owner, such as a multifamily affordable housing unit, may serve as the subscriber on behalf of its tenants. Direct bill crediting may be possible where the tenants have individual meters and where state policy allows.

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. "Design and Implementation of Community Solar Programs for Lowand Moderate-Income Customers." National Renewable Energy Laboratory. National Renewable Energy Laboratory, December 2018. https://www.nrel.gov/docs/fy19osti/71652.pdf.

How are LMI Community Solar Programs financed?

Incentives to Developers to offer favorable rates to LMI customers

- **Grant funding:** Several states are providing—or plan to provide—grant funding for LMI community solar projects. Some states have conditioned funding on requirements that the demonstration projects benefit LMI customers which can potentially help reduce up front costs
- **Community Reinvestment Acts:** Some banks may be willing to invest in community solar and donate the shares to LMI customers, thus eliminating the up-front cost barrier, as one way to fulfill their Community Reinvestment Act (CRA) obligations
- **New Market Tax Credits (NMTC):** The NMTC provides investors with a tax credit of 39% of the qualified equity investment made, realized over a seven-year period. The NMTC applies to investments made in business or economic development projects located in census tracts where the poverty rate is at least 20% or where median family income does not exceed 80% of the area median.

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. "Design and Implementation of Community Solar Programs for Lowand Moderate-Income Customers." National Renewable Energy Laboratory. National Renewable Energy Laboratory, December 2018. https://www.nrel.gov/docs/fy19osti/71652.pdf.

Effective Communication Strategies for LMI Community Solar Programs

- **Avoiding Customer Skepticism:** Messaging should convey benefits and costs. Information that can be useful includes customer's current electricity costs, the customer's subscription cost (even if the program is subsidized), and the value of the customer's bill credits
- **Audience-Specific Messaging:** Outreach groups should be prepared to speak languages that are prevalent in local LMI communities and prepare promotional materials in those languages. Outreach efforts should concentrate on local media frequently used by LMI customers and include basic educational information about solar and energy in general
- **Localized Messaging and Pilots:** Effective LMI messaging may vary in different contexts, so using pilot programs to test messaging in certain regions and evaluating results to refine messaging could be effective.

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. "Design and Implementation of Community Solar Programs for Lowand Moderate-Income Customers." National Renewable Energy Laboratory. National Renewable Energy Laboratory, December 2018. https://www.nrel.gov/docs/fy19osti/71652.pdf.

Effective Communication Strategies for LMI Community Solar Programs

Effective Partnerships can aid in basic education and outreach to potentially enrolling customers directly

- **Utilities** have the most direct access to customer information and can most readily estimate customer energy burdens and customers participating in low-income programs and are known by LMI customers with outreach channels
- **Solar Developers** can provide expertise on customer acquisition, even if these practices must be modified in the LMI context
- **NGOs & Community groups:** Working with a non-utility partner may help programs overcome LMI customer skepticism. Community groups already have established relationships with LMI customers that facilitate customer education and acquisition
- **Existing LMI Programs:** Collaboration with other LMI programs to raise awareness can be effective. Leveraging existing outreach materials can reduce subscription costs.

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. "Design and Implementation of Community Solar Programs for Lowand Moderate-Income Customers." National Renewable Energy Laboratory. National Renewable Energy Laboratory, December 2018. https://www.nrel.gov/docs/fy19osti/71652.pdf.

What are Communication Strategies for LMI Community Solar Programs?

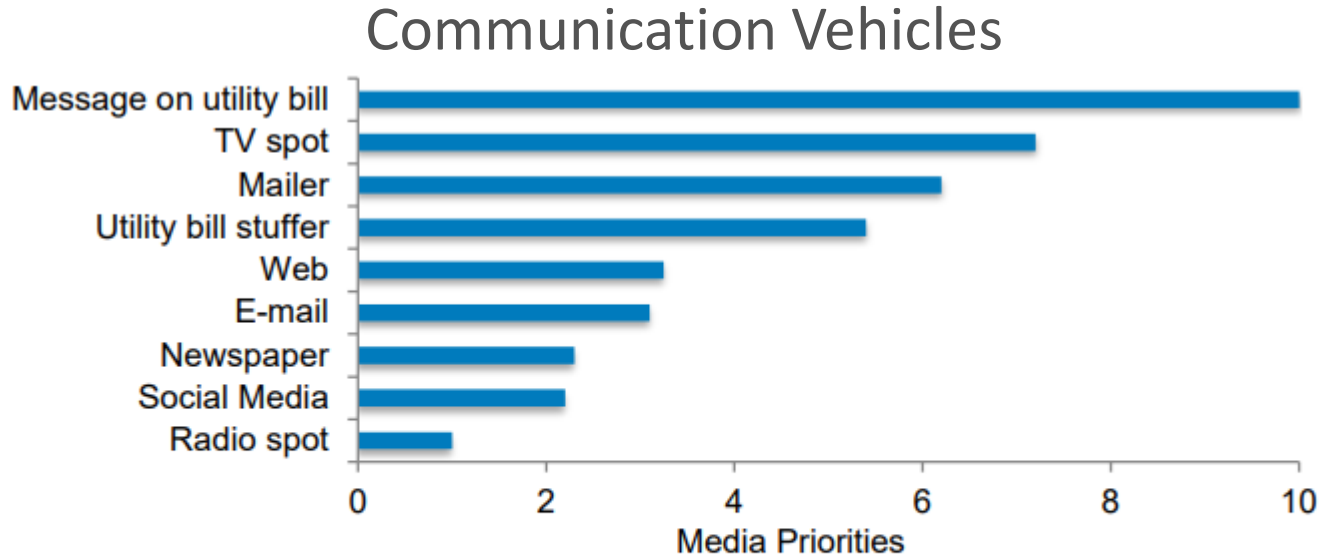


Figure 5. Most effective messaging channels for LMI community solar customers

Source: Pacific Consulting Group 2017

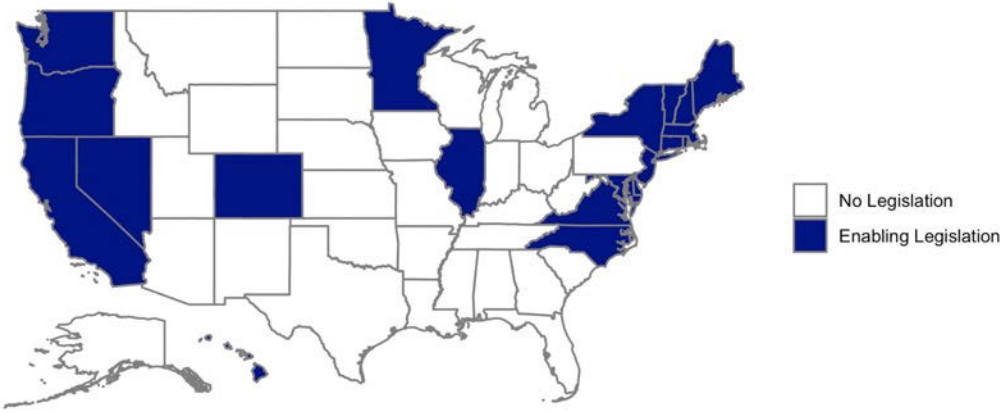
PCG (Pacific Consulting Group). 2017. Community Solar for Low Income Customers, SEPA Webinar, Designing and Marketing Community Solar Programs for Low-Income Customers, May 11, 2017.

Policies Related to Community Solar Design

Community Solar Support, Net Metering, Third-Party Solar Power Purchase Agreement

Community Solar State Policies

- 20 states and Washington, D.C., have passed some form of legislation enabling community solar, either through statewide programs or the authorization of a limited number of pilot projects
- These programs vary in scope, but generally all allow for some form of virtual net metering so that subscribers can benefit from their community solar subscriptions.

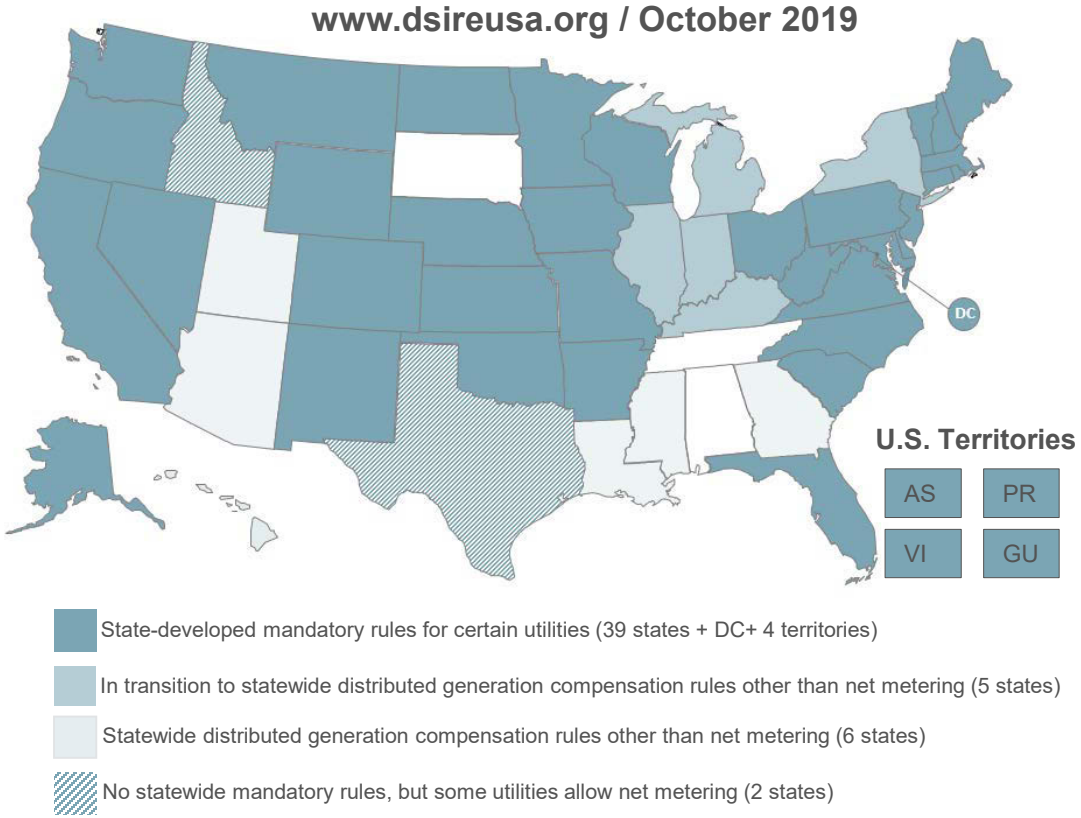


State-level community solar enabling legislation

See appendix for detailed legislation descriptions

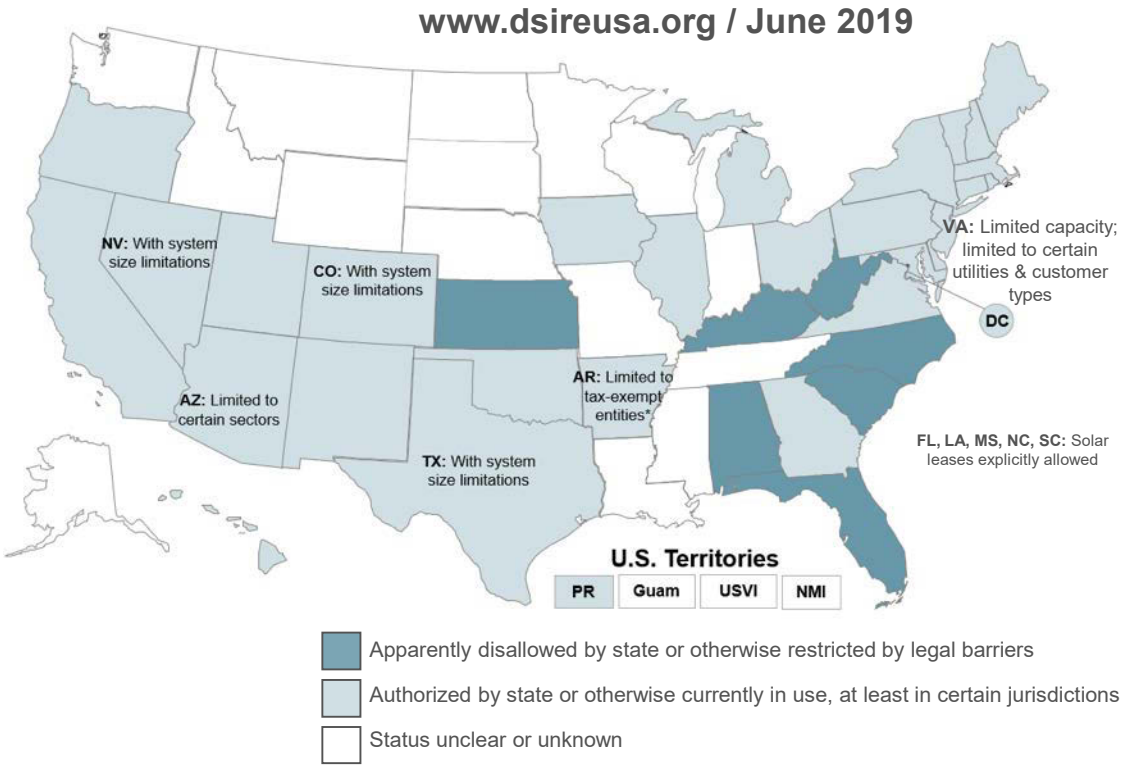
Net Metering State Policies

- Community solar customers receive benefit through net metering and net billing
- Customers can be credited at retail rate, less than retail rate (avoided cost rate), not compensated, or compensated in hybrid modes
- 39 States + D.C., AS, GU, PR, and USVI have mandatory net metering rules.



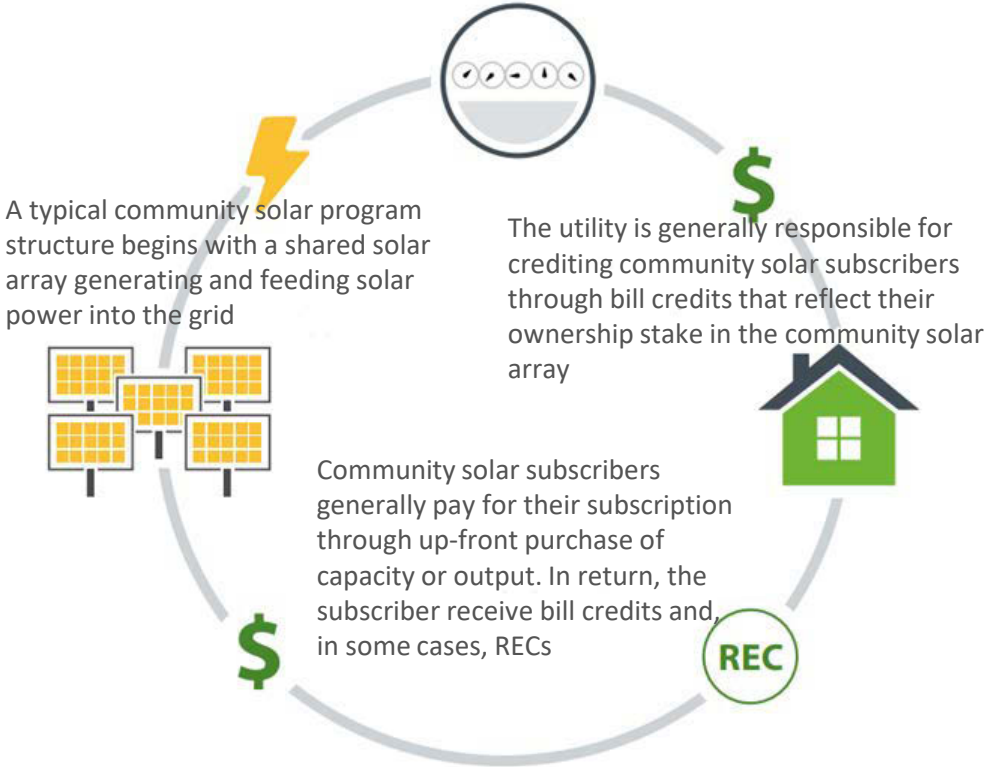
Third-Party Solar Power Purchase Agreement Policies

- Third-party solar PPA allows customer to purchase electricity generated by solar panels on their roof from a third-party-owned system. This will affect community solar project structure design
- At least 28 States + Washington, D.C., and Puerto Rico authorize or allow third-party PPA for solar PV.



Utility Sponsored/Third-Party Developer Model

- Utility-sponsored model is the most common structure used in the current U.S. community solar market. In this case, local utility owns and sells solar panel to subscribers
- For states that allow third-party solar PPA, subscribers can contract upfront or monthly payment with solar developers and receive bill credit from utilities. Meanwhile, the solar developer will operate and maintain the system.



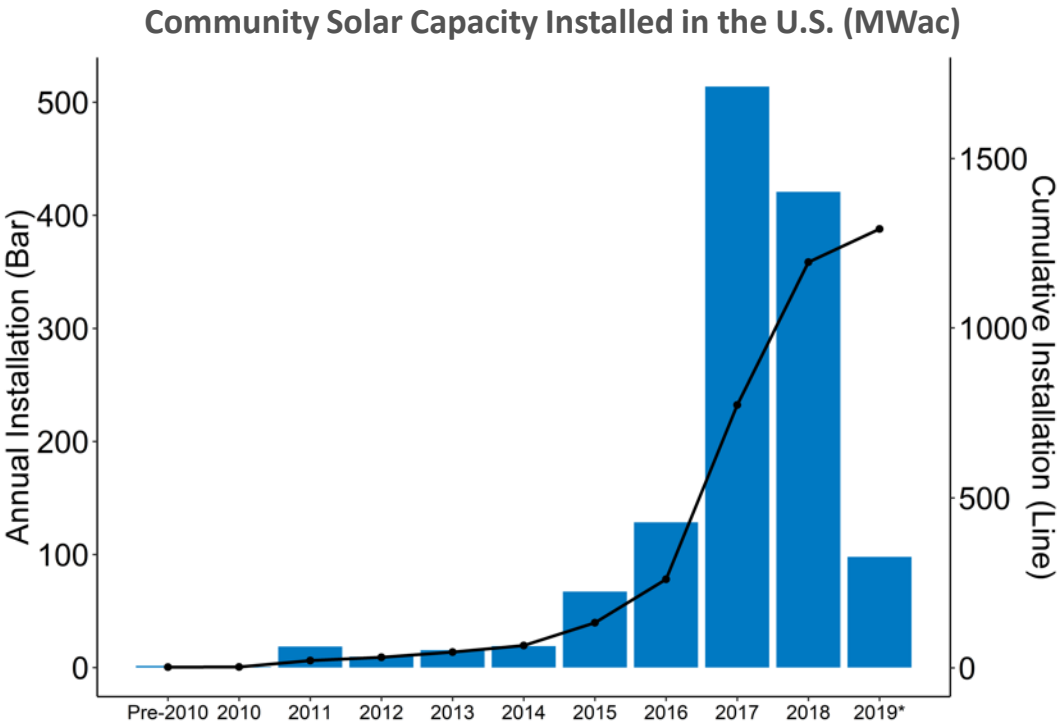
Community Solar Program General Structure
Source: LESSONS LEARNED: COMMUNITY SOLAR FOR MUNICIPAL UTILITIES, NREL

Community Solar Market Overview

Data Sources and Timing

- Data for this market update was collected as part of the Sharing the Sun project run by the National Renewable Energy Laboratory and funded by the U.S. Department of Energy's Solar Energy Technologies Office.
- NREL maintains a current list of community solar projects, found here: https://www.nrel.gov/state-local-tribal/community-solar.html.
- Data are gathered from public sources including press releases, utility websites, project developer listings, public filings, as well as data sent to NREL directly from project developers.
- This list been reviewed but errors may exist, and the list may not be comprehensive. Errors in the sources (e.g., press releases) may be duplicated in the list.
- NREL invites input to improve the database, including to: Correct erroneous information, add missing projects, fill in missing information, and/or remove inactive projects. Updated information can be submitted to Jenny Heeter at jenny.heeter@nrel.gov.

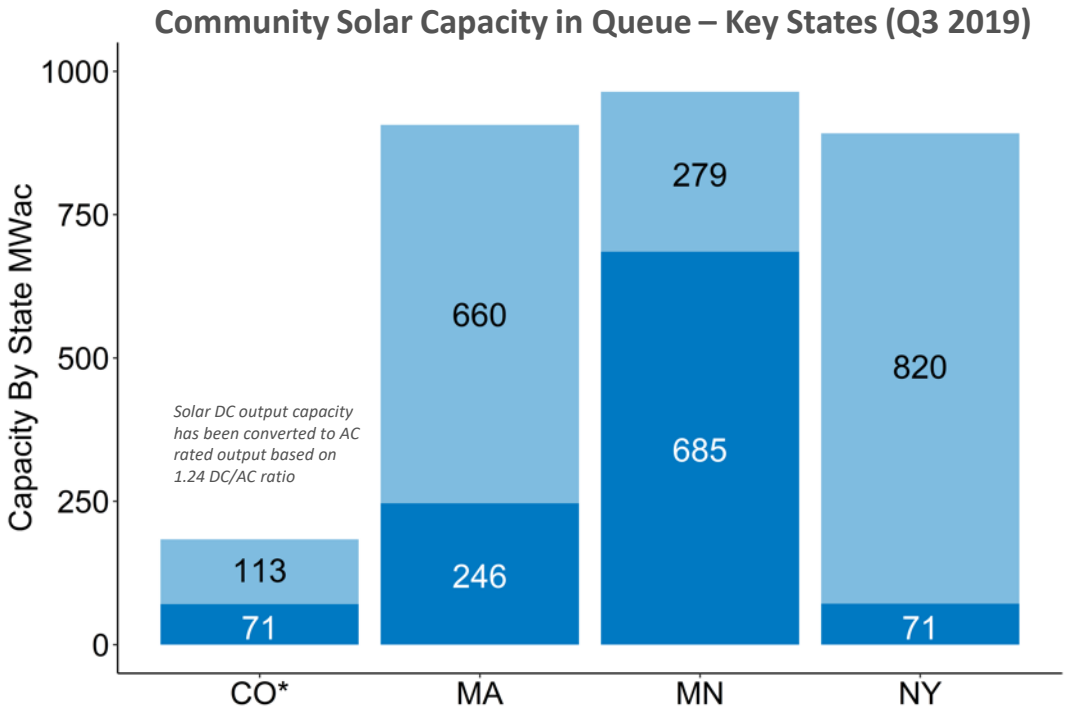
Community Solar Capacity Updates



Data Source: NREL_UMN Community Solar Project Lists

- As of Nov. 2019, about 1.3 GWac of community solar were installed
- While growing, community solar represents a relatively small share of total U.S. solar capacity
  - As of 2019, H1, 69.1 GWdc solar were installed
- MN and MA lead the community solar development and have over 700 MWac projects operational.

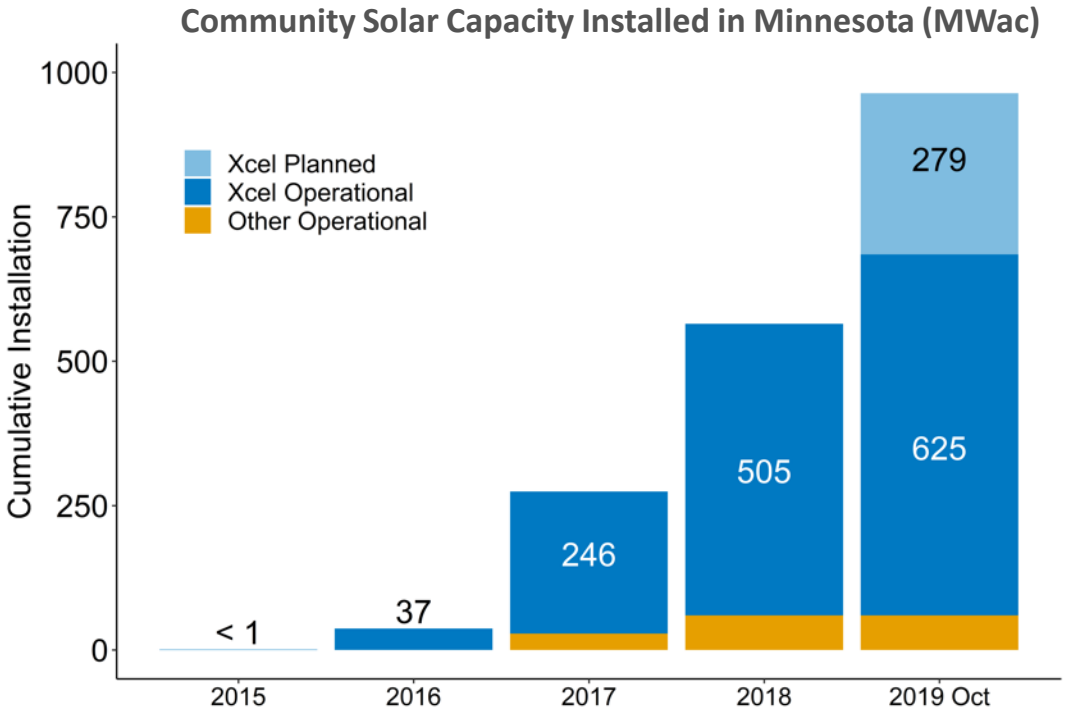
Community Solar Capacity in Queue



Operational data come from the NREL/UMN Sharing the Sun Data List. CO: Colorado installed solar capacity only includes projects under Xcel program; MA: Planned capacities include SREC II (converted to AC) and SMART program; MN: Planned capacities only includes projects under Xcel program; NY: Planned capacities are converted to AC output.*
The solid blue represents the cumulative rated AC power output (MW) for community solar in operation by corresponding year in corresponding state. The semi-transparent blue represent capacity in queue

- As of Q3 2019, four states (CO, MA, MN and NY) have the most community solar capacity in queue
  - ➢ Over 1,800 MWac in queue
- In addition, Florida has submitted petition for approval of 1.4 GW community solar in Q1 2019.

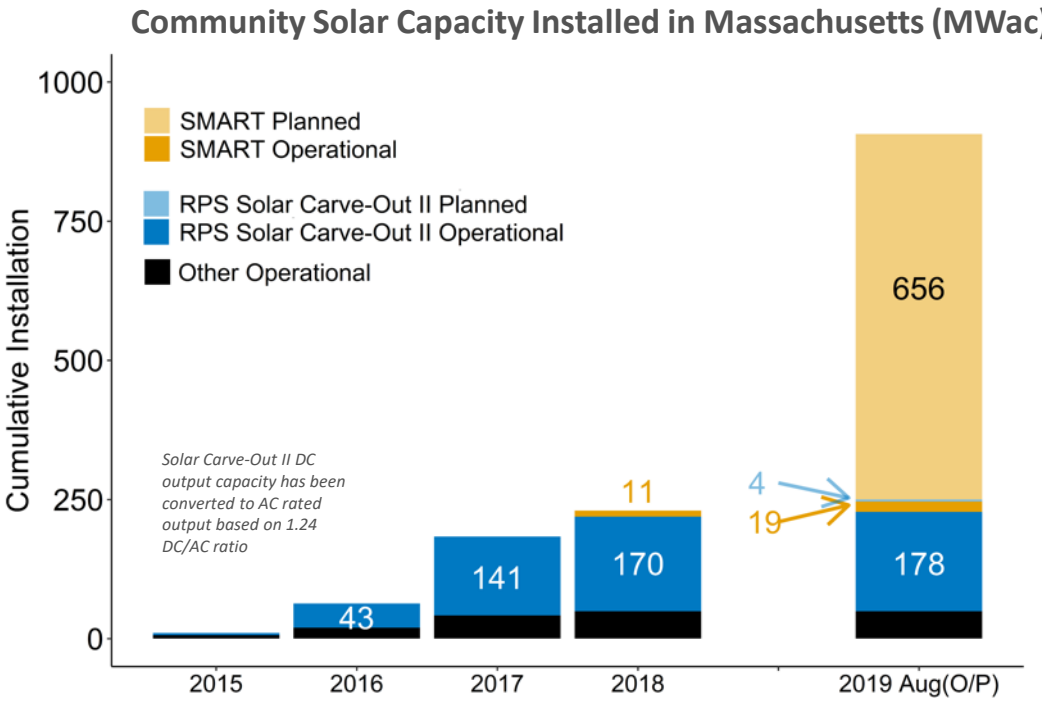
Minnesota's Market is the Largest; Has Significant Capacity in Queue



- Minnesota leads community solar deployment in the U.S., and ranked first in terms of cumulative installed community solar capacity by Oct. 2019
  - Over 680 MWac in operation
- Xcel contributed to the majority of community solar deployment in Minnesota
  - 625 MWac in operation
  - 279 MWac in queue.

Data Source: 2015-2018: NREL/UMN Sharing the Sun Project Lists; 2019 Oct: Xcel Distributed Generation Interconnection Report 2018; Xcel Compliance Filling Monthly Update, DOCKET No. 13-867The planned status includes in construction, in study analysis and in application stage. The solid blue represents the cumulative rated AC power output (MW) for community solar in operation by corresponding year in MN. The semi-transparent blue represent capacity in queue

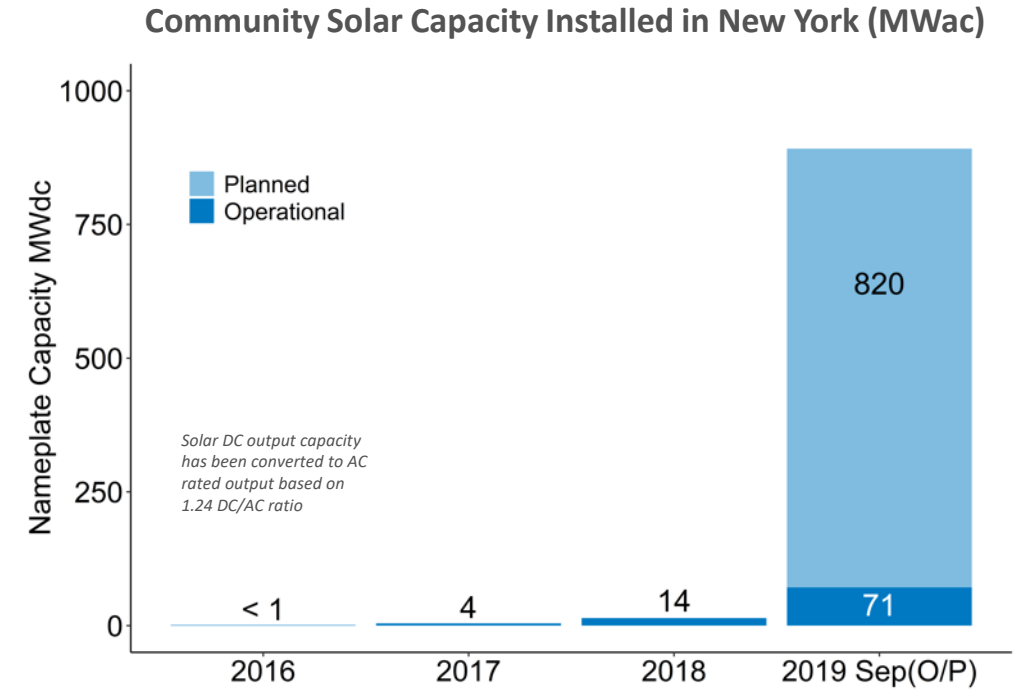
Massachusetts in Transition to SMART Program



- By Aug. 2019, over 240 MWac of community solar projects in operation
  - 656 MWac planned (630 MWac for community shared projects, 26 MWac for low income projects) under the SMART program
- Y/Y growth from 2017 to 2018 slowed down as the state is transitioning from the RPS Solar Carve-Out II program to the Solar Massachusetts Renewable Target (SMART) Program.

Data Source: 2015-2018: NREL/UMN Sharing the Sun Project Lists; 2019 Aug: MA RPS Solar Carve-Out II Renewable Generation Units; Solar Massachusetts Renewable Target (SMART) Application Update *2019 Aug(O/P): Operational and Planned by 2019 August. The planned status includes approval/pending/under-construction. The solid colors represent the cumulative AC output (MW) for community solar in operation by corresponding year in MA. The semi-transparent colors represent the AC output (MW) of planned community solar projects.*

New York has Little Community Solar to Date, but Large Pipeline



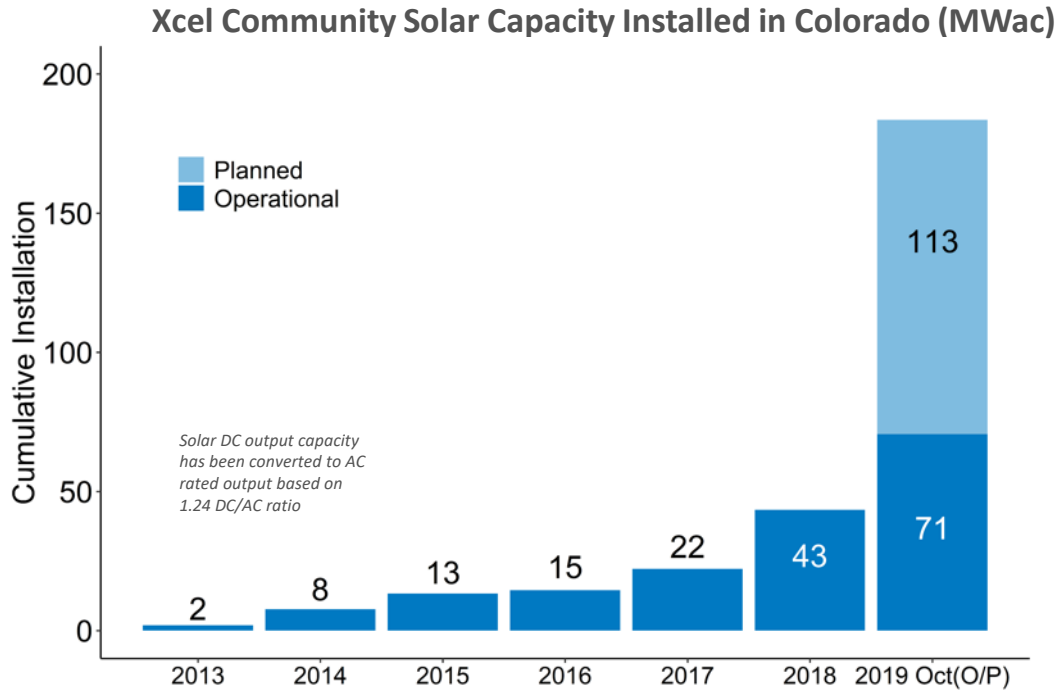
- By Sept. 2019, 71 MWac of community solar projects were operational
  - The New York State Energy Research and Development Authority (NYSERDA) has an ambitious community solar plan
- The community solar pipeline in New York is above 800 MWac.

Data Source: 2016-2018: NREL/UMN Sharing the Sun Project List; 2019 Sep: New York Solar Electric Programs Reported by NYSERDA

The planned status includes approved, pending approved, received and submitted

The solid blue represents the cumulative nameplate capacity (MWac) for community solar in operation by September 2019 in NY. The semi-transparent blue represent the nameplate capacity (MWac) of planned community solar projects.

Colorado Market Grows but Installs are Capped



- By Oct. 2019, over 70 MWac of community solar projects in operation with more than 110 MWac planned
- The Solar*Reward Community program enables solar gardens ranging in size from 10.1 kW to 2 MW.

Data Source: For 2013-2019 operational data: Solar*Rewards RES Compliance Report; For Planned data, planned projects are as of 2018 RFP

2019 Oct (O/P): Operational and Planned by 2019 Oct. The planned status includes approval/pending/under-construction
The solid blue represents the cumulative nameplate capacity (MWac) for community solar in operation by corresponding year in CO. The semi-transparent blue represent the nameplate capacity (MWac) of planned community solar projects.

Thank you.

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NREL/PR-6A20-75982

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Appendix Community Solar State Policies

Legislation Name	State
Virtual Net Metering for Multi-Tenant Buildings	California
Green Tariff Shared Renewables Program - SB 43	California
Green Tariff Shared Renewables Program (GTSR) - Enhanced Community Renewables (ECR) Option	California
HB 1284 - Expand Scope of Shared Photovoltaic Facilities	Colorado
HB 1003 - Concerning community solar gardens	Colorado
An Act Establishing a Shared Clean Energy Facility Pilot Program - SB 928	Connecticut
Community Net Metering Provisions (Order 7946)	Delaware
SB1050 / HB484: An Act Relating to Energy	Hawaii
Community-Based Renewable Energy Program (CBRE)	Hawaii
SB 2814, Future Energy Jobs Bill	Illinois
Net Energy Billing to Allow Shared Ownership	Maine
Electricity - Community Energy-Generating Facilities - Pilot Program - HB 1087 / SB 481	Maryland
Virtual Net Metering as part of Massachusetts Green Communities Act (SB 2768)	Massachusetts
Neighborhood Net Metering (SB 2395)	Massachusetts
Solar Massachusetts Renewable Target (SMART) Program	Massachusetts
Solar Energy Jobs Act (HF 729)	Minnesota
Assembly Bill 465 Establishes provisions relating to solar energy	Nevada

Appendix Community Solar State Policies

Legislation Name	State
Group Net Metering	New Hampshire
Senate Bill 165 Relative to net energy metering by low-moderate income community solar projects	New Hampshire
In the Matter of the Community Solar Energy Pilot Program (Docket No. QO18060646)	New Jersey
PSC Order Establishing a Community DG Program	New York
New York Solar for All	New York
Reform North Carolina's Approach to Integration of Renewable Electricity Generation through HB 589	North Carolina
Section 22, SB 1547	Oregon
Community Remote DG and Community Remote Net Metering	Rhode Island
Shared Solar	Rhode Island
Group Net Metering	Vermont
HB 2547 Electric utilities; net energy metering	Virginia
Community Renewables Enabling Act	Washington
Community Renewables Energy Act	Washington, DC