



Sharing the Sun: Community Solar Deployment, Subscription Savings, and Energy Burden Reduction

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Contents

1. Market Status
2. Impact of Policy and Market Drivers
3. Leading Community Solar States
4. The Subscriber Value Proposition

Market Status

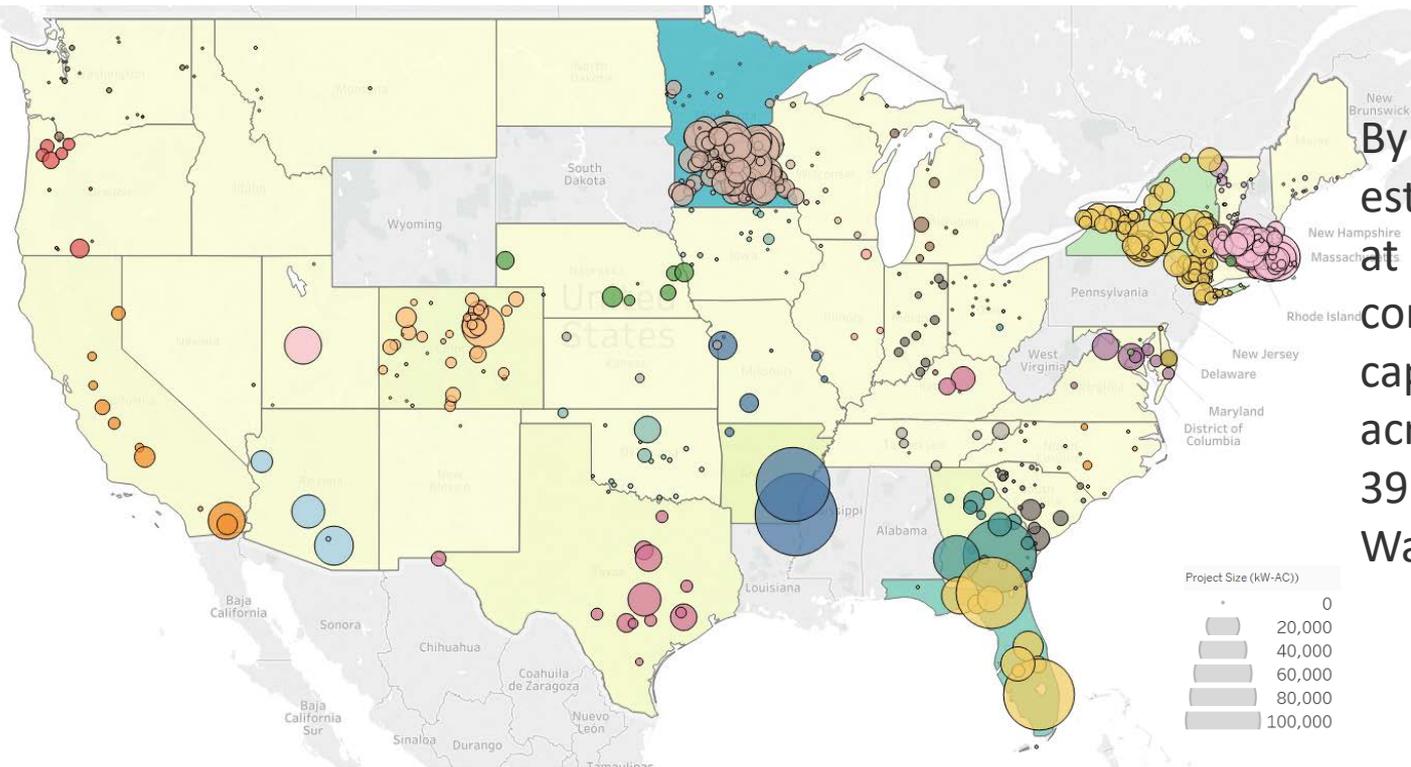
This section summarizes data on community solar deployment over time, by state, and by project characteristics.

What is Community Solar?

We define community solar as

“... a solar installation with multiple offtakers or owners, referred to as “subscribers.” The subscribers enter into a contractual relationship with the owner or operator of the installation (or an intermediary) to receive some or all of the financial returns from a predefined share of the installation’s output.”

Community Solar Capacity by State



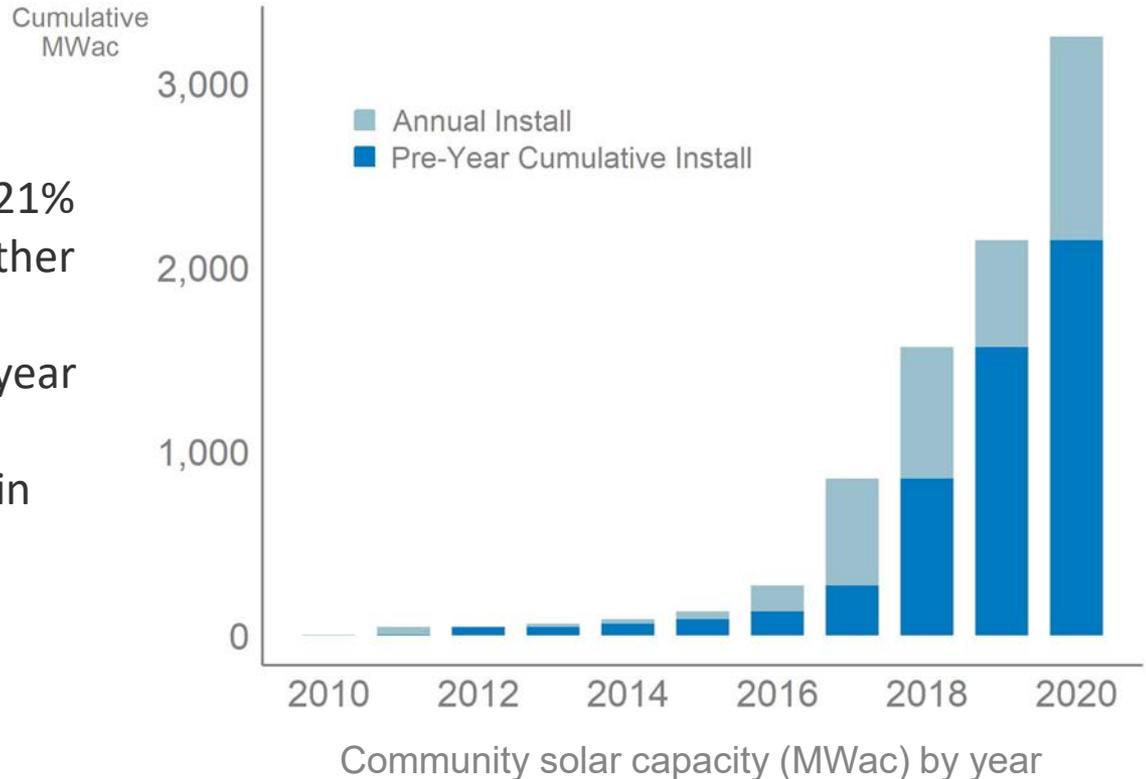
By the end of 2020, we estimate that there were at least 3,253 MW-AC of community solar capacity distributed across ~1,600 projects in 39 states and Washington, D.C.

Community solar projects in the Contiguous United States

Data Source: [Sharing the Sun Project List 2020](#)

The Rapid Growth of Community Solar

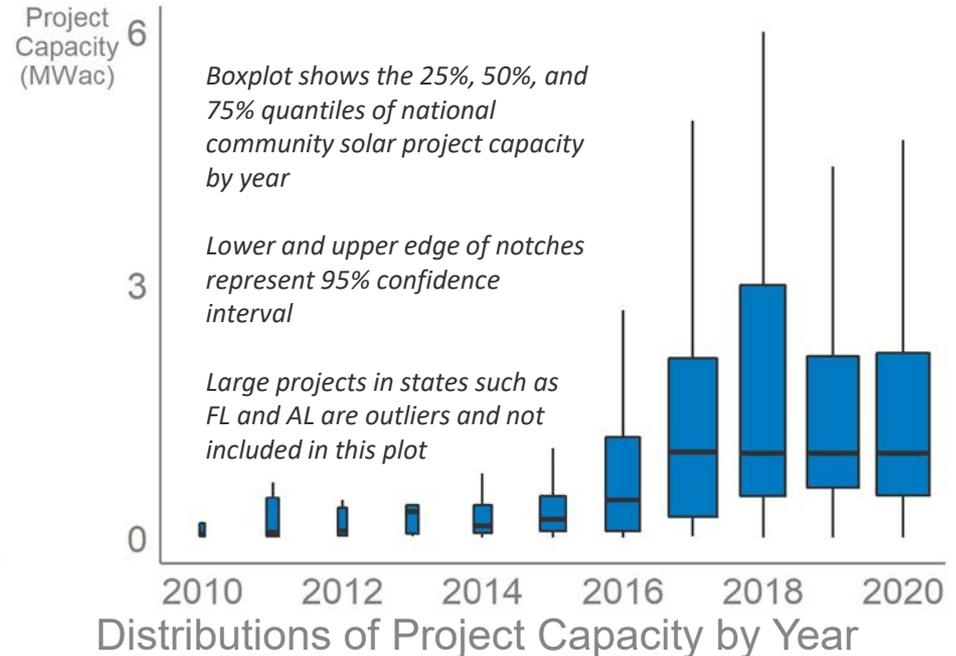
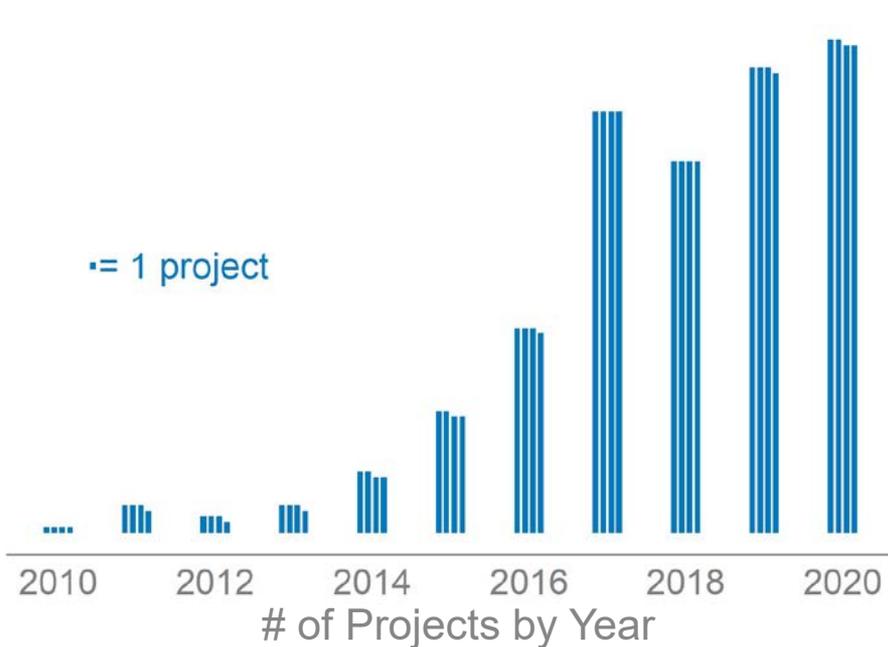
- Cumulative community solar capacity has grown by about 121% year over year since 2010, in other words, capacity has more than doubled on average year over year
- About 1,107 MW came online in 2020 alone.



More and Larger Projects

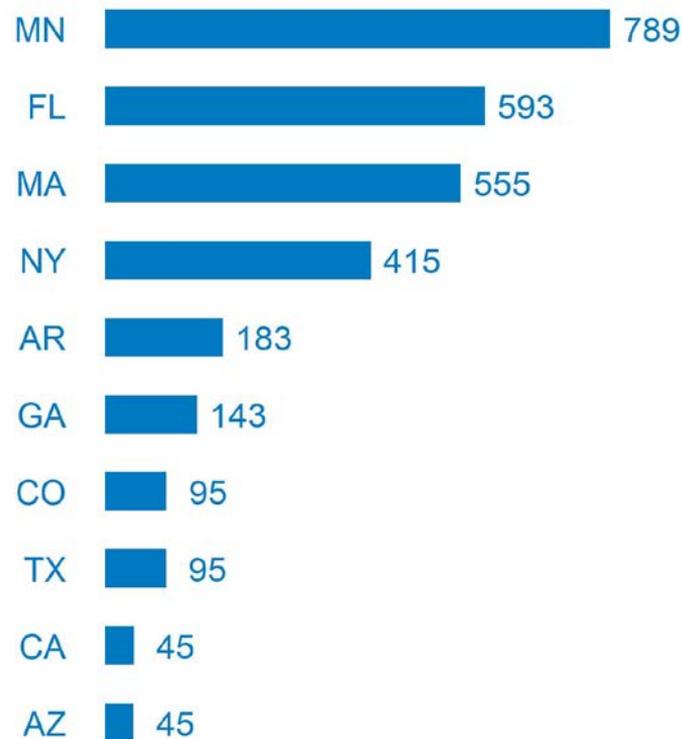
Community solar capacity has increased both because more projects have come online and because projects have generally become larger over time.

Florida and Arizona built large size (over 50 MWac) community solar projects in 2020



A Few Key States Lead the Community Solar Market

- About 91% of cumulative community solar capacity is located in the top 10 states.
- 22 States have installed over 10 MWac projects
- About 72% of cumulative capacity is in just four states: Minnesota, Florida, Massachusetts, and New York.
- Florida saw the most deployment in 2020, with 447 MW installed.

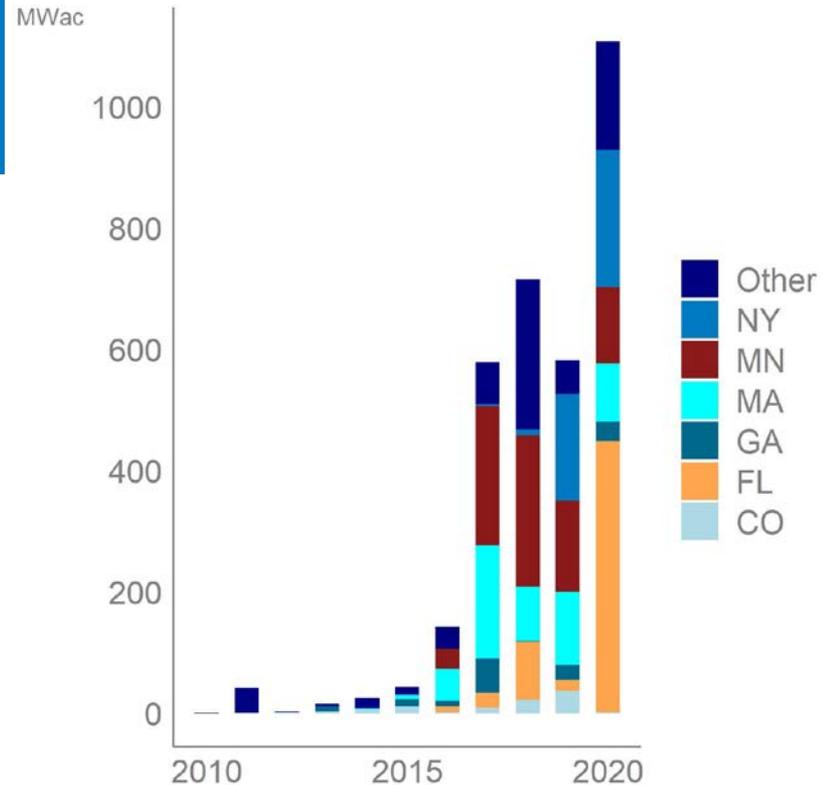


Capacity (MWac)

Cumulative community solar capacity (MW) by state

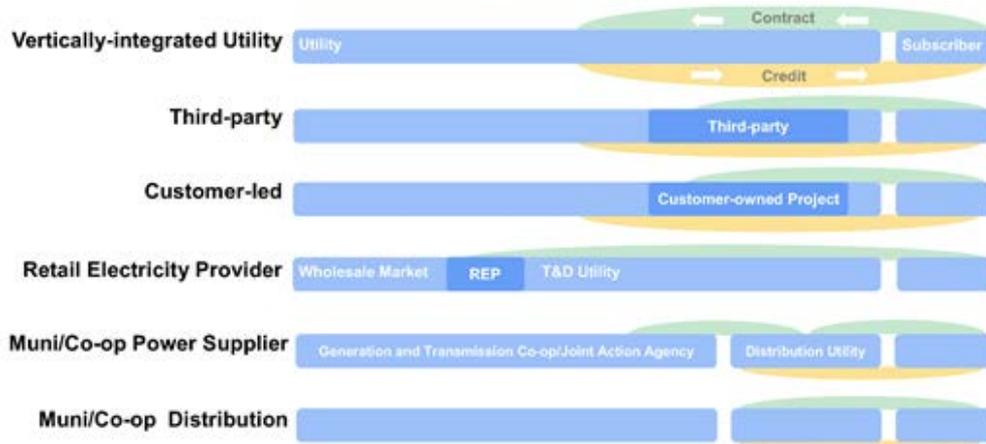
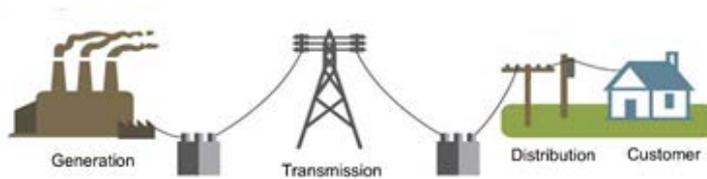
Community Solar Capacity has been Installed in Waves in Different Key Markets

- Colorado was the early state leader, with significant capacity expansions from 2011 to 2015.
- Massachusetts and Minnesota expanded capacity significantly in 2016-2019.
- Leading states are changing dynamically. Florida and New York have emerged as key markets in recent years.



New community solar capacity (MWac) by year and state

Archetypes of Community Solar Ownership(1/2)



Source: Generation, transmission, and distribution graphic adapted from National Energy Education Development Project (public domain)

We identify six archetypes of community solar that emphasize ownership, leading actor type, and revenue/cost flows

Vertically integrated: Connect directly to subscribers, with the business handling both subscriptions and bill credits

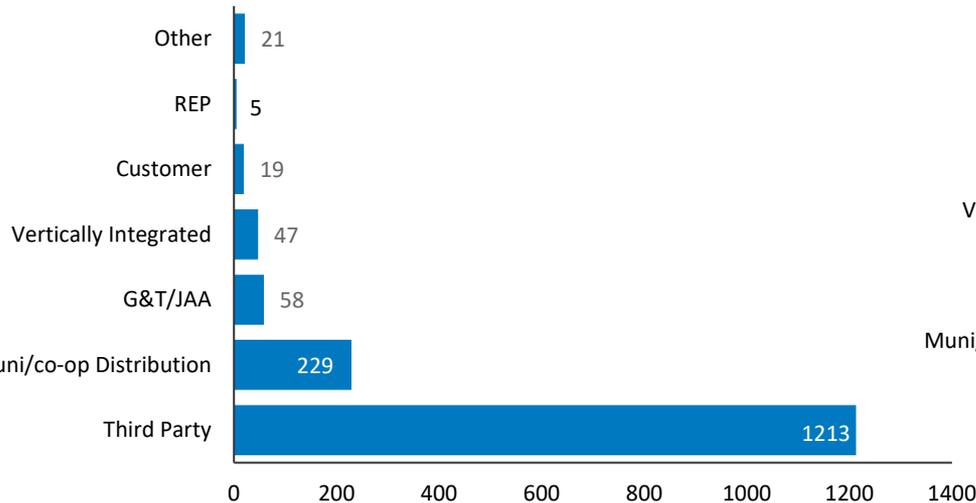
Third-party Lead: Work outside vertically integrated utility organizations at either the generation or distribution level

Customer-led (Customer): Interconnect projects at the G&T or distribution level, managing payments behind the meter.

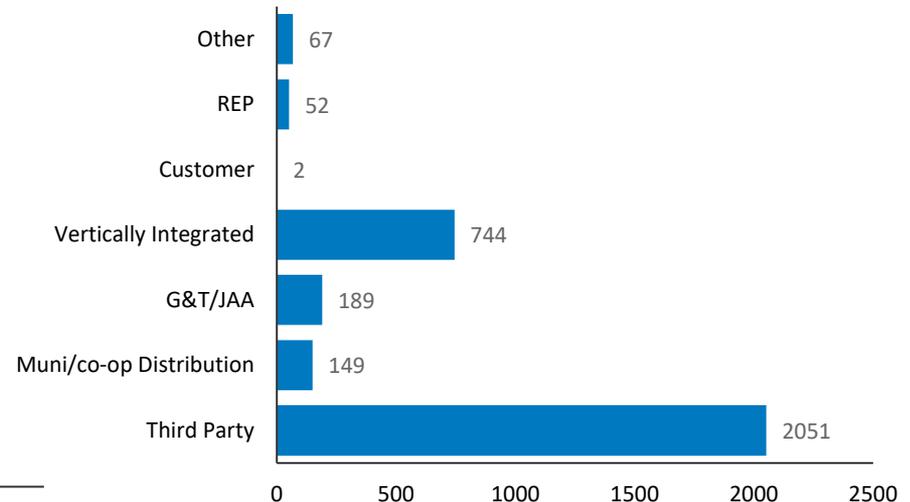
Archetypes of Community Solar Ownership (2/2) -Most capacity (64%) and projects (76%) are developed and operated by third parties

- **Retail Electric Provider (REP):** Work at the interface of wholesale markets and G&T utilities, connecting with subscribers to manage payments and credits
- **Muni/Coop Power Supplier (G&T/JAA):** A generation and transmission (G&T), joint action agency (JAA), or other aggregating organization can collect and then pass through benefits to customers through distribution utilities
- **Muni/Coop Distribution:** A utility owns or operates a community solar array for customer participation, with subscription payments and bill credits flowing between the two levels

Project Number by Archetype



Total Capacity MWac by Archetype

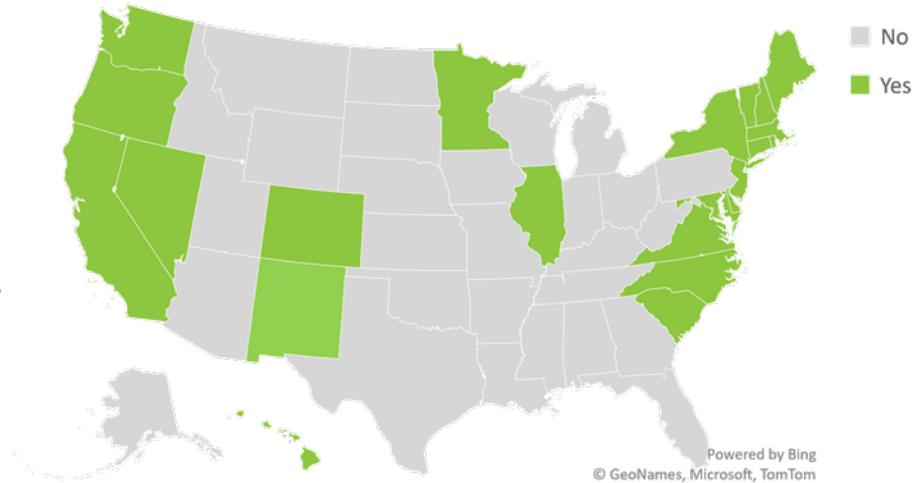


Impact of Policy and Market Drivers

This section discusses how various policy and market factors have shaped community solar deployment.

Community Solar State Policies (1/2)

- 21 states and Washington, DC have passed some form of legislation enabling community solar, either through state-required programs or the authorization of a limited number of pilot projects.
- These programs vary in scope, but they generally all allow for some form of virtual metering that enables subscribers to benefit from their community solar subscriptions

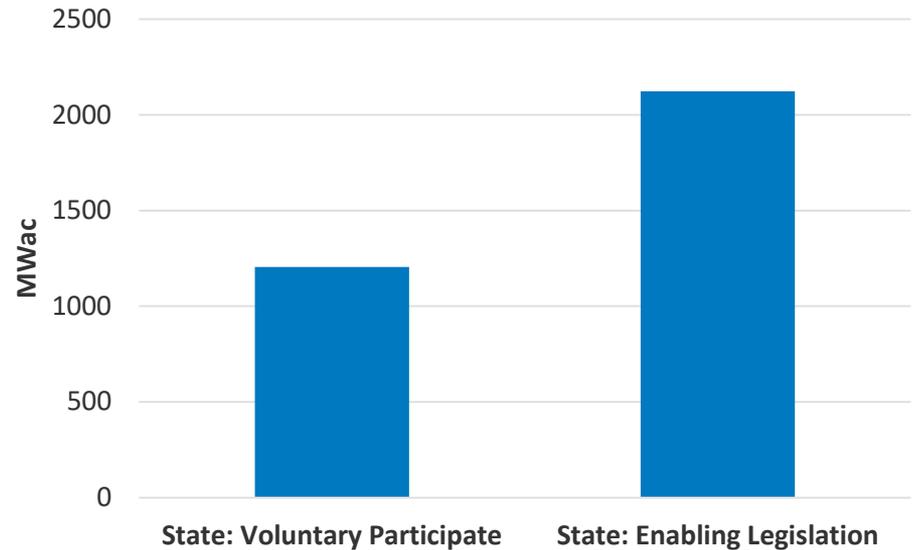


State-level community solar enabling legislation*

* Legislation applies to at least one utility in the state

Community Solar State Policies (2/2)

- Some states currently have limited policy activities regarding community solar.
- FL, AR, GA, and TX voluntarily participates contribute to 80% of Non-enabling legislation state community solar deployment.
- Voluntary community solar market booms in recent years. For example, FL has deployed 560 MWac projects since 2018

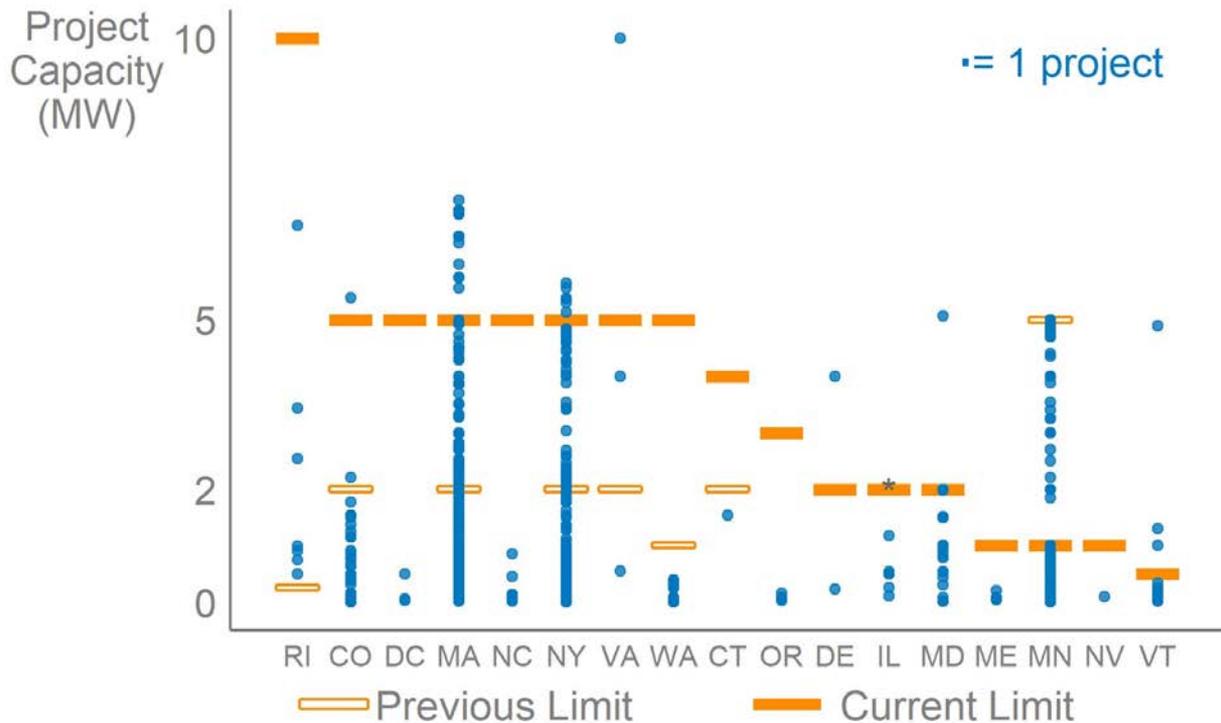


Cumulative Installed Capacity by State with/without Enabling Legislation

* Legislation applies to at least one utility in the state

Some States Impose System Size Caps

- 19 states with projects and Washington, D.C. set a maximum size for community solar projects. NJ (Capped at 5 MW), HI and NH (Capped at 1 MW) have no project online.
- Some states have revised project caps over time.
- In Minnesota, projects were initially co-located up to a 5 MW total cap. Since early 2016, projects could not co-locate beyond the 1 MW cap.



Project capacities compared to state program system size caps

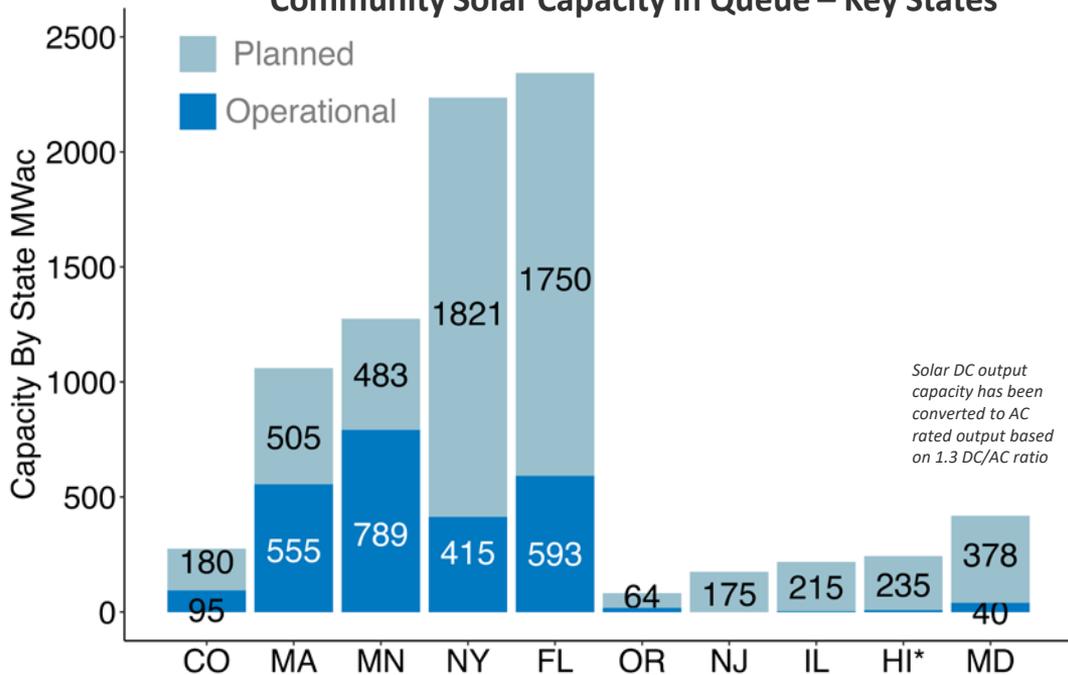
* Based on 2 MW cap of the Adjustable Block Program. Low-income pilot projects can be larger than this cap.

Leading Community Solar States

States with high installed community solar capacity and large amount of projects in queue

Community Solar Capacity in Queue Top States

Community Solar Capacity in Queue – Key States

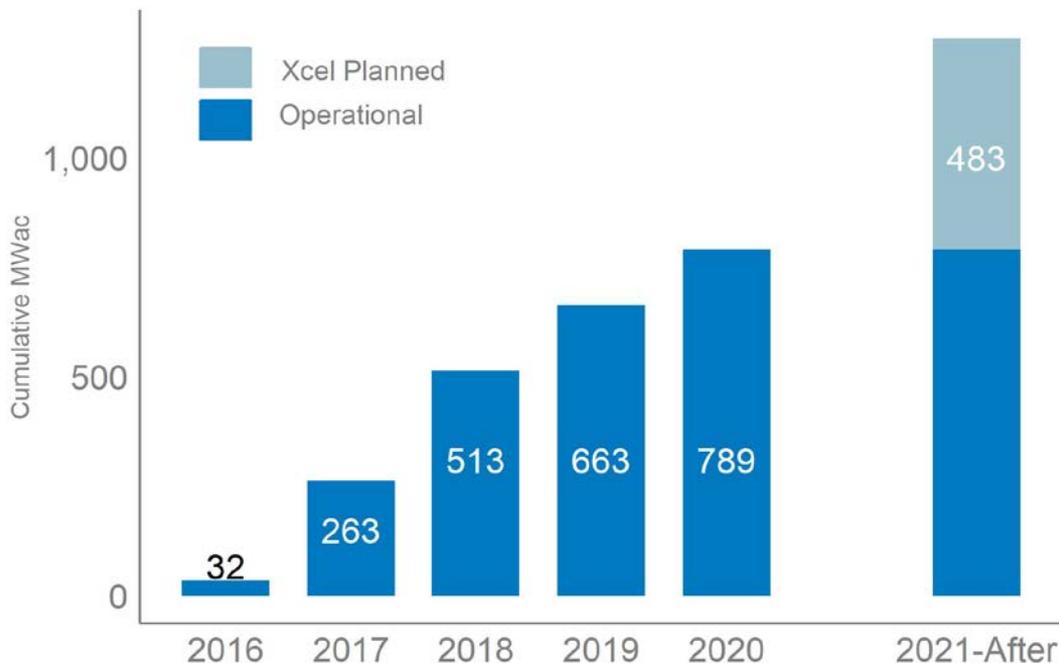


Operational data come from the NREL [Sharing the Sun Project List 2020](#). CO: Planned solar capacities include projects under Xcel program; FL: Planned capacities include FPL and Duke Energy Program; MA: Planned capacities include SREC II (converted to AC) and SMART program; MN: Planned capacities only include projects under Xcel program; NJ: Planned capacities include Phase 1 and Phase 2 Community Solar Pilot Program; IL: Planned capacities include Adjustable Block Program only; HI*: Planned capacities include Hawaiian Electric Community based renewable energy program, assumed AC capacity. MD: Planned capacities include MD Community solar pilot program. OR: Planned capacities include Oregon community solar program. 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 planned

- As of 2020, five States (CO, MA, MN FL, and NY) have the most community solar capacity installed + in queue.
 - Over 4,700 MWac in queue
- MD, OR, NH, IL, HI are implementing state-level community solar programs to increase the markets in their states.
 - Over 1,000 MWac in queue
- “Planned” indicates community solar projects in queue and will be installed thereafter

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

Community Solar Capacity Installed in Minnesota (MWac)



- **Minnesota leads community solar deployment in the U.S., and ranked 1st in terms of cumulative installed community solar capacity by 2020**
 - Nearly 800 MWac in operation
- **Community solar deployment in Xcel Energy's service area contributed to the majority of deployment in Minnesota**
 - 784 MWac in operation
 - 483 MWac in queue

Data Source: 2016-2020: [Sharing the Sun Project List 2020](#); Planned: [Xcel Compliance Filing Monthly Update, DOCKET No. 13-867](#) Xcel projects only. The 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 to be installed in 2020 and thereafter*

Massachusetts in Transition to SMART Program

Community Solar Capacity Installed in Massachusetts (MWac)

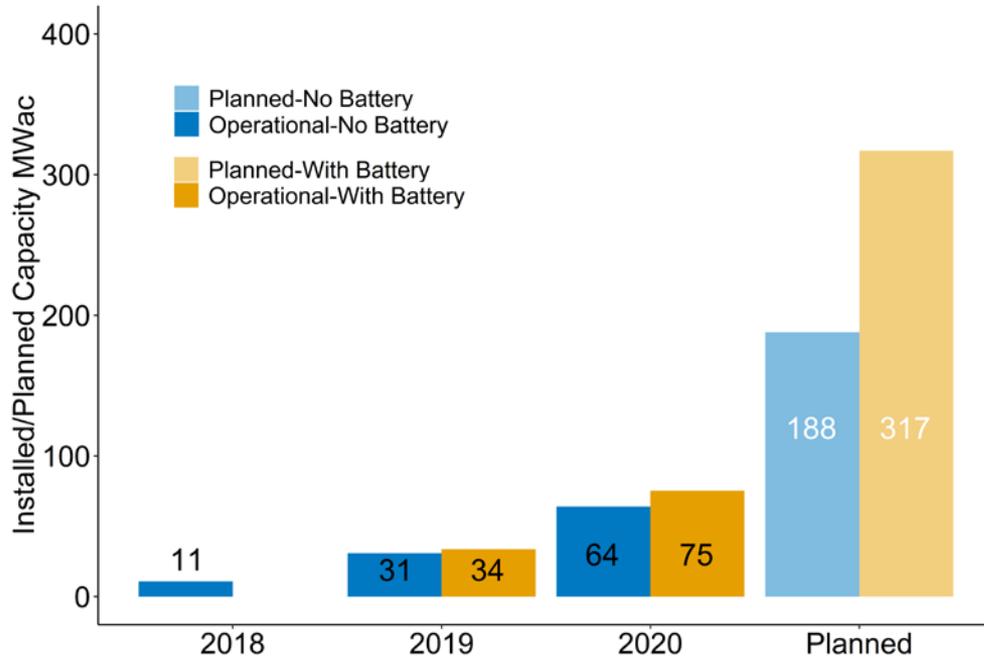


- **By 2020, over 550 MWac of community solar projects in operation**
 - 505 MWac planned (projects “under review” were not included) under the SMART program
- **Y/Y growth from 2017 to 2018 slowed down as the state is transitioning from the RPS Solar Carve-Out II program to the Solar Massachusetts Renewable Target (SMART) Program.**

Data Source: 2015-2020: [Sharing the Sun Project List 2020](#); Planned*: [MA RPS Solar Carve-Out II Renewable Generation Units](#); [Solar Massachusetts Renewable Target \(SMART\) Application Update](#) SMART projects only. 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 (Qualified) community solar projects to be installed in 2020 and thereafter

Pairing Community Solar with Storage in Massachusetts- SMART

SMART Community Solar in Massachusetts (MWac)

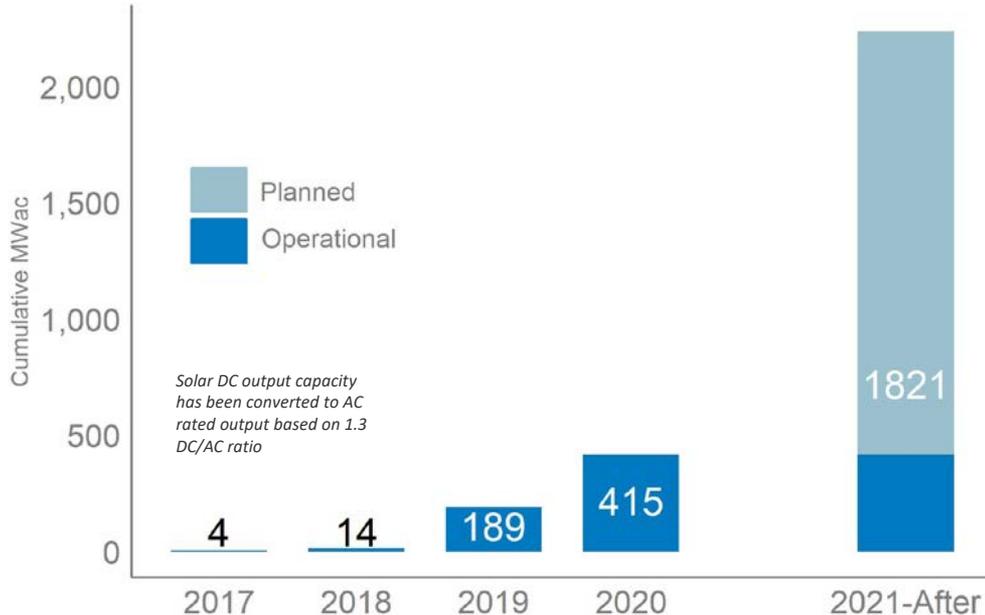


Data Source: [Solar Massachusetts Renewable Target \(SMART\) Application Update](#)

- **SMART program at a glance:**
 - 2 community solar components:
 - 1) community shared and 2) low income community shared
 - added incentive for projects paired with battery storage
- **505 MWac community shared projects are planned under SMART**
 - 317 MW with battery storage (94 projects)

New York has over 400 MW of Community Solar and a Large Pipeline

Community Solar Capacity Installed in New York (MWac)



- **By 2020, 415 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 1800 MWac.**

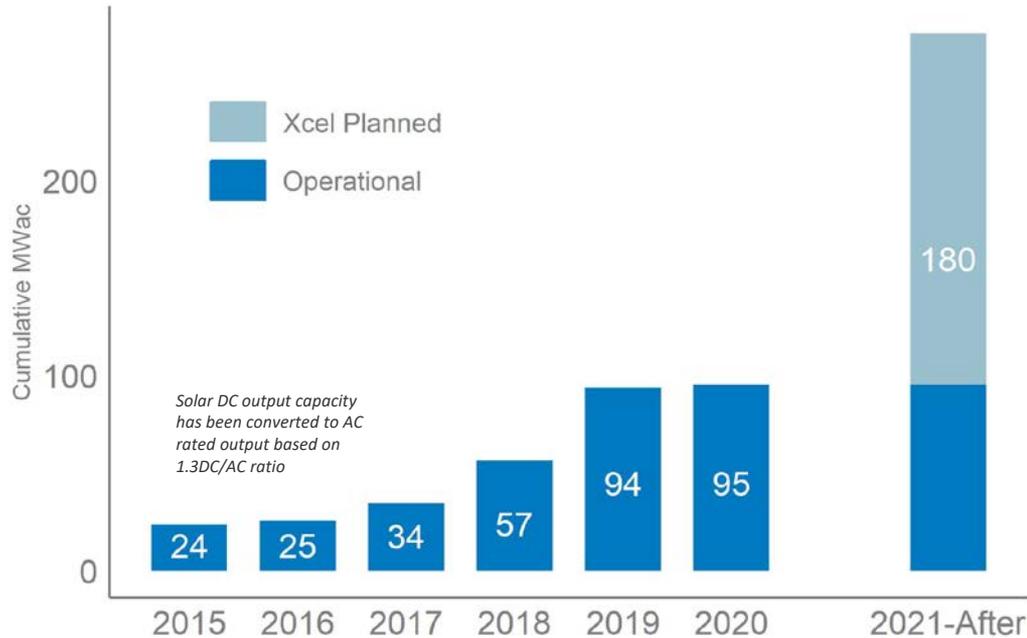
Data Source: 2017-2020: [Sharing the Sun Project List 2020](#); Planned: [New York Solar Electric Programs Reported by NYSERDA](#)

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 2020 in NY. The semi-transparent blue represent the nameplate capacity (MWac) of planned community solar projects to be installed in 2020 and thereafter

Colorado Market Grows, Led by Projects in Xcel Territory

Community Solar Capacity Installed in Colorado (MWac)

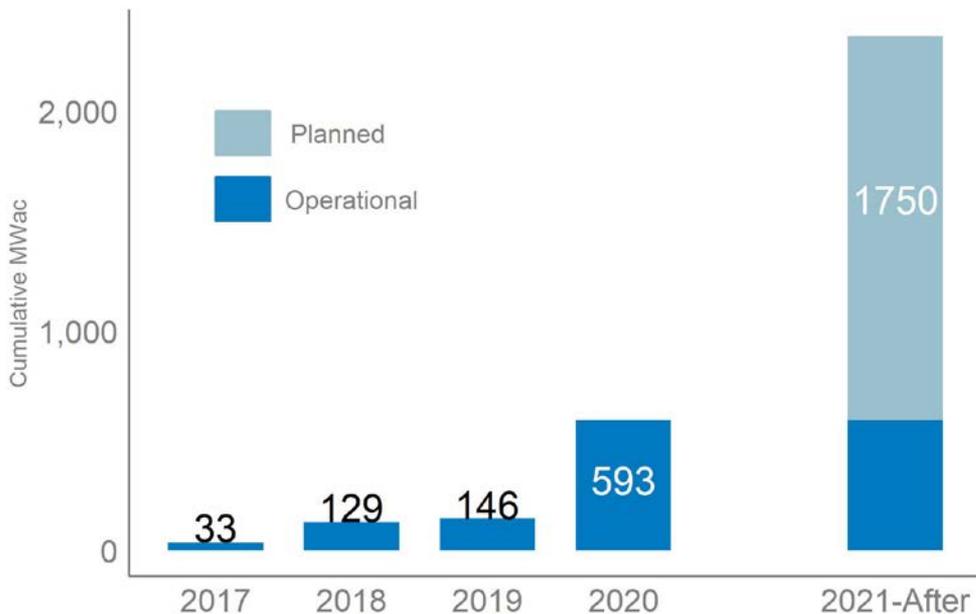


- Xcel Colorado Solar*Rewards Program leads the community solar market in Colorado. By 2019, over **70 MWac** of community solar projects in operation (~80% of total community solar capacity installed in CO) with more than **180 MWac** planned
- The Solar*Rewards Community program enables solar gardens ranging in size from 10.1 kW to 2 MW

Data Source: 2015-2020: [Sharing the Sun Project List 2020](#); Planned*: [Solar*Rewards RES Compliance Report](#); Xcel projects only. 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 to be installed in 2020 and thereafter

Florida Community Solar Takes Off

Community Solar installed in Florida (MWac)



Data Source: 2016-2020: [Sharing the Sun Project List 2020](#); Planned: [Florida PSC Docket 20200176](#) and [FPL Solar Together Program](#). The semi-transparent blue represent capacity in queue to be installed in 2020 and thereafter

- **Florida FPL SolarTogether™:**
 - Florida Power & Light (FPL) has the nation's largest community solar program, with 1.49 GWac projects
 - [First 6 projects](#) with total capacity at 447 MWac achieved commercial operation in 2020, making cumulative installed capacity to 593 MWac
 - ~1 GW remaining
- **In addition, Florida PSC approved a stipulated agreement on Duke Energy's 750-MW Clean Energy Connection (CEC) program**
 - Solar projects are expected to be in service between 2022-2024

New Jersey

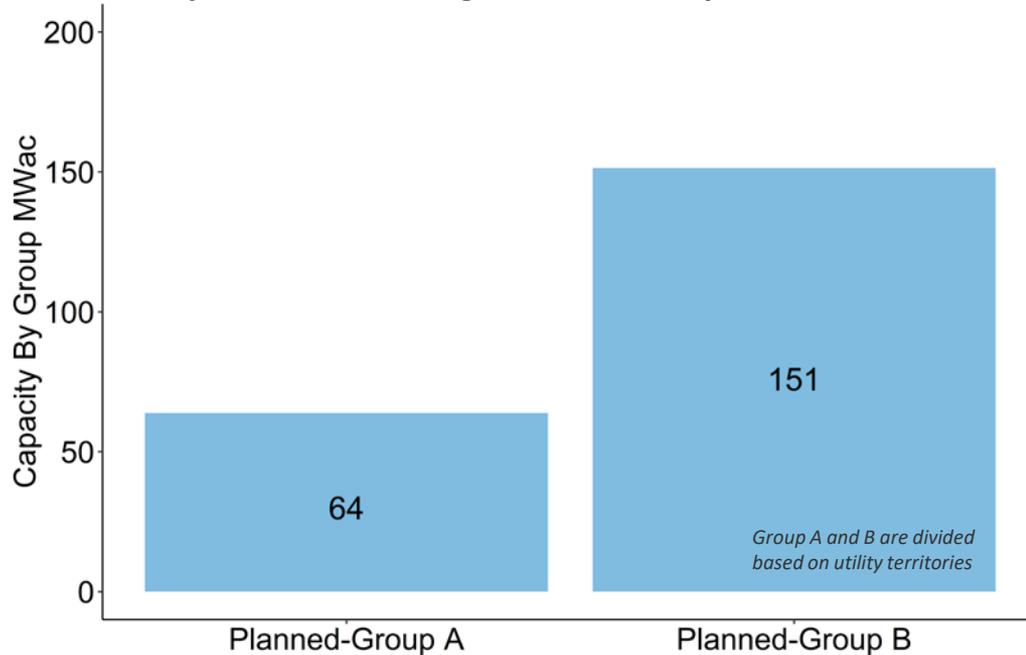
- New Jersey implemented a 3-Year [Community Solar Pilot Program](#) in 2019
 - Year 1: 45 community solar projects representing a total of **77.1 MWdc** [received conditional approval by the BPU on 12/20/19.](#) At least 51% project capacity subscribed by LMI subscribers.
 - Year 2: In planning or development, **150 MWdc** in total. At least 40% project capacity subscribed by LMI subscribers.
- Project size capped at 5 MWdc, co-located projects are allowed

Hawaii

- Hawaii PUC approved the Hawaiian Electric Community based renewable energy program (“[CBRE](#)”) in 2018
 - Phase 1: **8 MW** of capacity have been allocated and under construction. [Two projects](#) with total capacity about 0.3 MW achieved commercial operation.
 - Phase 2: [In progress](#), 235 MW in total open for application

More than 1,500 MW of Community Solar Waitlisted in Illinois Adjustable Block Program

Adjustable Block Program Community Solar Queue in Illinois (MWac)



- The lottery for projects to receive an incentive via the Illinois Power Agency's Adjustable Block Program resulted in more than **200 MWac** of community solar
- An additional ~1,500 MW of community solar was not selected in the lottery process.

*Data Source: For community solar projects in operation: NREL/UMN Sharing the Sun Project List; for planned community solar: [Illinois Power Agency Adjustable Block Program Lottery Results](#)
The planned status in this figure represents community solar projects accepted through the lottery
The semi-transparent blue represent the nameplate capacity (MWac) of planned solar gardens.*

Illinois Low-Income Community Solar Sub-Program is small but growing gradually

- By 2020, IL only has about 3 MWac community solar in service
- Low-income community solar, as a sub-program under the IL Solar for All, **13.6 MWac** projects were selected since 2018. (See [2018-2019](#), [2019-2020](#), and [2020-2021](#) awarded projects)
- In addition, IL launched [Low-Income Community Solar Pilot program](#) in 2019. Projects selected through the Low-Income Community Solar Pilot will receive a \$/REC price determined through a competitive bidding process. The total capacity awarded are unknown.

Maryland and Oregon set Long-term capacity goals

- Maryland launched the [community solar pilot program in 2017](#). This program aims to installed 418 MWac capacity state-wide till 2024.
 - 40 MWac have come online, 378 MWac remaining
- Oregon launched the [community solar program](#) in 2020.
 - Initial program capacity are 161 MWac, and the currently program released 82 MWac (Interim Offering) among three utilities

The Subscriber Value Proposition

Analysis of Subscription Contract Value:
Estimated subscriber value shows that
most subscribers now save money with
community solar

Net Present Value Calculation Methodology

- Residential subscriber contract data are currently matched individually to 403 projects, and 1,037 additional projects are in programs that we model with representative contracts offered in that program
- For each available contract, we built a cash flow model to calculate the net present value (NPV) of the contract. We needed to make assumptions in order to determine the financial value of a subscription contract, including:
 - Annual solar facility degradation factor: low scenario 0.75%, central scenario 0.5%, high scenario 0.30%
 - Annual utility rate escalation: low scenario 1.5%, central scenario 2.5%, high scenario 3.5%
 - Discount rate: low scenario 8.4%, central scenario 6.4%, high scenario 4.4%

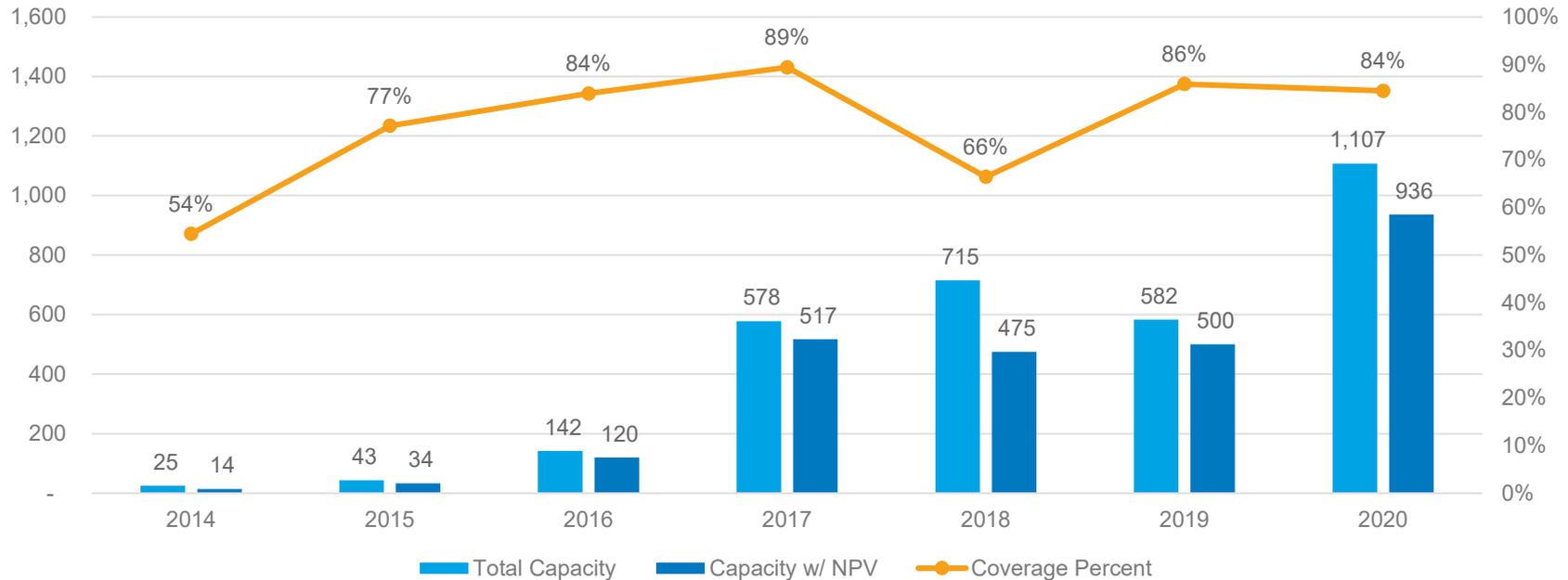
Assumptions used in NPV Calculation Methodology

- Additional assumptions included:
 - Standard contract assumptions: We used standard contract term assumptions (see Appendix) where the contracts did not specify or were flexible within a wide range.
 - Retail rates: We used retail rates from the Utility Rate Database and the Energy Information Administration.
 - PV production: We calculated PV production using the System Advisor Model.
- This methodology is sensitive to future retail rate changes, solar production, and economic variables. We performed sensitivities around these factors, which are presented in the following slides.

NPVs study covered over 70% projects through most years, 81% overall

- Three reasons for missing NPV data: 1) complicated contract, 2) missing contract data and 3) missing retail rates

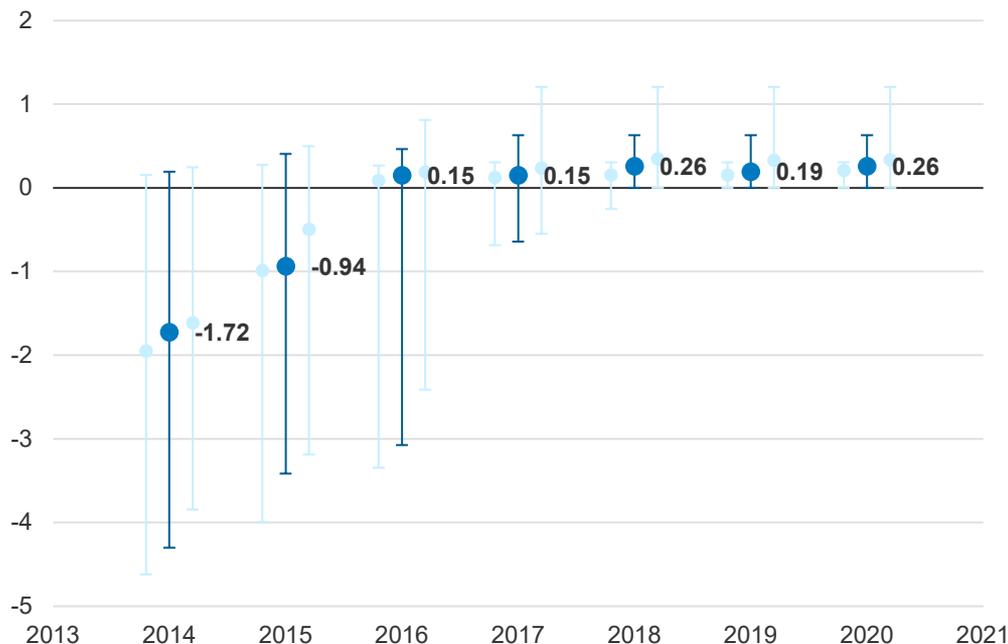
NPV Coverage



NPVs are Increasing Over Time

- The median NPV of subscriptions has been positive since 2016, when state-legislated programs began to rapidly expand
- Virtual metering for programs in CO, MN, MA, and NY after 2017 also increase the overall NPVs

Net Present Value (\$/W)

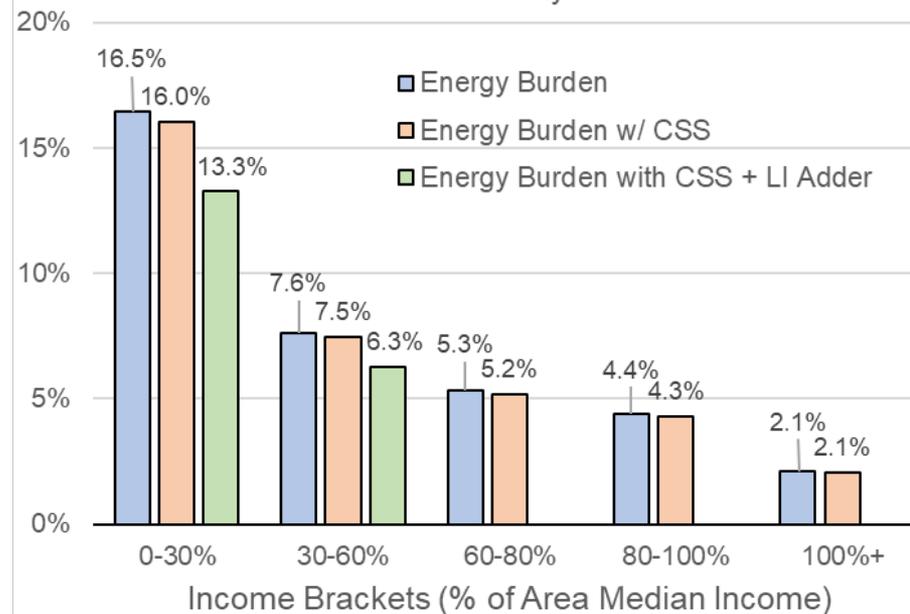


Error bars show p10 and p90. Light blue bars show high and low sensitivities to rate escalation, inflation, and discount rates

Example: Net Present Value of Community Solar in Massachusetts

- The average community shared solar subscription in Massachusetts has a net present value (NPV) of \$0.15/W.
- Translated to an annuity equivalent, the average subscription yields a benefit of ~\$14/kw·yr.
- To cover 100% of average electric load, the average community solar subscription reduced energy burden by ~0.5pp for the lowest income bracket.
- Energy burden is defined as the percentage of gross household income spent on energy costs, inclusive of electricity, natural gas, and delivered fuels and exclusive of transportation
- Including the MA \$0.06/kWh low-income adder to the average subscription, community solar reduces energy burden for the lowest income bracket by ~3.2 pp.

Energy Burden in Massachusetts with and without Community Solar

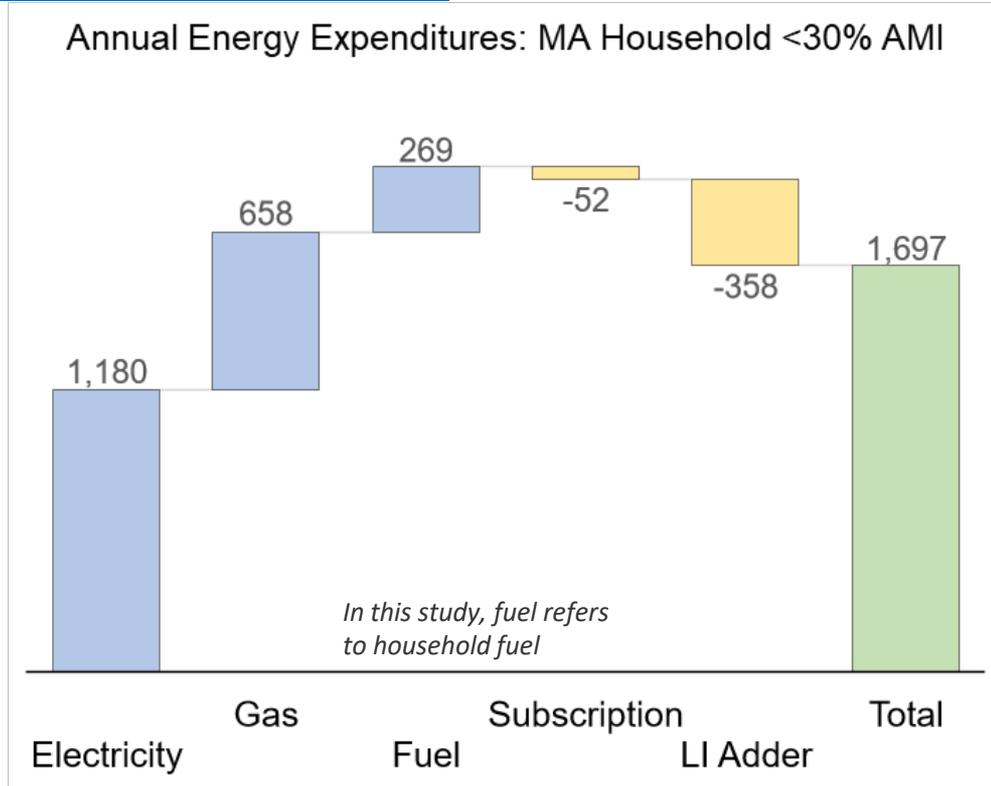


Additional data sources: DOE LEAD tool, EIA-861. Energy burden is shown for the first-year of a subscription with community solar benefits shown as an annuity equivalent with a 7% discount rate. The [MA low-income adder](#) is available to projects with >50% of offtake to subscribers below 65% state median income.

NREL | 34

Example: Impact of Adder on Low-Income Bills in Massachusetts

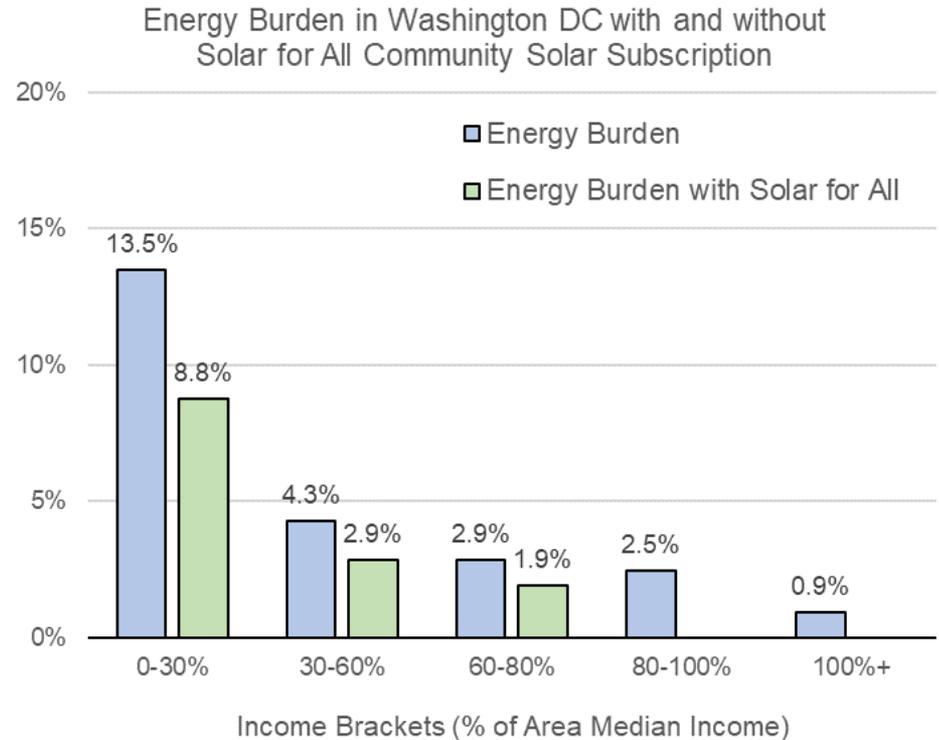
- MA households below 30% of area median income (AMI) have average annual energy expenditures of \$2,107 (\$1,180 in electricity expenditures).
- The average community solar subscription that covers 100% of electricity usage reduces ~\$52/year for low-income subscribers
- If subscriptions are from a project eligible for the \$0.06/kWh low-income adder, there is an additional average benefit of ~\$358/year
- The average subscription with the LI adder reduces average energy costs for low-income customers to \$1,697 (~19% reduction) and average electricity costs to \$770 (~35% reduction)



Note: Electricity, Gas, and Fuel types are determined based on the [LEAD Tool](#).

Example: Impact of Solar for All in Washington, D.C.

- Washington, D.C.'s Solar for All Program offers free community solar subscriptions to households below 80% of Area Median Income
- Subscriptions are set to offset approximately 50% of electricity bills
- Solar for All subscriptions reduce energy burden for the lowest income households from 13.5% to 8.8%.



Value of subscriptions assumes subscriptions reduce 50% of annual electricity costs

Appendix

Net Present Value Calculation

Methodology

- Additional assumptions and considerations include:
 - Multiple contract options: For projects that offered multiple contract options, when conducting analysis weighted by capacity, we used the average value of all contracts offered for that project.
 - Hedge value: We also do not quantify any hedge value that community solar subscriptions can provide (i.e. the value of reduced net electricity payment volatility). Instead, we quantify the expected values of subscription contracts and perform sensitivity analysis around key variables (solar degradation factors, retail rate escalation factors, and discount rates).
 - Retail rates: Retail rates were collected from the Utility Rate Database (URDB) and the Energy Information Administration, when rates were not available in the URDB.
 - Solar production: PV production was calculated using the System Advisor Model using the location of the project or nearest possible location. For projects above 1 MW we assumed 1-axis tracking and for those below 1 MW we assumed fixed tilt.