Community Solar Models and Stakeholder Perspectives

Deliverable for the Energy Office, South Carolina Office of Regulatory Staff
January 5, 2020

This analysis was conducted to meet an immediate need and was based on the best information the analysts had available within time constraints. The data, results, and interpretations presented in this document have not been reviewed by technical experts outside of NREL, the DOE Solar Energy Technology Office. This report is intended to be a starting point for additional research and analysis into solar options and does not constitute a comprehensive roadmap for solar deployment.

Executive Summary

The South Carolina Office of Regulatory Staff, Energy Office, requested assistance from the National Community Solar Partnership in identifying community solar options for the state, and in particular, options that benefit low-income utility customers. A key focus area was on cross-subsidization solutions for community solar programs.

Cross-subsidization: Although concerns are raised in regards to cross-subsidization impacting non-participants, several solutions have been successfully implemented by utilities of varying size in different states. Solutions include: program size limitations, coordinating program growth with generation needs, addressing program start-up funding, developing program charges for subscribers, and identifying opportunities for unsubscribed load. These issues are discussed in Section 3 and examples are provided in Table 1.

Community solar design elements. When developing a community solar program or policy, many different design elements come into play. These include: which entities can own projects, what restrictions are there on the location and size of projects, how will community solar relate to other state goals, how can RECs be purchased for community solar programs, how will customers pay for their subscription, how will low- and moderate-income participation be addressed, and what ancillary benefits might the program or policy encourage. These questions are addressed in Section 4.

Stakeholder perspectives on community solar models. There are multiple stakeholders involved with community solar development: state policymakers, utilities, solar project developers, community solar subscribers, and environmental advocates. Their high-level perspectives are summarized in Table 2 and Section 5. It should be noted that these are general perspectives and that all stakeholders may have their own considerations of particular attributes. Specially speaking, different utility types (investor-owned utilities, municipal utilities, and cooperative utilities) may have different views on how community solar should be implemented

Non-traditional "community solar" designs. Other models for delivering the benefits of solar to customers exist. Section 5 also provides case examples of these different models: Multifamily affordable housing facility participation in community solar, cooperative utility solar projects, and behind the meter solar with a community benefit. Each identified model has a different potential to scale, implementation cost, and need for new regulations.

In sum, this memo serves to educate South Carolina Office of Regulatory Staff, Energy Office on community solar practices and considerations.

1 Introduction

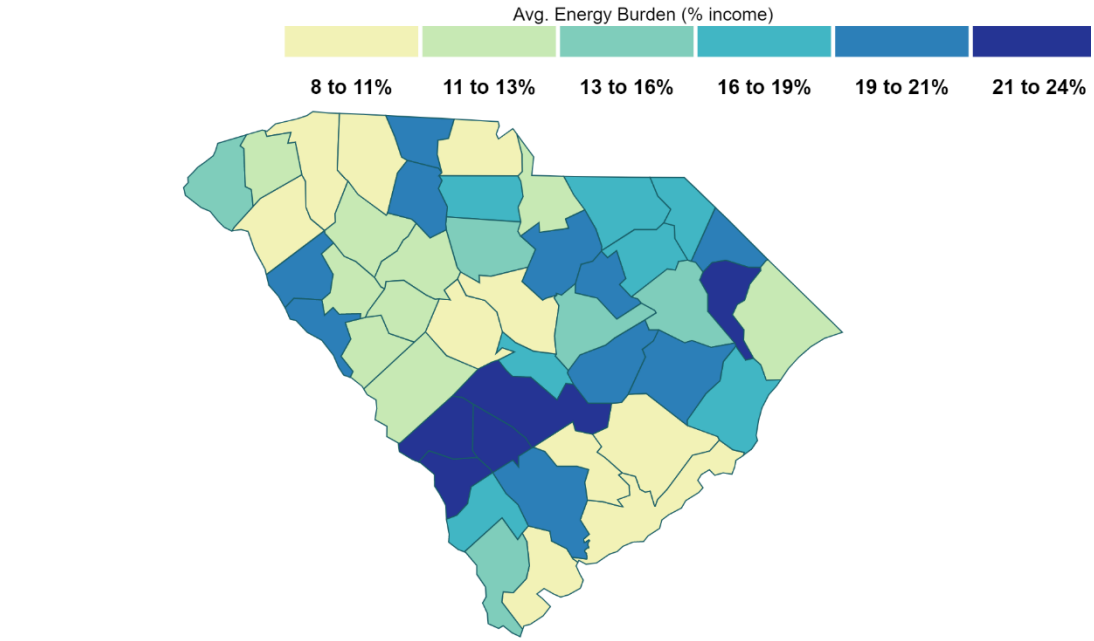
The South Carolina Office of Regulatory Staff, Energy Office was selected to receive technical assistance from the U.S. Department of Energy via the National Community Solar Partnership (NCSP). The NCSP is a coalition of community solar stakeholders working to expand access to affordable community solar to every American household by 2025, funded but the U.S. DOE and implemented by the Solar Energy Technologies Office, the National Renewable Energy Laboratory, and Lawrence Berkeley National Laboratory.

South Carolina Office of Regulatory Staff, Energy Office was selected to receive assistance identifying potential community solar program designs that benefit low-income utility customers. The Energy Office was looking for designs that will take into account Act 62 (the Energy Freedom Act), which allows investor-owned utilities to develop community solar, but does not require them to do so, and its provision that participant costs cannot be borne by non-participants. This document provides examples from other jurisdictions and a framework to evaluate potential approaches for low-income community solar in the state, including options that Investor-owned, municipal, and cooperative utilities could implement.

NREL has identified 31 MW-AC of community solar in South Carolina, located in 22 projects across the state. These projects have been developed by both investor-owned utilities and cooperative utilities. See Appendix A for details on these projects.

South Carolina has a unique context in terms of energy burden and housing stock, which could be used to inform a community solar strategy. While the state average energy burden is 3%, there is significant variability within the region and between income classes. The energy burden for low- and moderate-income (LMI) residents in South Carolina (defined as <60% of the area median income) is as high as 24% in some counties.[1]

[1] https://www.energy.gov/eere/slsc/maps/lead-tool



Low-Income Energy Affordability Data Tool Map Export (https://www.energy.gov/eere/slsc/maps/lead-tool)
Exported On: 10/26/2020
AMI: 0% - 30%, 30% - 60%
Building Age: Before 1940, 1940 - 59, 1960 - 79, 1980 - 99, 2000 - 09, 2010+
Heating Fuel Type: Utility Gas, Bottled Gas, Electricity, Fuel Oil, Coal, Wood, Solar, Other, None
Building Type: 1 unit detached, 1 unit attached, 2 units, 3 - 4 units, 5 - 9 units, 10 - 19 units, 20 - 49 units, 50+ units, Boat/RV/Van, Mobile/Trailer
Rent/Own: Renter-occupied, Owner-occupied

A large number of South Carolina residents also reside in manufactured housing units. On-site solar is difficult to install on these units, thus making community solar a potential solution. In South Carolina, 1 out of every 5 families resides in a manufactured housing unit, according to the Manufactured Housing Institute of South Carolina.[2]

This whitepaper provides a review of best practices for using community solar to provide affordable and equitable access to solar, including creative solutions that may not meet standard definitions of "community solar". For each option presented, NREL will discuss how key stakeholders (e.g. utility, subscriber, solar developer) would be impacted by the option as well as any needed regulatory and legislative actions.

Our "standard" or "traditional" definition of community solar is that it refers to a product where the financial benefits of a single solar photovoltaic array are distributed among an exclusive group of customers that have chosen to subscribe to the program.

2 South Carolina Regulatory Context

Solar development was first encouraged in South Carolina via the Distributed Energy Resource Program Act in 2014. The legislation was collaboratively designed with legislators, utilities, and other stakeholders, and encouraged solar development by requiring utilities to install a solar nameplate generation capacity equal to at least 2 percent of the previous five-year average of the

[2] https://mhisc.com/home-buyer-info/

electrical retail peak demand by 2021.[3] This legislation did not include any community solar provisions, however the investor-owned utilities did provide this option when they developed their solar programs.

The more recent South Carolina Energy Freedom Act (Act 62), implemented in 2019, encourages community solar development, and directs the Public Service Commission (PSC) to promote energy projects for low to moderate income customers. However, the legislation does not mandate any community solar programs. Act 62 also requires participating customers to cover all program costs for community solar programs, ensuring no cross-subsidization to non-participating customers.[4]

Cross-subsidization is a concern when implementing and expanding community solar programs. If not explicitly designed to avoid these situations, program and project costs may be incurred by non-participating customers who may not reap the immediate benefits. However, it is important to note that some of these costs, and benefits, of community solar can be especially difficult to quantify and track. Costs of community solar could include integration and transmission costs for the grid, stranded assets, marketing and administrative, and IT upgrade costs. Benefits of community solar could include contribution towards the state's energy goals, societal benefits, avoided distribution system upgrades, and other system benefits.

3 Cross-subsidization Solutions

Although concerns are raised in regards to cross-subsidization impacting non-participants, there are a number of solutions that have been successfully implemented by utilities of varying size in different states. Interviews conducted by the Smart Electric Power Alliance (SEPA) provide insights into how four investor owned utilities (IOUs) and two cooperatives executed key strategies to overcome these issues across their nine associated community solar projects.[5] Table 1 summarizes the concerns these utilities have faced, as well as the solutions they employed.

3.1 Program Size Limitations

The first tactic to limit cross-subsidization used by utilities is to limit the size of the community solar program, even if temporarily. When a program represents a small proportion of the overall load generated by the utility, the indirect impacts on the grid in terms of integration, as well as the impacts on the non-participating customers, is limited. A small program can also reduce the risks that are associated with unsubscribed loads, generation-load mismatches, and stranded assets as confirmed by Poudre Valley Rural Electrical Association (PVREA) and Rocky Mountain Power (RMP). PVREA has one major voluntary community solar program with two offerings totaling 1.5 MW in Colorado, while RMP operates a single voluntary 20 MW community solar program in Utah.[6,7]

[3] https://www.scstatehouse.gov/sess120_2013-2014/bills/1189.htm
[4] http://www.energy.sc.gov/files/view/SC%20Energy%20Freedom%20Act_summary%2009.012.2019.pdf
[5] https://sepapower.org/resource/striking-the-balance-allocating-community-solar-costs-and-benefits/
[6] https://pvrea.coop/mylocalsolar
[7] Utah PSC docket 15-035-61

Large utilities can benefit from introducing limited capacity pilot programs, with the goal of growing the program using successfully established practices, such as Xcel Energy in Minnesota and their voluntary Renewable*Connect Program.[8]

An alternative to limiting the program size is to accept solar procurements on a rolling basis, based on predicted subscription levels. This approach is currently being used by the IOU Pacific Gas & Electric (PG&E) in California to execute their mandated Solar Choice program, which is capped at 272 MW.[9]

3.2 Coordinating Program Growth with Generation Needs

One approach utilized by DTE Energy, an IOU in Michigan, was to implement their program as part of their broader Renewable Electricity Plan and coal plant retirements.[10] By coordinating their 75 MW MIGreenPower program with the new generation needs, they were able to get their program approved with minimal scrutiny on the risk of stranded costs and unsubscribed generation.[11]

PVREA also acknowledged this coordination, stating that because their utility is generally in need of new generation, they did not consider stranded assets a risk when designing their community solar program.

3.3 Program Start-up Funding

To design and launch a new community solar program, there are costs incurred before the program is launched or any customers have subscribed. These costs can include general program design, billing system upgrades, marketing, and other administrative costs.

1. **Costs borne by subscribers**. PG&E, Xcel, and RMP diligently tracked these costs to ensure they could later incorporate them into rates paid by participating customers. Using this approach, utilities could then recover these costs within the first few years or over the life of the program depending on their program design. Demonstrating that all startup costs can be recovered by the program can help emphasize the viability of the program, enabling program expansion in the future.

2. **Costs borne by all ratepayers**. Other utilities were able to socialize the costs for particular aspects that could benefit all customers of the utility. For example, DTE and PVREA were both able to include billing system upgrades for their programs in a broader IT upgrade. This approach allows both the costs and the benefits from improvements to be spread across all ratepayers.

3. **Costs borne by utility shareholders**. If these costs cannot be easily recovered, California's Office of Ratepayer Advocates recommends any excess program costs recovered be borne by utility shareholders. They also recommend diligently tracking these startup costs, and if necessary, hire separate staff to implement the program or keep

[8] Minnesota PUC docket 15-985
[9] California PUC docket A.12-04-020
[10] https://dtecleanenergy.com/
[11] Michigan PUC docket U-18076

strict tracking of employee hours. Another option is to use specific tracking and balancing accounts to account for all costs, revenues, and credits related to the specific project. [12]

3.4 Program Charges

Larger programs risk introducing program charges for costs that may not be directly attributed to generation used for the community solar program. Programs that are developing renewable energy resources outside of utility's existing generation needs may also risk introducing these type of costs. These may include stranded assets, line losses, and integration costs that could impact non-participants. Xcel and PG&E both introduced program specific charges to quantify these costs and attribute them to participants.

1. **Neutrality adjustment**. Xcel's Renewable*Connect includes a program cost called the Neutrality Adjustment which acts to offset forecasted line losses, curtailment costs, integration, system balancing posts, and the potential for stranded resources.[13] They have implemented the adjustment into their three voluntary Renewable*Connect programs in Minnesota, Colorado, and Wisconsin, which total 200 MW combined.[14, 15] Incorporating this cost allowed the initial program to be scalable without distributing costs to non-participants.

2. **Power charge indifference adjustment**. PG&E utilizes a similar charge to quantify these costs and distribute them to participants of their Solar Choice program, called the power charge indifference adjustment (PCIA). The PCIA reflects potential stranded costs from customers who switch to the Solar Choice Plan and ensures that those customers pay their share of the generation costs required to serve them.[16]

3.5 Identifying Opportunities for Unsubscribed Load

If a project is not fully subscribed to, the unsubscribed load, which is electricity generated by a portion of a community solar installation that does not have a subscriber, poses a potential cost that will also need to be accounted for. Many utilities are approved to pass the costs of unsubscribed load on to all of their customers.[17] However, targeting a specific use for unsubscribed load can help mitigate any potential burden for non-participants of the program. For example, PG&E, DTE, and RMP all use unsubscribed capacity to meet renewable portfolio standards (RPS) requirements. Each MWh of produced capacity can be used towards a voluntary solar offering, or RPS compliance, but not both. However, capacity from a single project can be allocated to deliver a set amount of RECs to each purpose. For this structure to work successfully

[12] https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M084/K893/84893703.PDF
[13]https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={CB545E80-73C0-4342-BD01-96465E189AA0}&documentTitle=201511-115703-01
[14] Wisconsin PSC Proceeding Wisconsin: 4220-TE-102
[15] Colorado PUC Docket 16A-0055E2: Xcel submitted application on January 27, 2016, and entered a non-unanimous settlement agreement on August 15, 2016, which was approved by the PSC on November 9, 2016.
[16] https://www.pge.com/pge_global/common/pdfs/solar-and-vehicles/options/solar/solar-choice/CommunitySolarChoicePlan_TermsConditions_11_2017.pdf
[17] Unsubscribed load refers to a portion of the community solar project that is not serving subscribers.

and gain approval, it is important that the electricity sourced from community solar be competitively priced as compared to other energy sources used.[18]

[18] https://sepapower.org/resource/striking-the-balance-allocating-community-solar-costs-and-benefits/

Table 1. Summary of Key Cross-Subsidization Concerns & Solutions from SEPA Interviews

Utility & State	Direct Program Costs	Stranded Assets and/or Costs	Program Rate Structure	Under-subscription Risk	Start-up Costs & Billing
DTE Energy-Michigan	Customers pay directly for dedicated program resources and the marketing and administration costs for the program.	Program resources were in line with overall system needs (approved as part of DTE's Renewable Energy Plan), which meant there was no risk of stranded assets.	Customers remain on regular rate schedule, which includes generation, transmission, and distribution charges. The program is a rider that includes a rate and a credit. Rate is fixed at $0.072. The credit is variable (changes annually) and was $0.039 in 2019.	Approved to be rate-based. Approved to be allocated to RPS compliance. Small program size also minimizes risk of under-subscription.	Start up costs were tracked and allocated to the program. Billing upgrades were spread across ratepayers as they coincided with larger system upgrades.
Pacific Gas & Electric (PG&E)-California	Customers pay directly for dedicated program resources and the marketing and administration costs for the program. If costs exceed revenue for the program, these costs are borne by PG&E and shareholders. PG&E is required to return any excess revenue at least every five years.	Regulator approved a rate adjustment to cover costs associated with the existing resource portfolio (Power Charge Indifference Adjustment [PCIA]) to ensure costs are not shifted to non-participating customers.	The rate changes every year because the four components making up the total rate change each year. In 2019, the overall charge (minus credit) was $0.0066/kWh for residential customers.	Approved to be rate-based. Approved to be allocated to RPS compliance. Solar procurements for the program are approved based on estimates on subscription levels in order to avoid over-procurement. PG&E was also able to borrow resources from the RPS portfolio to make deliveries early in program.	Start-up costs & billing expenses were tracked carefully, amortized, and will be charged over life of program.
Poudre Valley Rural Electric Association (PVREA)-Colorado	The resource is purchased through PVREA's wholesale provider (Tri-state) for 20 years. PVREA waives the upfront fee for non-profits through to a patronage dividend incorporated into the cooperative model to benefit non-profits. PVREA waives the upfront fee for the PV For All program through a grant from Grid Alternatives.	Not a concern. Program is small, PVREA is seeing load growth, and is incorporated into the contract with their wholesale power provider.	My Local Solar: $48 per panel upfront, plus $3.46 per panel monthly. The program is treated like net metering on the customer's bill. The upfront fee is waived for non-profits. The price was set so as to be cost competitive with rooftop solar. 2. PV For All: No upfront costs, LMI customers receive energy at 30% savings on energy costs.	Not a concern. Wholesale power provider purchases all of the power from the project.	Start-up costs and project development costs were borne by the utility. Billing system upgrades were spread across ratepayers as they coincided with largest system upgrades.
Rocky Mountain Power (RMP)-Utah	Customers pay directly for dedicated program resources and the marketing	Not a concern because program was small relative to overall utility load. However, stranded assets would be a	Each rate class has a separate rate schedule. The rates are comprised of a generation charge, which is	Approved to be rate-based.	RMP provided initial funding (start up costs and billing updates) and these costs were embedded in rate amortized

Utility & State	Direct Program Costs	Stranded Assets and/or Costs	Program Rate Structure	Under-subscription Risk	Start-up Costs & Billing
	and administration costs for the program.	concern for program expansion/future program development.	fixed for the duration of the contract, and a delivery charge which may change over time consistent with changes in non-generation related costs approved through rate cases.		over 20 years (plus interest for capital use of money).
Trico Electric Cooperative-Arizona	Customers pay directly for dedicated program resources and the marketing and administration costs for the program.	Stranded assets were not a concern because the program is very small relative to overall utility load.	Panel purchase option: $920/full panel, $460/half panel, $230/quarter panel. A full panel provides a monthly credit for 36 KWh (currently $11.771 cents/kWh, or roughly $4.25/panel). Monthly option: Customer pays a solar block energy rate that is fixed, and the remainder of their energy rate is variable component. The solar block rate fluctuates depending on the avoided cost rate at the time that the customer signs up, but then it is fixed for the life of the agreement (20 years). Total rate for residential customers with solar energy is currently 14.823 cents per kWh for the first 800 kWh, and 15.823 cents per kWh over 800 kWh.	Approved to be rate-based.	Trico received a grant for almost a million dollars through the American Recovery and Reinvestment Act that allowed them to develop the program.
Xcel Energy-Minnesota, Colorado, Wisconsin	Customers pay directly for dedicated program resources and the marketing and administration costs for the program.	The primary means by which Xcel addressed cross-subsidization is through a component of the pricing structure called the neutrality adjustment (different term used in Colorado). The neutrality adjustment accounts for the costs that might be stranded as a result of customers switching to the renewable energy offering.	Varies by state program, refer to Xcel Renewable Connect webpage for rates.	Approved to be rate-based.	Program administration costs, including marketing, program administration, and cost of any IT infrastructure was tracked separately and charged directly to the program. The costs that were accrued in the first year of the program (to get the program up and running) are expected to be recovered over the first five years of the program.

Source: Smart Electric Power Alliance. *Striking the Balance: Allocating Community Solar Costs and Benefits*. SEPA. 2020. https://sepapower.org/resource/striking-the-balance-allocating-community-solar-costs-and-benefits/

4 Overview of Variables that Impact Community Solar Design

Community solar can be implemented in many ways. This section reviews key design variables and existing experience with them. Additional detail on some topics, along with key terms and definitions is available in A Guide to Community Shared Solar: Utility, Private, and Nonprofit Project Development.[19]

Project ownership: Most commonly, utilities or third-parties will own the community solar asset. Projects can also be owned by nonprofit entities or building owners, though these options are less common. Project ownership can be related to the subscriber organization, but not always. For example, a utility may own a project but hire a separate subscriber organization. Similarly, a third-party might subscribe its own projects or hire a separate subscriber organization. The use of national subscriber organizations has become popular in states where consumers save money by signing up for community solar.

In South Carolina, for investor-owned utilities, the utility is the only organization that can own a community solar asset. Cooperatives and municipal utilities do not have the same restrictions. In some states, legislation has authorized third-party ownership of community solar projects located in investor-owned utility service territories.

Location and size of projects: The *median* project size has increased from 218 MW-AC in 2015 to 2,081 MW-AC in the first half of 2020. However, the *average* project size increased to 10,507 MW-AC for projects developed in the first half of 2020, and Florida Power & Light brought online six 74.5 MW-AC projects. While NREL does not track the location of projects in terms of whether they are interconnected at the distribution level or transmission level, a rough proxy would be to expect projects under 10 MW to be interconnected at the distribution level.

Interconnection Year	Average Project Size (kW-AC)	Median Project Size (kW-AC)	Project Count
2015	618	218	86
2016	969	443	147
2017	1,944	1,013	305
2018	2,740	1,000	259
2019	1,704	1,000	309
2020 (June)	10,507	2,081	49

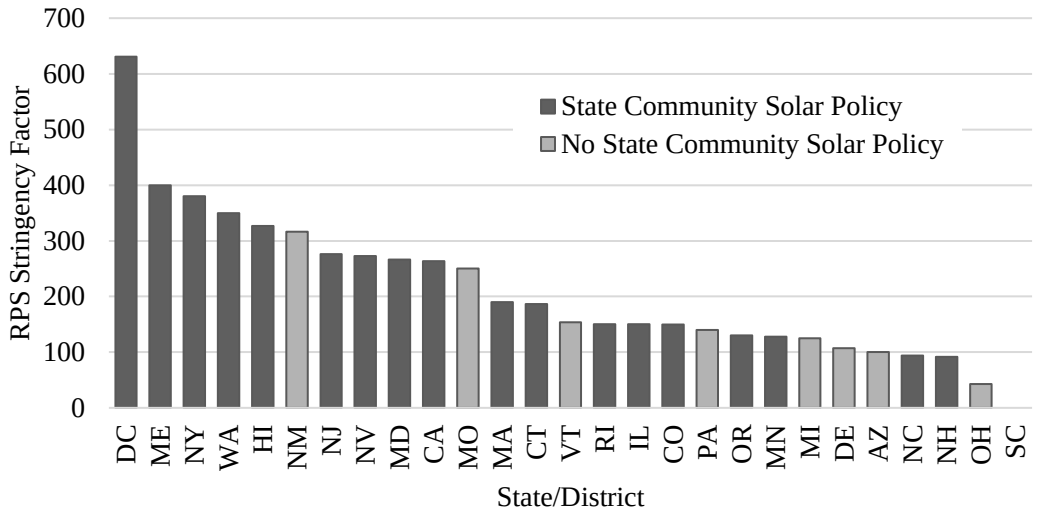
Source: Sharing the Sun (June 2020 release)

Relationship to other goals. States have a variety of energy, environmental, and socio-economic policies. Some states have established a renewable portfolio standard (RPS) or a clean energy standard (CES). In those cases, it is most common that community solar is contributing to those

[19] https://www.nrel.gov/docs/fy12osti/54570.pdf

targets, via an exchange of the renewable energy certificates (RECs) from the subscriber to the utility or compliance entity. In cases where the utility or state does not have an RPS or CES, community solar projects may still allocate the RECs to the utility, though a few programs do provide the RECs to the community solar subscriber.

The figure below shows the relationship between RPS stringency and community solar legislation. Of the 25 states and D.C. with RPS mandates, 70% of them also have community solar policies. Further, nine out of the ten most stringent RPS policies are accompanied by community solar programs. South Carolina is the only state with no RPS legislation that has passed community solar legislation to date. As a result, it does not have an existing framework to procure or incentivize renewable energy generation.



Note: The RPS Stringency Factor is calculated as $(Mandate_{final} - Mandate_{initial})/(Year_{final} - Year_{initial})$

It should be noted that community solar projects do exist in states without either an RPS, CES, or community solar policy. Namely, Florida, Georgia, and Arkansas have seen utilities develop community solar projects; in those cases, the RECs are likely retained by the subscriber as they do not have a market value.

Procuring RECs via community solar programs. States with existing RPS or CES polices have implemented ways to procure RECs from community solar projects. A few examples are illustrated here:

- In Massachusetts, incentives are provided for community solar via the SMART program. The incentive is a combination of a retail rate and the REC and varies by utility, project size, and other factors.

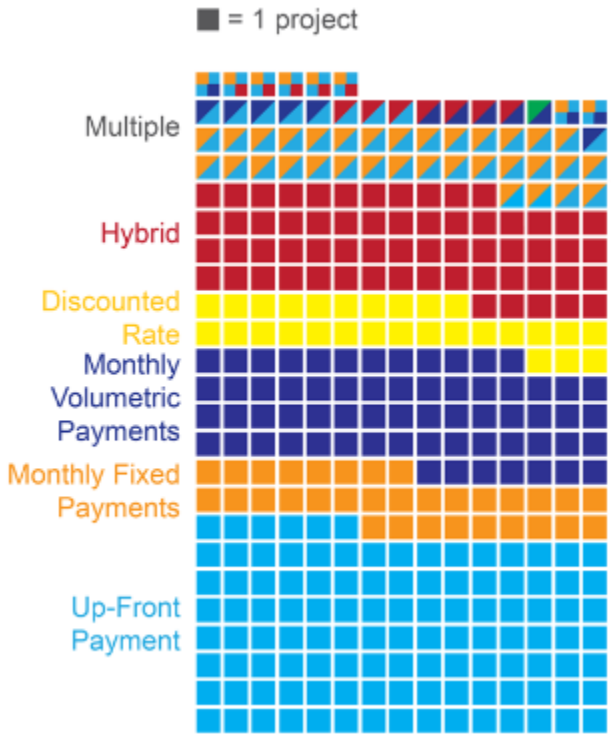
- In Colorado, Xcel Energy is mandated to offer community solar and procures it from third party solar developers via an RFP process.[20]

[20] https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/Regulatory%20Filings/19A-0369E_JWI-3_FINAL.pdf

Subscription structures. A variety of payment terms exist and can be separated into four representative types. Upfront payment asks the subscriber to give a larger sum of money all at once at the beginning of their subscription period, commonly to pay for the use of the entirety or a portion of a solar panel. A hybrid contract may ask for an upfront payment followed by multiple payments. This could look like the cost of part of a panel plus month-to-month electric bill charges. Multiple payments might take the form of a monthly bill. Customers pay a rate for their subscription, commonly a few cents lower than their main electricity rate, and receive the difference as a credit on their monthly bill. Finally, some contracts offer a fixed discount on the customer's electricity rate instead of a payment.

Up-front payments are the most common payment structure, offered in about 50% of projects, followed by a hybrid model that combines different up-front and monthly payments (31%). About 22% of projects offer monthly volumetric payments, while 16% of projects offer multiple payment structures, most commonly a combination of upfront and fixed monthly payments. 9% of projects offered a fixed discount rate.

South Carolina community solar programs are a mixture of this structure. Most used a hybrid structure (14/19 subscription structures identified), with upfront payments ranging from $75-$325 and ongoing monthly payments of $5-25. Other structures (5) identified included the up-front payment, monthly volumetric, or monthly fixed payment model.



Low- and moderate-income participation. States and utilities have found a variety of ways to incorporate LMI participation in community solar. Common approaches are to require a certain percentage of LMI participation (e.g., a percent carve out) or otherwise incentivize it (e.g., via a competitive procurement process that prioritizes LMI subscription). Some examples also exist where a utility will voluntarily create a program that targets LMI customers.

South Carolina's investor-owned utility community solar programs have a carve out for LMI. The programs are full and include a waiting list. Duke Energy's program has 400 kW of a 1 MW project dedicated to LMI customers, and Dominion Energy South Carolina's program has 1 MW reserved for LMI customers.[21]

Ancillary Benefits. Like other solar projects, community solar can be designed to meet other needs, such as resiliency (e.g., by pairing with storage), workforce development, community engagement, and/or strategic siting to provide grid services. Some ancillary benefits of community solar projects have been detailed in a report on the Department of Energy's Solar in Your Community Challenge program.[22] Workforce development practices for low income solar projects have been complied as well.[23]

Some states require utilities to provide hosting capacity maps so that community solar (or any distributed solar project) can be sited in an area with the most available capacity. It is important that these maps be both accurate and regularly updated in order for them to be useful.[24] Community solar projects are different from traditional behind-the-meter projects because the end-user and subscriber differ. For example, with a behind-the-meter project, the project host is also the one benefiting from the bill credit. However, with community solar projects, the project host may not be a subscriber, and the host may or may not have electricity load associated with its site. This provides the opportunity for community solar to be sited for other strategic reasons aside from serving load.

5 Stakeholder Perspectives on Community Solar Models

There are many stakeholders involved with community solar development: state policymakers, utilities, solar project developers, community solar subscribers, and environmental advocates. Their high-level perspectives are summarized in Table 2 and will be further discussed in the following section. It should be noted that these are general perspectives and that all stakeholders may have their own considerations of particular attributes. In particular, different utility types (investor-owned utilities, municipal utilities, and cooperative utilities) may have different views on how community solar should be implemented.[25]

[21] https://illumination.duke-energy.com/articles/how-south-carolinians-share-solar-energy-and-save#:~:text=The%20company%20set%20aside%20400,will%20waive%20their%20startup%20fees. https://www.sceg.com/docs/librariesprovider5/electric-gas-rates/community-solar-rider-to-retail-rates.pdf

[22] https://www.nrel.gov/docs/fy19osti/72575.pdf

[23] https://www.lowincomesolar.org/best-practices/workforce-development/

[24] https://irecusa.org/2020/06/validation-is-critical-to-making-hosting-capacity-analysis-a-clean-energy-game-changer/

[25] For example, the New Mexico distribution electric cooperatives passed a resolution stating their support for community solar legislation that separately addresses cooperative utilities and does not mandate community solar participation.

Table 2. Summary of Stakeholder Perspectives on Community Solar Program Attributes

Stakeholder Type	Project Ownership	Size and Location of Project	Relationship to Other Goals	Subscription Structures	LMI Benefits	Ancillary Project or Program Elements
State Legislator	Might favor investor-owned utility	Might favor least cost PV projects	Might favor allow the utility to keep the RECs	Might favor any design with consumer savings	Might favor a LMI carve out	Might favor workforce development
Environmental Advocates	Might favor third-party ownership	Might favor smaller projects on the distribution grid	Might prefer to have subscribers keep the RECs	Might favor any design with consumer savings	Might favor a carve out or dedicated LMI program	Might favor projects with grid benefits, resilience, storage
Subscribers (LMI and Non-LMI)	Indifferent	Might favor smaller projects on the distribution grid	Might favor allow the utility to keep the RECs	Might prefer fixed-discount	Might favor a carve out or dedicated LMI program	Might favor workforce development
Solar Project Developer	Might prefer being the project owner	Might favor smaller projects on the distribution grid	Might favor allow the utility to keep the RECs	Might favor any design with consumer savings	Might favor no LMI carve out	Might oppose projects or elements that increase cost without providing direct value
Investor-Owned Utility	Might prefer being the project owner	Might prefer least cost PV projects	Might favor allow the utility to keep the RECs	Might favor upfront payment	Varies	Might favor projects with grid benefits
Cooperative or Municipal Utility	Might prefer third-party ownership	Might prefer smaller pilot projects	Might prefer to have subscribers keep the RECs	Might favor upfront payment	Might favor a default supply for all customers	Might favor projects with grid benefits

Note: These perspectives are general in nature and may not reflect individual organizations' perspectives.

5.1 Utility-Run Program with a Low-Income Participation

Utility-run programs can be either mandated by the state or offered voluntarily. The utility may build community solar projects itself or have third-party developers develop the projects.

LMI subscribers can be included in a variety of ways as well, including via mandatory participation, incentives, or some other means.

1. **Voluntarily offered utility program.** Austin Energy, a publicly owned utility, was directed by the Austin City Council in 2010 to achieve 200 MW of solar power by 2020.[26] The utility voluntarily offered its Low Income Community Solar Project beginning in 2018, which was not a part of the original solar directive. The municipal utility has 2.8 MW of community solar currently and plans to expand by 1.5 MW. The project has a 50% low-income carve out. Customers keep the RECs and pay a fixed-rate for the community solar that replaces the fuel charge on their bill for 15years. The current community solar rate is $0.0427/kWh for standard customers and $0.0277/kWh for eligible customer assistance program (CAP) customers, compared to the current fuel charge of $0.02895/kWh.[27] Austin Energy has committed to continue providing these types of benefits to limited-income communities and communities of color by ensuring access to the affordability and dependability benefits laid out in their 2030 Climate Protection Plan. [28]

2. **Mandated community solar program with a carve out or dedicated LMI projects**. Colorado's Community Solar Gardens Act passed in 2010, requiring a low-income carve-out for community solar projects for the state's investor-owned utilities.[29] Rules currently allow projects up to 5 MW in size to be developed by third parties; projects are competitively selected through an annual RFP process managed by Xcel Energy. There are about 100 MW installed as of Fall 2020, with about 100 MW in development. Subscribers are awarded a bill credit based on their average retail rate less transmission and distribution charges, which equates to approximately $.0.075/kWh for residential subscribers and $0.065/kWh for commercial subscribers.[30] LMI customer participation has evolved over time; initially each project was required to subscribe 5% of its capacity to LMI customers. Developers and others were not happy with this approach, and subsequent changes have allowed Xcel to manage capacity that is 100% dedicated to LMI subscribers.

3. **Mandated community solar program with utility ownership of LMI projects.** In Hawaii, the Community Based Renewable Energy (CBRE) rules for Phase 2 implementation allow the investor owned utilities including Hawaiian Electric Company and its subsidiaries to operate 9 MW, of which 50% must serve LMI customers.[31] Phase 1

[26] https://austinenergy.com/wcm/connect/b08ba414-ce2f-43f8-a78b-676c5583ed73/ourEnergyRoadmap.pdf?MOD=AJPERES&CVID=n89qGZ9
[27] https://austinenergy.com/ae/green-power/solar-solutions/for-your-home/community-solar
[28] https://austinenergy.com/wcm/connect/6dd1c1c7-77e4-43e4-8789-838eb9f0790d/gen-res-climate-prot-plan-2030.pdf?MOD=AJPERES&CVID=n85G1po
[29] https://leg.colorado.gov/sites/default/files/images/olls/2010a_sl_344.pdf
[30] Xcel Energy presentation 9/15/20.
[31] https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A19H20A90614D00155

of the mandate was originally implemented in 2017. Phase 2 was approved in April 2020, and currently the companies are in the process of drafting their request for proposals (RFPs). [32]

5.2 Multifamily Affordable Housing Facility (MAFH) Participation in Community Solar

Community solar programs seeking inclusion of LMI subscribers can provide a role for multifamily affordable housing facilities. Because these properties have an inherent set of LMI tenants, they can help streamline solar access for LMI customers. Affordable housing facilities can participate in community solar or community-solar like projects in a variety of ways. Often the type of participation depends on whether tenants pay their own electricity bills.

In some cases, these models would need to see changes in South Carolina's existing programs in order to be implemented. MFAH can provide a host site for community solar, fulfil a subscriber role, or install a net metered solar array. Under current South Carolina regulations and programs, an on-site net metered array is the only option currently available. Participation options include:

- Building subscription to community solar array for common spaces
- Tenant subscription to community solar array for their own electricity bills
- Building installs solar on its rooftop or other spaces and net meters the system; cost savings can be passed on to tenants via property improvements.
- Building hosts a community solar project on its facility

The Denver Housing Authority, a quasi-municipal corporation, was the first housing authority to develop, own and operate a community solar garden. They did so through their voluntary CARE project, which is a 2 MW community solar project serving 100% low-income customers. Denver Housing Authority is able to subscribe 500 homes to the project.[33]Some residents receive direct bill reduction (close to 20%), while others are not able to do this, because they do not pay their own electricity bills. Several housing authority residents also received job training benefits.[34] To use this model in South Carolina, the utility would need to offer a community solar program that allowed participation by a housing authority. For residents to get a bill credit, they will need to 1) pay their own electricity bill, and 2) the utility must have some form of metering available to provide the bill credit.

Other examples exist of multifamily properties hosting solar projects. While not traditional community solar, hosting solar on multifamily properties can provide some of the benefits of community solar. Preliminary analysis by NREL suggests that more than 2,600 multifamily

[32] https://puc.hawaii.gov/energy/cbre/
[33] https://www.usgbc.org/sites/default/files/2020-02/DHA%20Case%20Study%20October2019_1.pdf
[34] https://www.lowincomesolar.org/dha-community-solar-project-keeps-housing-affordable/

affordable housing buildings across the country have solar installed on them. These buildings have more than 200,000 units.

Most of the buildings are located in California, likely the result of the state's Multifamily Affordable Solar Housing (MASH) Program, which provided an incentive to solar projects on multifamily affordable housing (MFAH) facilities. In June 2019, the program was replaced by the Solar on Multifamily Affordable Housing (SOMAH) Program, which utilizes cap and trade funding streams directed from the electric investor-owned utility's Greenhouse Gas Auction Proceeds. This funding source allows $100 million to be directed towards subsidized solar energy systems on MFAH each year, substantially increasing the funding granted through the MASH program. The program focuses on brining solar to the state's most disadvantaged communities, identified through the CalEnviroScreen.[35] South Carolina would need to identify a funding source in order to replicate this model. Funding sources could include state general funds, ratepayer funds, or grant funds.

5.3 Cooperative Utility Solar Projects

Cooperative utilities may have a different view on community solar, as their subscribers are also owners of the utility. Because of this unique relationship, some cooperatives have begun adding more solar to their supply, often calling the projects "community solar" or "shared solar," though they do not use a subscriber-model. Many cooperative utilities have high proportions of LMI customers, allowing them to make the case that their solar projects are benefiting LMI without the need of a specific focus on LMI subscription.

Cooperative implementation of community solar can be complicated by the cooperatives' contracts with their generation and transmission (G&T) provider. Typically, G&T contracts will limit the amount of self-generation (by the cooperative) that can occur.

In South Carolina, Santee Cooper (also known as the SC Public Service Authority) is the main G&T provider for the electric cooperatives. There is a limit to the amount of generation the cooperatives can provide themselves. Central Electric Cooperative has worked in cooperation with Santee Cooper on their community solar projects. Through this partnership, 5 MW of solar were developed, at 20 different cooperatives. Some of these projects were structured as community solar, using a subscription model. Central Electric helped distribution members determine pricing for subscriptions, if they were interested. Going forward, Central Electric will likely source from large, utility scale solar projects, noting that industrial customers are interested in this option and customers prefer the economies of scale from utility scale projects.[36]

One example of cooperative solar is Green Power EMC in Georgia. Green Power EMC, a nonprofit organization, has 72 MW of solar, which it sells to more than 30 member cooperatives. Some of those cooperatives in turn offer a "traditional community solar" product.[37]

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[35] https://calsomah.org/about

[36] Conversation with Cole Price, Vice President, Member Services, Central Electric Power Cooperative, December 1, 2020.

[37] https://www.prnewswire.com/news-releases/green-power-emc-to-significantly-expand-its-solar-energy-portfolio-with-construction-across-four-georgia-locations-300668713.html

More broadly, the National Rural Electric Cooperative Association found in 2018 that 198 cooperatives (nearly a quarter of their membership) offered community solar to their members, up from just 19 in 2013.[38]

5.4 Behind the Meter Solar with Community Benefit

Where community solar is not enabled in state environments, there is interest in sharing any savings an organization might get from installing a solar project on their property ("behind the meter"). For example, if the organization is saving 10% on its electricity bill by installing solar, could they take those savings and pass them along to the community? Or, more in line with the community solar model, could they have individuals fund the solar project and pass savings along to them? No clear model here exists, and there may be tax or legal implications that should be carefully considered. Two examples provide some insight as to how this structure could work.

First, RE-Volv, a nonprofit organization, uses a crowdfunded model it calls the "Solar Seed Fund". This fund is a revolving fund used to finance solar leases for nonprofit hosts of the solar project, such as homeless shelters, schools, community centers, and houses of worship. A percentage of the lease payment that hosts make is then reinvested back into the fund.[39] While the nonprofit organizations benefiting from the fund may save up to 15% on their electric bills, the individuals providing the crowdfunding do not see any personal financial return other than the possibility of claiming a deduction on their taxes for the contribution. To date, the project has funded solar systems for 38 nonprofit organizations, totaling 1.44 MW of capacity. Coastal Carolina University in South Carolina participates in RE-Volv and has been able to install solar on non-profit organizations.

Second, the Sun Shared Vermont Energy Investment Corporation (VEIC) developed a rooftop project that is behind their meter, but relies on virtual net metering to implement the program. To implement this option, South Carolina would need a virtual net metering crediting structure. VEIC hosts a 200-kW system and is an anchor tenant for the project. VEIC also offers subscriptions to its employees, who can subscribe without credit checks or an upfront payment. Instead, employees pay via a payroll deduction. In turn, they receive 10% of the credits associated with their share's production (the remaining 90% goes to VEIC to pay for the solar project). Of the participating employees, 18% qualify as low-income.[40]

[38] https://www.cooperative.com/programs-services/bts/Documents/SUNDA/DOE-EE0006333%20-%20NRECA%20-%20SUNDA%20-%20Final%20Technical%20Report.pdf
[39] https://re-volv.org/about-us/re-volv
[40] https://www.nrel.gov/docs/fy19osti/72575.pdf

6 Conclusions

There are a variety of community solar structures operating in the United States. In addition to traditional community solar, other models are emerging that provide some of the benefits of community solar, such as solar on MFAH facilities, electric cooperative solar, and behind the meter solar projects with community benefit. These models all have benefits and challenges to them. Table 2 summarizes the key components of these models.

Community solar involves many key decisions, such as those attributes discussed in Section 2. Some of these decision factors are not required if using an alternative structure such as MFAH solar, cooperative solar, or behind the meter solar with community benefit. However, these alternative structures may be more difficult to scale, providing a more limited benefit overall than traditional community solar.

Table 2: Model Key Considerations

Model	Potential to Scale	Implementation Cost	South Carolina Context	Ease of Adopting New Regulations
Traditional community solar	High: Program could be offered without a cap on the number of projects (e.g. Minnesota)	Medium: Requires subscription acquisition and maintenance costs as well as costs to run an RFP process, if the community solar projects are developed by 3rd parties.	IOUs are allowed, but not required, to develop community solar programs. Cooperative utilities could adopt this model voluntarily.	Utilities may oppose community solar if they do not see any benefit from it for their shareholders or members.
MFAH solar	Medium: Only about 2% of MFAH buildings have solar to date.	Medium: Lowers costs for MFAH property owners, however, there may be challenges trying to access financing options for solar on MFAH.	Net metered projects are possible now in South Carolina.	Some process may be required if tenants are able to have a reduced electricity bill, in order that they do not subsequently need to pay in rent. A number of state agencies and owners of multi-family housing have expressed interest in a net metering arrangement for multi-family units.
Cooperative solar (not subscription based)	Low: Co-ops, while they serve large geographic regions, tend to have smaller electricity loads than IOUs. They also may be interested in piloting a small program to assess risk before deciding whether to scale their solar efforts.	Low: Lack of subscriber model could provide reduced administrative costs.	Possible now, with restrictions on project sizes based on cooperative's all-requirements contracts.	If cooperatives run into restrictions based on their all-requirements contracts they will need to develop work-arounds, such as having the G&T own the project.
Behind the meter solar with community benefit	Low: While there are a lot of buildings that could install solar behind the meter, the challenges with crowdfunding and crediting have limited the scaling of this option to date.	High: Crowdfunding campaigns are costly and work to investigate the legal and the tax implications of providing value to funders could be costly and time consuming.	Possible now.	No new regulations would be needed for behind the meter projects.

Appendix A. Community Solar Projects Located in South Carolina

Please see https://www.nrel.gov/state-local-tribal/community-solar.html for future updates on deployed community solar projects across the country.

Utility Name	Utility Type	Community Solar Array Name	Array Size (MW-AC)	Year Energized
Santee Electric Coop, Inc	Cooperative	Colleton Solar Farm	3000	2014
Aiken Electric Cooperative	Cooperative	Aiken Electric Cooperative, Inc. Solar Program	250	2017
Tri-County Electric Coop, Inc	Cooperative	Tri-County Community Solar	250	2017
York Electric Coop Inc	Cooperative	Lesslie Community Solar Farm	50	2016
York Electric Coop Inc	Cooperative	YEC's East York Community Solar Farm	180	2019
South Carolina Electric&Gas Company (DBA Dominion Energy)	Investor Owned	Springfield Solar Farm	6000	2018
South Carolina Electric&Gas Company (DBA Dominion Energy)	Investor Owned	Nimitz Solar Farm	8000	2018
South Carolina Electric&Gas Company (DBA Dominion Energy)	Investor Owned	Curie Solar Farm	2000	2019
Horry Electric Coop Inc	Cooperative	Horry Electric Community Solar	250	2017
Blue Ridge Electric Coop Inc - (SC)	Cooperative	Blue Ridge Electric Community Solar	250	2016
Broad River Electric Coop, Inc	Cooperative	Broad River Electric Coop Community Solar	150	2017
Coastal Electric Coop, Inc	Cooperative	Coastal Electric Coop Community Solar	48	2016
Fairfield Electric Coop, Inc	Cooperative	Fairfield Electric Community Solar	60	2018
Laurens Electric Coop, Inc	Cooperative	Mauldin Community Solar Farm	160	2016
Laurens Electric Coop, Inc	Cooperative	Laurens Headquarters Farm	90	2017
Little River Electric Coop Inc	Cooperative	Little River Community Solar	240	2017
Newberry Electric Coop, Inc	Cooperative	Newberry Electric Cooperative Community Solar	250	2017
Palmetto Electric Coop Inc	Cooperative	New River Community Solar	120	2017
Palmetto Electric Coop Inc	Cooperative	Ridgeland Community Solar	120	2017
Duke Energy Progress - (NC)	Investor Owned	Whitney M. Slater Shared Solar Facility	7000	2018
Duke Energy Carolinas, LLC	Investor Owned	Piedmont Facility	2000	2019
Duke Energy Carolinas, LLC	Investor Owned	Pelzer Facility	1000	2019