APPA ACADEMY

AMERICAN PUBLIC
POWER ASSOCIATION

Community Solar Program and Subscription Design

Design elements and considerations for creating a municipal utility community solar program

Lead Instructor: Joyce McLaren, Ph.D.

Sr. Research Analyst, National Renewable Energy Laboratory

NREL Transforming ENERGY

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

AMERICAN PUBLIC POWER ASSOCIATION

Agenda: Day 1

12 p.m. (ET)	Agenda & Introductions
12.15 p.m.	Community Solar National Market Overview and Trends
12.30 p.m.	Program Goals
12.45 p.m.	Site Selection
12.50 p.m.	Break
1.00 p.m.	Program Design Elements
1.30 p.m.	Worksheet, Breakouts, Discussion
2.00 p.m.	Closing

*Times are in Eastern

Course Learning Objectives

At the conclusion of this course, participants will be able to:

1. Develop a draft community solar program description
2. Select program and subscription design elements that match utility goals and priorities
3. Identify community solar program design elements that encourage participation by low- to moderate-income (LMI) households

Introductions

Instructor Introductions

Speaker Backgrounds

NREL
Transforming ENERGY

Joyce McLaren
Sr. Research Analyst
National Renewable Energy Laboratory

Since joining NREL in 2009, Joyce has been designing and leading analyses and providing technical assistance to states, cities, utilities and non-profit organizations that aim to deploy solar, battery energy storage, electric vehicles, and grid-interactive building technologies. She has nearly 30 years of experience in the renewable energy field and holds a Ph.D. in Science and Technology Policy.

Simon Sandler
Research Analyst
National Renewable Energy Laboratory

Simon has conducted technoeconomic analysis of renewable energy in both the public and private sectors, drawing on his engineering background and master's in Sustainable Energy Systems. He joined NREL in 2023 to support the National Community Solar Partnership and provide decision support using NREL's REopt model.

Municipal Utility Experience

Tim Harvey
Customer Renewable Solutions Manager
Austin Energy

Tim began working with Austin Energy in the Solar Program in 2006. He is passionate about the environment and has played key roles in the development and operations of Austin Energy's renewable program offerings and rate designs.

Hannah Mulroy
Energy Portfolio Development Manager
Longmont Power & Communications

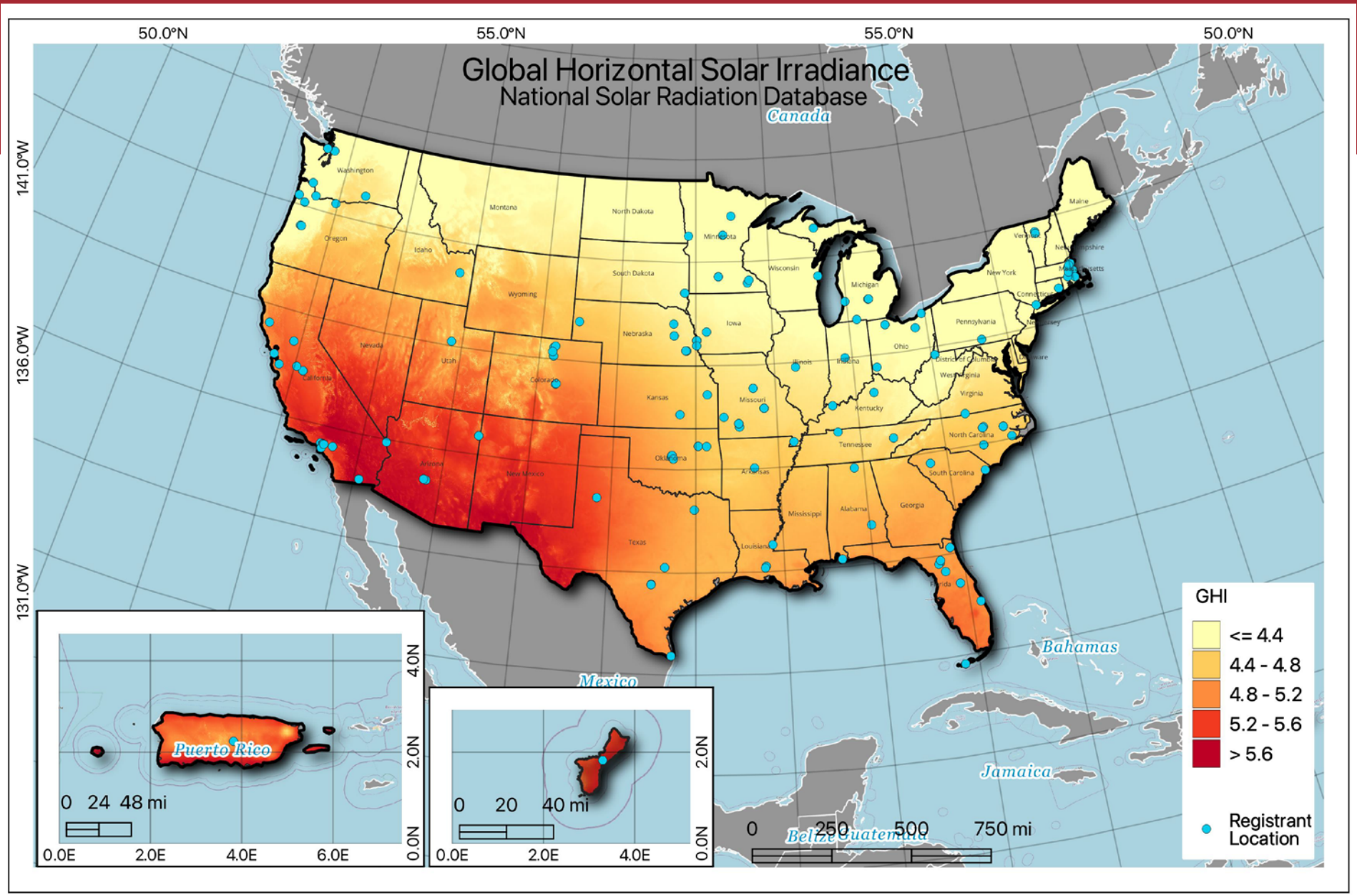
Hannah joined LPC in 2006, where she supports the 100% renewable electric energy by 2030 and resilience goals through the evaluation, promotion and integration of distributed energy resources and smart grid innovations.

Who is here today?

Attendee poll

AMERICAN PUBLIC POWER ASSOCIATION

Course Registrants Represent Municipal Utilities Nationwide



Community Solar National Market Overview and Trends

Community solar deployment over time, by state, and by project characteristic

https://www.energy.gov/communitysolar/community-solar-market-trends

p Goals

https://www.energy.gov/communitysolar/community-solar

Meaningful Benefits of Community Solar

GREATER HOUSEHOLD SAVINGS

- Provide a reduction in electricity bills for residential subscribers to a project

J40 Priority 1: Reduce Energy Burden

LMI HOUSEHOLD ACCESS

- Include subscribers from low- to moderate-income (LMI) households

J40 Priority 3: Increase Parity in Clean Energy

RESILIENCE AND GRID BENEFITS

- Include the capability to deliver power to households and/or critical facilities during a grid outage or strengthen grid operations

J40 Priority 7: Increase Energy Resiliency

COMMUNITY OWNERSHIP

- Local community members, subscribers, or local community organizations own or have equity in the project
- Other wealth-building strategies

J40 Priority 8: Increase Energy Democracy

WORKFORCE DEVELOPMENT AND ENTREPRENEURSHIP

- Advance high wages
- Reduce income disparities across race and gender
- Ensure a trained and available workforce reflective of the project community

J40 Priority 6: Increase Clean Energy Jobs

https://www.energy.gov/communitysolar/community-solar

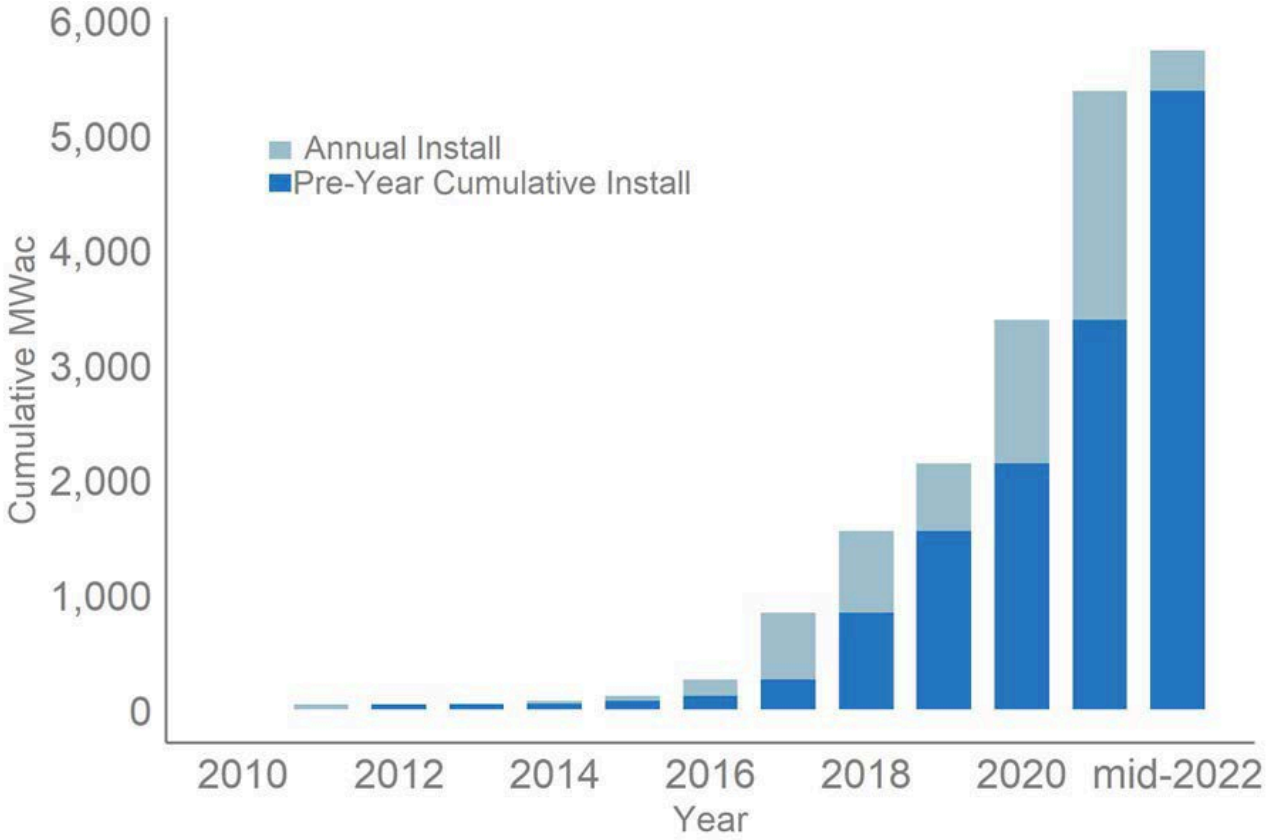
NCSP's Community Solar Definition

The *National Community Solar Partnership* defines community solar as:

"... a solar installation with **multiple off-takers** 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."

Total Installed Capacity

- Community solar projects are located in 39 states, plus Washington, D.C.
- 3,200+ MW_{AC} of total installed capacity
- ~74% is concentrated in four states:
  - Florida (1,636 MW_{AC})
  - Minnesota (834 MW_{AC})
  - New York (731 MW_{AC})
  - Massachusetts (674 MW_{AC}).



Community solar development capacity by year (MW_{AC})

https://www.nrel.gov/docs/fy23osti/84247.pdf

State-Level Community Solar Enabling Policies

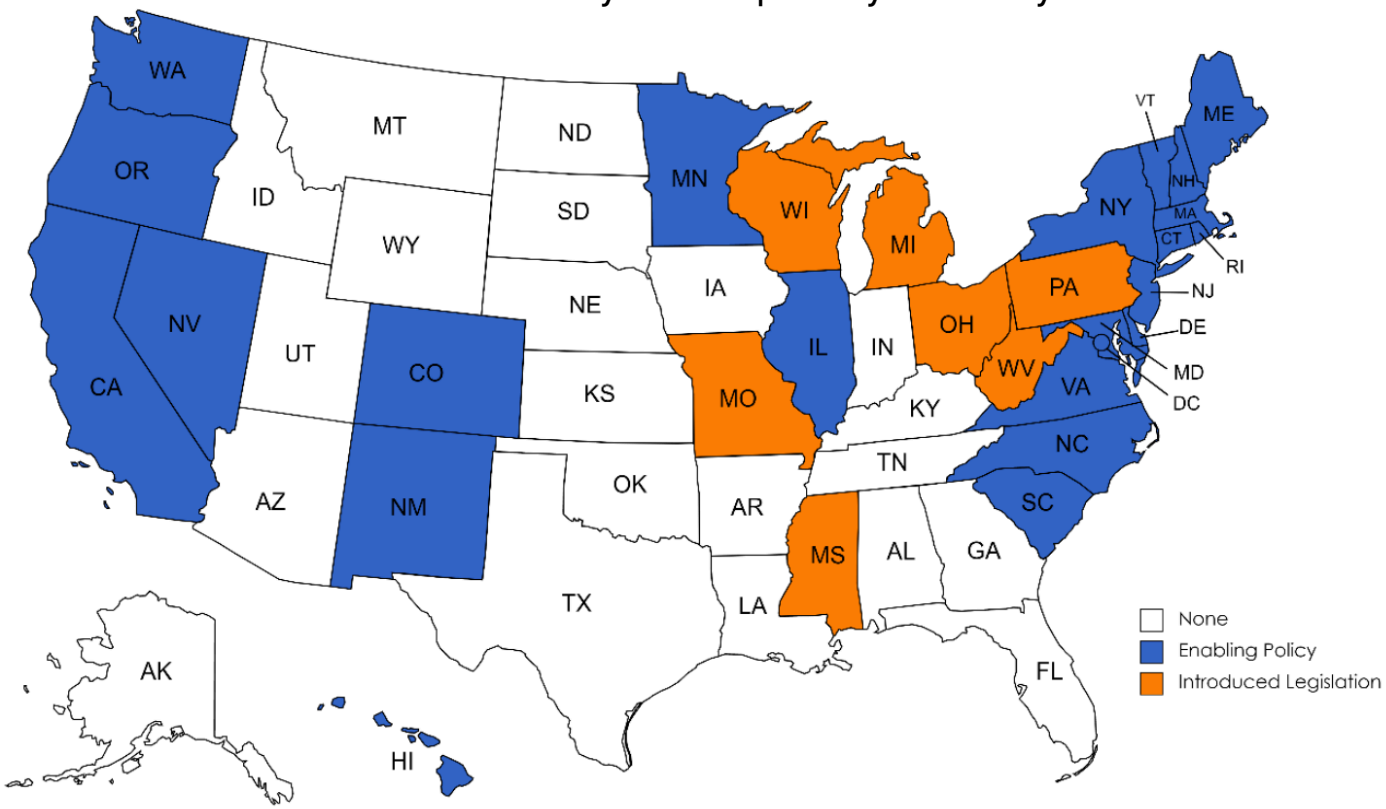
As of June 2022, 22 states and Washington, D.C. have policies that support community solar.

Community solar legislation has two primary forms, which vary by state:

(1) Establishing a state mandate for community solar

(2) Developing state-level programs that support or incentivize community solar.

Community solar policy activity



https://www.nrel.gov/docs/fy23osti/84077.pdf and https://nrellibrary.nrel.gov/store/NCSU/2022/NCSU_50StatesofSolar_Q12022.pdf

State-Level Program Caps

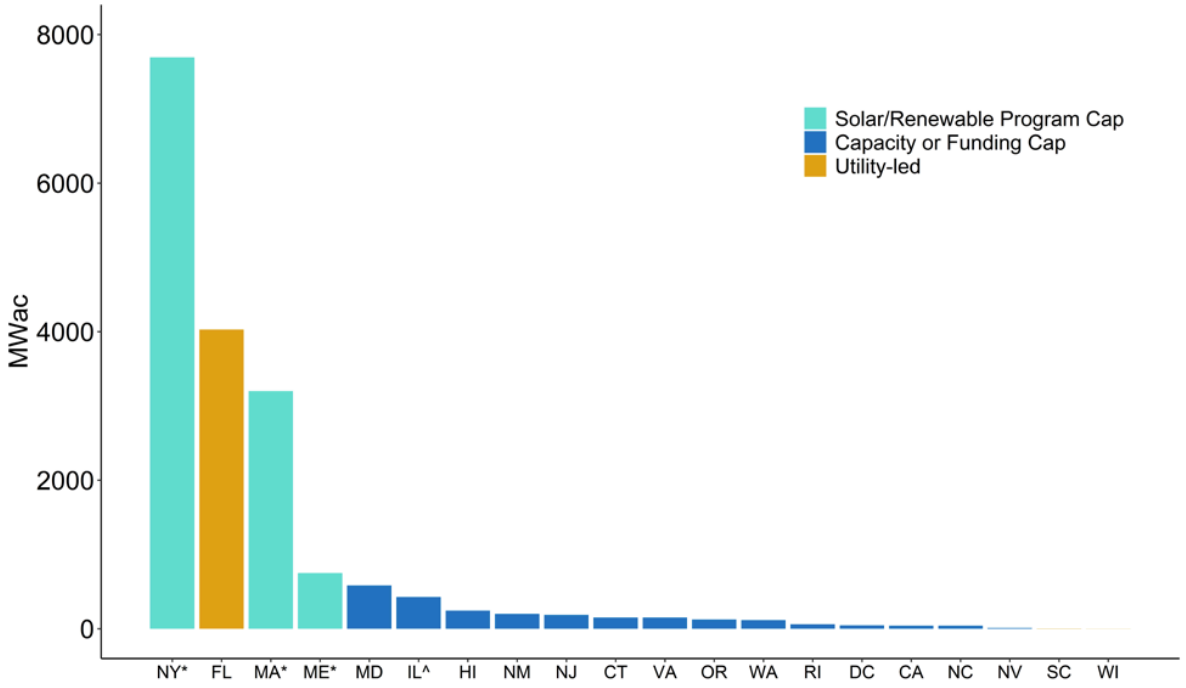
At least 19 states and Washington, D.C., have passed some form of community solar program cap.

Two approaches to community solar program caps:

(1) A cap on the capacity (MW) or funding (dollars) allotted to community solar deployment

(2) A cap on all forms of solar program deployment, including rooftop solar, community solar, and other systems.

Most community solar caps are capacity caps or funding caps that are required under state or program mandates.



https://www.nrel.gov/docs/fy23osti/84247.pdf

State-Level Subscriber Location Requirements

All states with community solar legislation require the subscribers to be in the same electric utility service territory as the facility.

CO, MN, and NC require that subscribers be located in the same or an adjacent county.

State	Same Electric Utility Service Territory as Facility	Same or Adjacent County as Facility	Additional Requirements
California^	✓		✓
Colorado	✓	✓	
Connecticut	✓		
Delaware	✓		
Hawaii	✓		
Illinois	✓		
Maine	✓		
Maryland	✓		
Massachusetts	✓		
Minnesota	✓	✓	
Nevada	✓		
New Hampshire	✓		
New Jersey	✓		
New Mexico	✓		
New York	✓		
North Carolina	✓	✓	
Oregon	✓		
Rhode Island	✓		
South Carolina	✓		
Vermont	✓		
Virginia	✓		
Washington	✓		
Washington, D.C.	✓		

Note: California^ subscriber eligibility applies to the community solar green tariff program enabled in 2013. The new legislation AB 2316 would require the commission to establish community renewable program, if deemed beneficial to ratepayers, on or before July 1, 2024.

State-level location requirements

https://www.nrel.gov/docs/fy23osti/84247.pdf

State-Level Subscriber Eligibility Requirements

- Minimum number of subscribers required
- Maximum number of subscribers allowed for each project
- Maximum capacity allowed for each subscriber
- Required share of subscriber types
  - Residential
  - Commercial
  - Government
  - LMI

Examples of State-Level Eligibility Requirements

- ✓ Ten states require that no more than 40% of a facility's generation can be attributed to one subscriber.
- ✓ 12 states and D.C. require a minimum subscriber count of between two and 10 subscribers per community solar installation.
- ✓ NJ: maximum number of subscribers at 250 (per 1-MW project).
- ✓ IL and MD: minimum subscription requirements by capacity.
- ✓ CA: No customer can exceed a 2-MW subscription.
- ✓ OR: 50% of a project must be residential and small commercial.

https://www.nrel.gov/docs/fy23osti/84247.pdf

State-Level Legislation for LMI Community Solar

As of June 2022, 17 states and D.C. passed legislation to expand community solar access for LMI households.

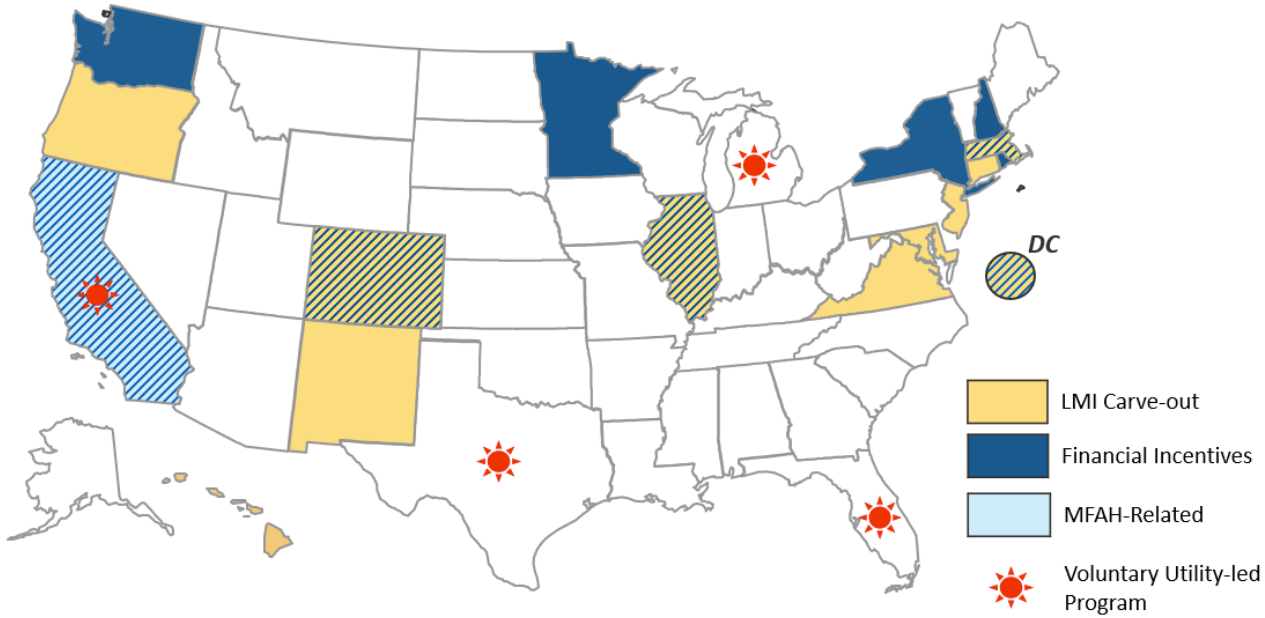
Four forms:

(1) Carve-outs for LMI subscribers in community solar programs or projects

(2) Financial incentives to enhance LMI community solar accessibility.

(3) Policies enabling community solar for multifamily affordable housing (MFAH)

(4) Voluntary LMI community solar development by utilities



Types of LMI community solar mandates and voluntary efforts

https://www.nrel.gov/docs/fy23osti/84247.pdf

Community Solar Program Goals

Austin Energy & Longmont Examples

AMERICAN PUBLIC POWER ASSOCIATION

Community Solar Projects in Austin

Clockwise from Top Left: Palmer Event Center, ABIA Blue Garage Carports, La Loma Community Solar Farm

Stakeholders Engaged

- Austin Independent School District
- Neighborhood Associations
- Neighborhood Planning
- Educational Institutions
- Customer Surveys

Community Organizations

- Think East
- Eastside Community School Alliance
- Austin Voices for Education & Youth
- Austin Partners in Education
- Communities in Schools of Central Texas
- Pride of East Side

Environmental Organizations

- ATX Environmental Justice
- Solar Austin
- Sierra Club
- Environmental Defense Fund
- Public Citizen
- PODER (People Organized in Defense of Earth and Her Resources)

Austin Energy Community Solar Goals

Clockwise from Top Left: Palmer Event Center, ABIA Blue Garage Carports, La Loma Community Solar Farm

Austin Energy Community Solar Goals

Equity and Inclusion Considerations

- **Expands** solar offerings for those unable to purchase rooftop solar
- Increased access to solar for **Low to Moderate Income (LMI) customers**
- **Workforce development** and local solar jobs
- Opportunities for **customer engagement and education**
- **Cross-promotional** opportunities (other environmental programs at Austin Energy)
- Creative pathways to community and grid **resilience**
- Potential to leverage future projects for **non-wires alternatives**

On-Site Solar Excludes:

- Renters
- Condo owners
- Homeowners with shaded roofs
- Customers unable to make the upfront investment in rooftop systems
- Customers with poor credit

Austin Energy Community Solar Goals

Goals and Challenges

- **Reduce the cost to participate in Community Solar**
  Challenge: Local solar is more expensive to procure
- **Create a commercial offering**
  Challenge: Need to increase capacity
- **Increase community engagement**
  Challenge: Historical relationship between City of Austin and Communities of Color
- **Increase LMI participation in Community Solar**
  Challenge: Customer acquisition/Need to increase capacity
- **Facilitate an opt-out option for CAP customers to make participation easier**
  Challenge: Insufficient capacity
- **Expand project capacity to enable more participation**
  Challenge: Rooftop projects difficult to secure and ground-mounted projects compete with housing needs
- **Incentivize commercial hosting participation**
  Challenge: Creating value for commercial hosts

Austin Energy Community Solar Goals

Expanding the Portfolio

- **Partner with the Equity Office to develop strategies for community engagement**

  Promote inclusion, awareness, and trust within the community

- **Develop a Standard Offer for developers of Community Solar projects**

  Will streamline RFP process and has potential to decrease costs

- **Solicit an RFI for Site Hosts**

  Will allow Austin Energy to pre-determine eligible sites for solar and increase certainty for RFP respondents

- **Partner with City of Austin facilities to host solar**

  Can leverage City of Austin carbon goals for its facilities

- **Partner with Office of Sustainability**

  Explore solar and storage at resiliency centers.

Site Selection

Considerations and Austin and Longmont Examples

AMERICAN PUBLIC POWER ASSOCIATION

Siting Considerations: Ground Mount Solar

- Identify the authority having jurisdiction (AHJ) over the site.
  - Consult assessor records, plat maps, and site plans.
- Conduct a complete survey of the proposed site conditions, zoning and comprehensive/master plans, regional or area plans, and transportation plans.
  - https://viewer.nationalmap.gov/basic/
- Conduct a soil survey.
  - Caliche or bedrock may require costly drilling.
  - Sandy soils may require deeper post embedment to meet wind and snow loading requirements.
  - Corrosive soils may require measures to protect embedded steel posts.
- Check for critical habitat, wetland, and historical or cultural resource designations.
  - https://ecos.fws.gov/ecp/report/table/critical-habitat.html
  - https://www.fws.gov/wetlands/Data/Mapper.html
  - https://www.nps.gov/maps/full.html?mapId=7ad17cc9-b808-4ff8-a2f9-a99909164466
- Determine floodplain status.
  - https://msc.fema.gov/portal/search#searchresultsanchor

Siting Considerations: Roof Mount Solar

- Building and roof orientation
- Roof pitch
- Shading (tree growth, neighboring construction, snow cover)
- Roof reinforcements for loading (records of reinforcements made)
- Roof age and warranty
- Insurance requirements
- Codes
- Safety precautions (guard-rails for flat roofs)
- Conduit, electrical panel, meter, inverter placement
- Aesthetics

Austin Energy and Longmont Siting Experience

Program and Subscription Design Elements

AMERICAN PUBLIC POWER ASSOCIATION

Program and Subscription Design Elements

1. Anchor tenants
2. Eligibility and customer classes
3. Renewable Energy Certificate (REC) treatment
4. Subscription limits
5. Unsubscribed energy
6. Term limits, exit rules, and transferability
7. Sign-up fees
8. Customer subscription payments (capacity-based vs. generation-based)
9. Customer credits and economic value (fixed vs. variable)
10. Scaling up the effort: project-based vs. portfolio-based programs

Connecting Program Goals with Design Considerations

Decisions within each element of program and subscription design may impact the success of the overarching goals of a community solar program. This table reviews where each element discussed in this slide deck connects to four common program goals.

		Design Elements							
		Anchor Tenants	Customer Classes Eligible To Enroll	Project-Based vs. Portfolio-Based Program	Subscription Minimums and Maximums	Term Limits, Exit Rules, and Transferability	RECs and Environmental Benefits	Upfront and Fixed Fees	Fixed or Floating Monthly Payment
Community Solar Goals (as stated by working group participants)	**LMI Access to Solar**		X		X	X		X	X
	Customer Cost Savings	X	X	X				X	X
	Renewable Energy Goals/ Environmental Leadership						X		
	Customer Demand for and Access to Solar	X	X			X	X		X

Anchor Tenants

Anchor tenants are large customers that subscribe to a significant portion of a community solar array.

Anchors may be:

- Local businesses or franchises with large electricity demand
- Municipal buildings/accounts (libraries, schools, city hall, etc.)
- Community partners or nonprofits with a strong local presence.

Anchors can potentially:

- Provide more revenue certainty
- Reduce financing and customer acquisition costs
- Reduce subscription costs to non-anchor subscribers
- Impact whether the project is representative of the customer base.

Programs can limit the subscriptions held by anchor tenants to maintain the "community" element and ensure sufficient shares for smaller subscribers. Some state programs limit the capacity that can be held by anchor tenants.

Eligibility: Customer Classes

- Some programs prioritize a participant mix that reflects the utility customer mix.
- Many programs include a carve-out for LMI participation.
  - Typically, a certain % of the project is set aside for LMI subscribers.
  - Including an LMI carve-out may require cost premiums for other customer classes.
- Choices regarding the desirable participant mix will inform other program design elements, including:
  - Subscription minimums and maximums
  - Term limits, exit rules, and transferability
  - Upfront fees
  - Monthly payment structures.

Proven Practices

- ✓ Allow all customer classes to participate
- ✓ Provide an LMI carve-out that ensures cost parity or cost savings for LMI customers
- ✓ NCSP Goal: provide 20% bill savings for customers

RECs and Environmental Attributes

RECs from a community solar project can be:

- **Retained** by the solar project owner, utility, or administrator to use for its own claims
- **Retired** on behalf of the subscriber (the person or business buying from/participating in the community solar program)
- **Provided** to the subscriber
  - *Note: Due to the complexity of the REC market, this option may only be desirable for large commercial customers.*

Only the party that owns the RECs can claim the green power benefits from the solar project!

Subscribers should be informed about how RECs are handled and given appropriate language to help them make claims consistent with standard environmental practice.

States with existing RPS or clean energy standards have implemented ways to procure RECs from community solar projects (e.g., Massachusetts, Colorado).

Subscription Limits

- Subscription **maximums** can limit participation based on either:
  - The customer's electricity use (average monthly kWh load)
    - Most programs set the maximum subscription level at ~100% of a subscriber's average annual load, based on the previous year's utility bill.
  - The percent of community solar project capacity
    - Maximum subscription level:

      total project capacity ÷ minimum number of participants desired

- Subscription **minimums** require subscribers to commit to a minimum monthly allocation.
  - Estimated cost to manage subscribers can inform a minimum subscription level.
  - A subscription minimum may be a barrier to entry (e.g., apartment dwellers have a smaller energy profile than single-family homes).

Ten states require that no more than 40% of a facility's generation be attributed to one subscriber.

Unsubscribed Energy

Unsubscribed energy can be:

- **Marketed** to a flexible subscriber (e.g., an anchor tenant)
  - No energy is unallocated on a monthly basis.
  - Project economics are lower risk with a guaranteed energy subscriber.
  - It is administratively more complex to reallocate subscription size and credits regularly.
  - Obtaining a flexible subscriber may be difficult.

- **Absorbed** by the utility and sent to the grid (socializes the cost of providing that energy)
  - Administratively easy to manage subscriptions
  - Does not require an anchor tenant or flexible subscriber base
  - Wholesale rate paid for unsubscribed energy is likely lower than subscription payment.

Term Limits, Exit Rules, and Transferability

Shorter subscription terms with an easy in/out process typically reduce subscriber acquisition costs.

- **Term limits** set the minimum time a subscriber is required to maintain their subscription (multiyear, annual, or month-to-month).
- **Exit rules** determine whether a subscriber must pay a fee for ending their subscription prior to the term limit, and how early they must provide notice.
- **Transferability** either allows or disallows subscribers to "transfer" their subscription to a different utility account within the utility's territory.
  - Can ease the impact of exit fees and term limits
    - Customer moves and wants to keep their subscription
    - Customer wants to transfer their subscription to another customer's account.

Proven Practices

- ✓ Allow for transfer of subscriptions within the utility territory
- ✓ Do not include a cancelation fee
- ✓ Use a month-to-month term structure

Note: Also consider defining the program length. How will you handle subscriptions at the end of the solar project's lifetime? Will you repower the project? End the program?

Upfront Fees: Options

Option	Description
Full Upfront Payment	Subscriber pays for all projected solar electricity generation over a set duration (e.g., 20 years), locked in at a set rate per kWh. A discount can be offered to customers selecting the upfront payment options versus an ongoing payment.
Upfront Payment + Monthly Payments	Hybrid that combines an upfront payment with either a fixed or variable monthly payment (see the following slides for monthly payment options).

Upfront Fees: Considerations

Pros:

- Can be combined with monthly payments
- Can help the utility hedge against a community solar project's construction or financing costs
- Can help with customer retention

Cons:

- Can present a barrier to entry for LMI participants
- Can increase customer acquisition costs.

Proven Practices

- ✓ No upfront fees
- ✓ If upfront fees are required, set the fee level low enough to ensure no barrier to entry for LMI customers

Existing Programs

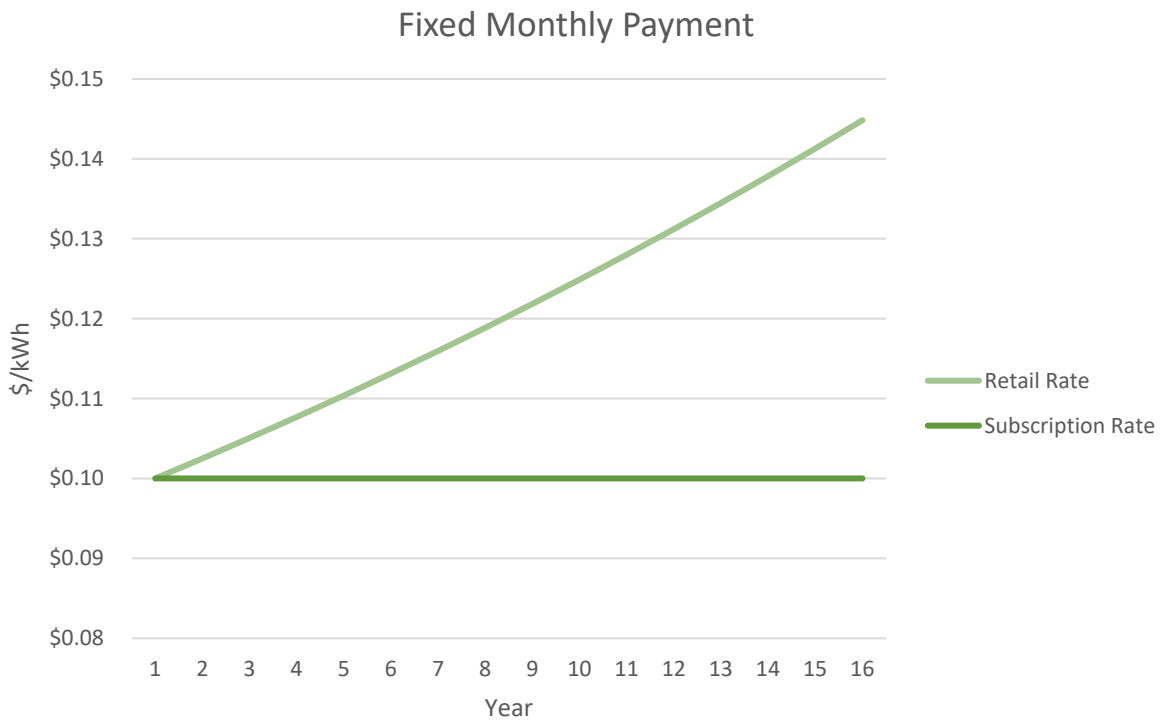
Upfront fees in existing programs surveyed ranged from $75–$325

Monthly Payments: Options

Payment Basis	Fixed Subscription Price	Varying Subscription Price
Capacity-Based ($/kW) Monthly payment based on the capacity associated with the subscription	The $/kW rate is set and fixed for the life of the project, resulting in a consistent payment every month.	The $/kW rate changes (e.g., annually). Adjustments may account for changes in project maintenance costs or program administrative costs.
Generation-Based ($/kWh) Payments are a price per kWh delivered	The $/kWh rate for solar subscription is set and never increases. Assuming electricity rates increase, the discount to subscribers increases over time.	The $/kWh rate changes (e.g., annually). Adjustments may account for changes in project maintenance costs or program administrative costs.
Subscribe To "Own" Model	Fixed monthly payment for a set number of years, after which point solar credits are "free." This option is most like rooftop solar model.	N/A

Fixed Monthly Payments: Considerations

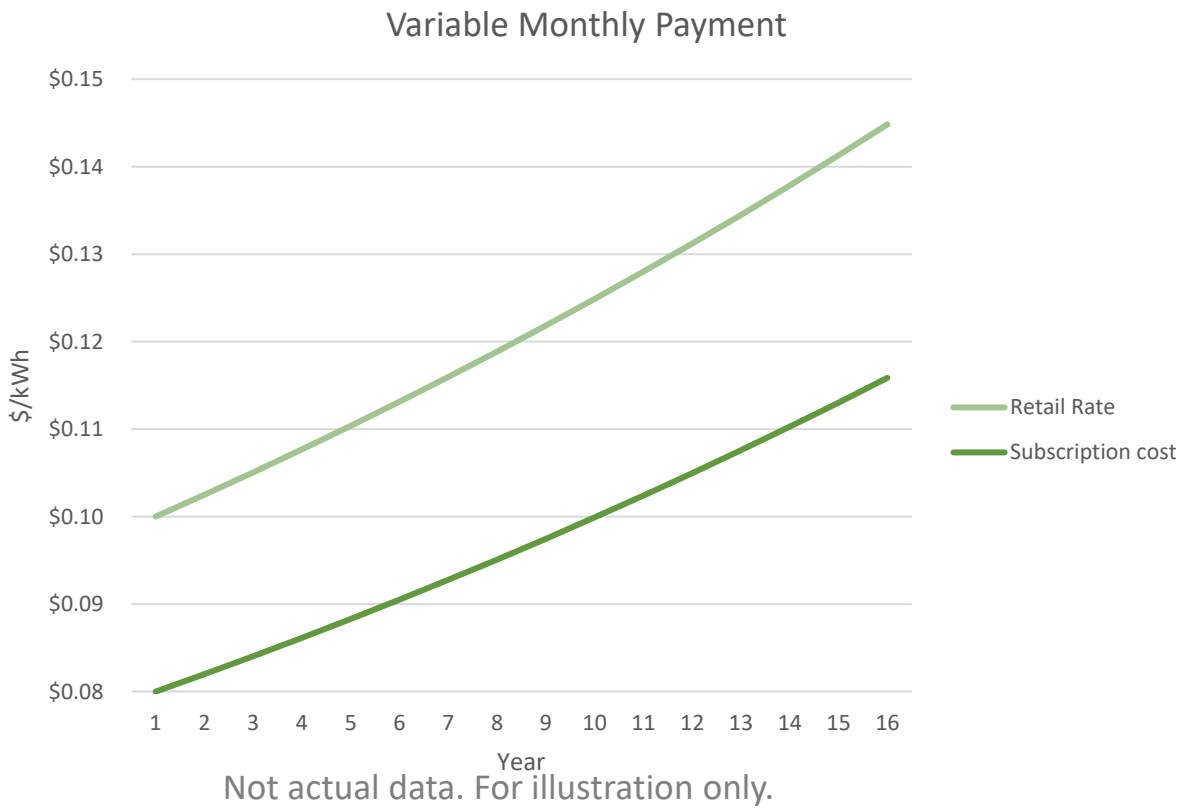
- Provide cost stability/predictability to subscribers
- Offer simple marketing and customer communication
- Not sensitive to retail rate changes year-over-year
- May or may not be a cost premium or cost saving to subscribers.



Not actual data. For illustration only.

Variable Monthly Payments: Considerations

- May be more complicated to explain to subscribers
- Hedge against retail rate changes year-over-year
- May or may not be a cost premium or cost saving to subscribers
- Can be used to guarantee savings for subscribers while providing greater utility cost recovery.

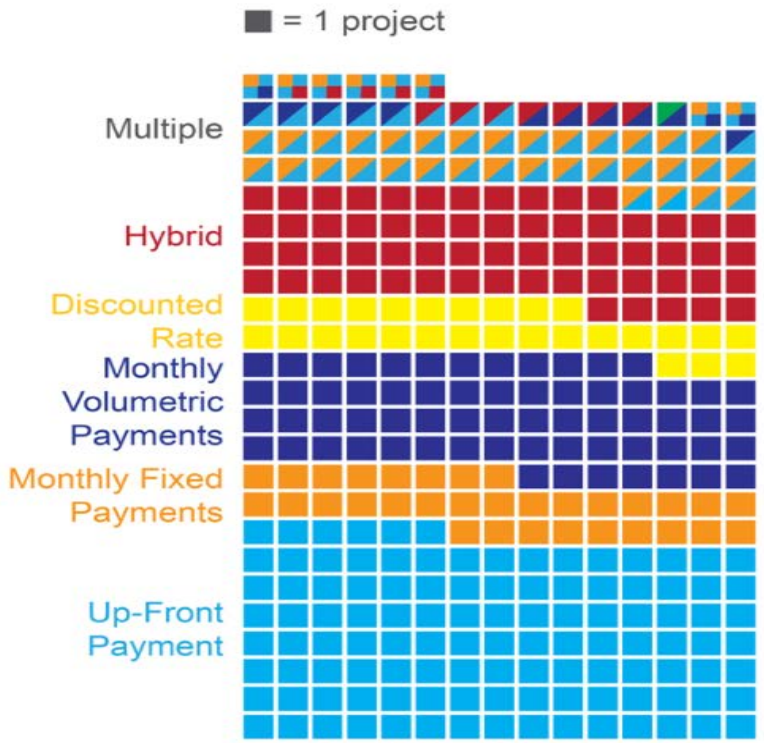


Not actual data. For illustration only.

Subscriber Credits: Options

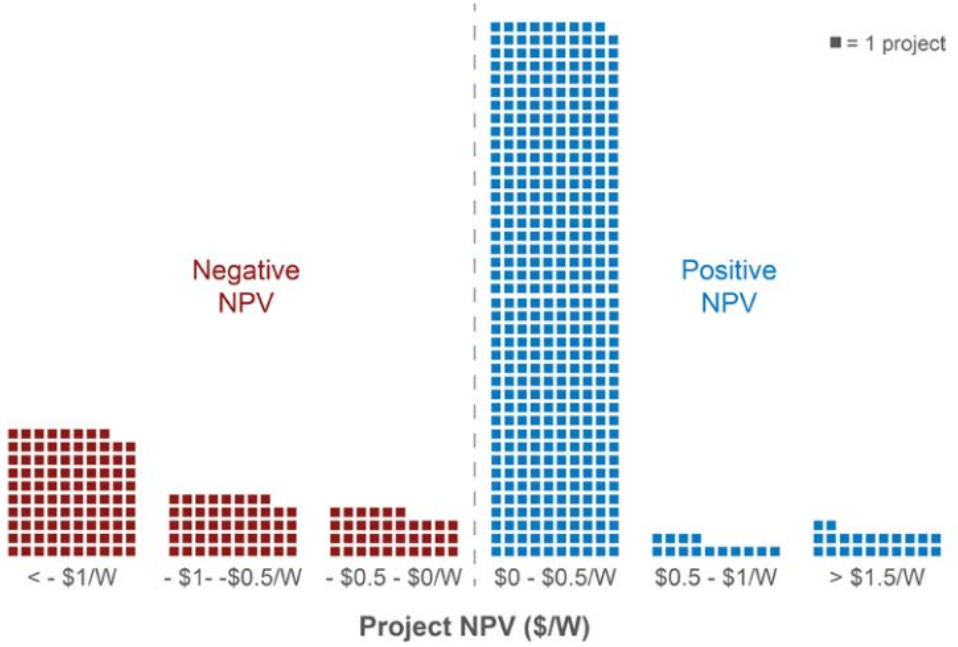
	Bill Credit to Subscriber	Considerations
Generation-Based Subscription	Subscriptions are for a defined block of kWh per month or year. Credits are distributed monthly—either as a fixed number of kWh or a variable number of kWh based on the customer's electricity consumption.	Due to the seasonal variability and lifetime degradation of solar generation, total possible subscriptions should be calculated using conservative solar generation estimates. This will ensure the promised number of kWh can be delivered. A portion of the project may need to remain unsubscribed. An anchor tenant may be willing to buy excess generation or accept fewer credits if there is under-generation.
Capacity-Based Subscription	Subscription is for a set capacity (kW). A varying number of kWh are credited to the customer bill each month based on the actual solar production of the capacity associated with the subscription.	A production guarantee can be used to reduce risk to the subscriber. This guarantee can be in the form of a $/kWh refund if the annual solar production associated with a capacity-based subscription is below a specified amount. This is the most common model of bill crediting.

More Than 80% of Projects Have a Positive Net Present Value (NPV) for Residential Subscribers



Distribution of Program Payment Methods

Subscription payment structures vary widely.



Distribution of Project-Level NPVs

Most projects result in positive net benefits to customers over the course of the subscription.

https://www.nrel.gov/docs/fy20osti/75438.pdf

Project-Based vs. Portfolio-Based Programs

Project-based programs allow subscribers to sign up for a *specific project.*

- Subscribers know exactly where their project is located.
- Ease of potential subscriber identification and marketing.
- Subscribers concerned about land use (or other issues) can ensure their project meets their personal criteria.

Portfolio-based programs allocate subscriptions based on aggregated solar capacity across the utility's solar portfolio.

- Subscription costs tied to overall portfolio cost
- Aggregates projects together that have different installation costs
- Distributes the advantage of falling solar prices across all program subscribers
- Encourages customers to support more solar development, even if they are already subscribed
- Passes cost savings from the utility's increasing solar capacity directly to program subscribers.

Summary: Program Design Best Practices

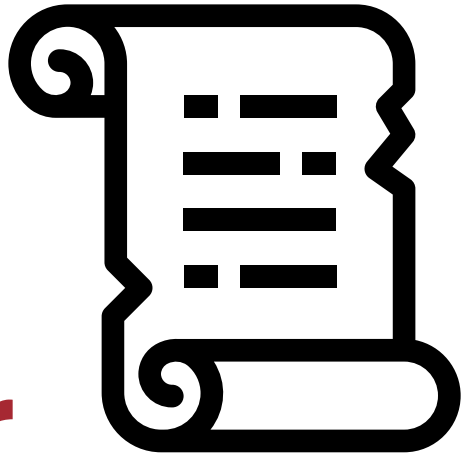
- ✓ No upfront fees
- ✓ Flexible exit rules
- ✓ 40% of subscriptions set aside for LMI customers
- ✓ Easy onboarding and no credit check
- ✓ Consolidated billing
- ✓ 20% bill savings
- ✓ Engage subscribers with updates and news
- ✓ Continuous improvements through subscriber feedback.

Month-to-month subscribers need more engagement.

Customers have been shown to leave a community solar program after one bad experience.

Longmont: Draft Program Design Elements

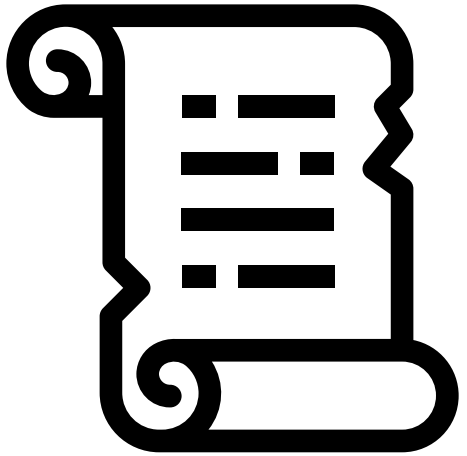
	Eligible Customer Classes	
	Low-Moderate Income (LMI)	**Market Rate (Residential)**
Subscription Rate (Fixed)	Discount $/kWh (± 10%)	Premium $/kWh
Upfront Fee	$0	$50-$100
Recurring Fee (Annual)	None	$10-20
Subscription Term/Length	Month-to-Month (30 Days' Notice)	6 – 12 Months
Anchor Tenant(s)	No*	
Subscription Min vs. Max	Maximum Based on System Size	
Exit Fee/ Transferability	No Fee Not Transferable/Reabsorbed and Reassigned	
Unsubscribed Energy	Absorbed	
Renewable Energy Credits (RECs)	City Retains RECs	
Capacity vs. Generation Based	To Be Determined (TBD) Net Billing	



Worksheet: Design Your Community Solar Program

Using the worksheet, you will create a draft community solar program design, based on the design elements covered above.

Fill out the worksheet before Day 2 of the course begins tomorrow.



Breakout Groups

Share your experience of filling the worksheet. (~20 min)

- What are your goals for community solar?
- What program design elements did you choose? Why?
- What elements did you struggle with? Why?

Report-Out/Chat-Out

Use the “raise-hand” feature. It is your turn to speak when you appear in the top left corner of the Zoom screen.

Alternatively, use the chat to share your thoughts.

- Share your experience of filling the worksheet. (~20 min)
- What are your goals for community solar?
- What program design elements did you choose? Why?
- What elements did you struggle with? Why?

APPA ACADEMY

AMERICAN PUBLIC POWER ASSOCIATION

NREL Transforming ENERGY

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Community Solar Program and Subscription Design

Day 2 – Impact of Program Design Elements on Financials

AMERICAN PUBLIC POWER ASSOCIATION

Agenda: Day 2

12 p.m.	Welcome and Agenda
12.05 p.m.	Discussion of Homework Assignment
12.30 p.m.	Inflation Reduction Act (IRA)
12.45 p.m.	System Advisor Model (SAM)
12.55 p.m.	Break
1 p.m.	Impact of Program Design Elements on Project Financials
1.30 p.m.	Austin Example
1.40 p.m	Q&A/Open Discussion/Idea Sharing
1.55 p.m.	Poll, Wrap-Up and Evaluation
2 p.m.	Closing

Discussion of Worksheet

Breakout group prompts:

- How will you use the design elements to achieve your utility's goals for community solar? Which design elements are most critical?
- Which design elements were most challenging to think through? Why? What did you decide?

Community Solar Program Financials

Inflation Reduction Act (IRA); Ownership and Administration Considerations

Common Solar Ownership Models for Munis

- Utility-owned
  - Utility-financed
  - Pay up-front
- 3rd party owned and operated (PPA)
- Partnership-flip structure (ownership transfers to utility)

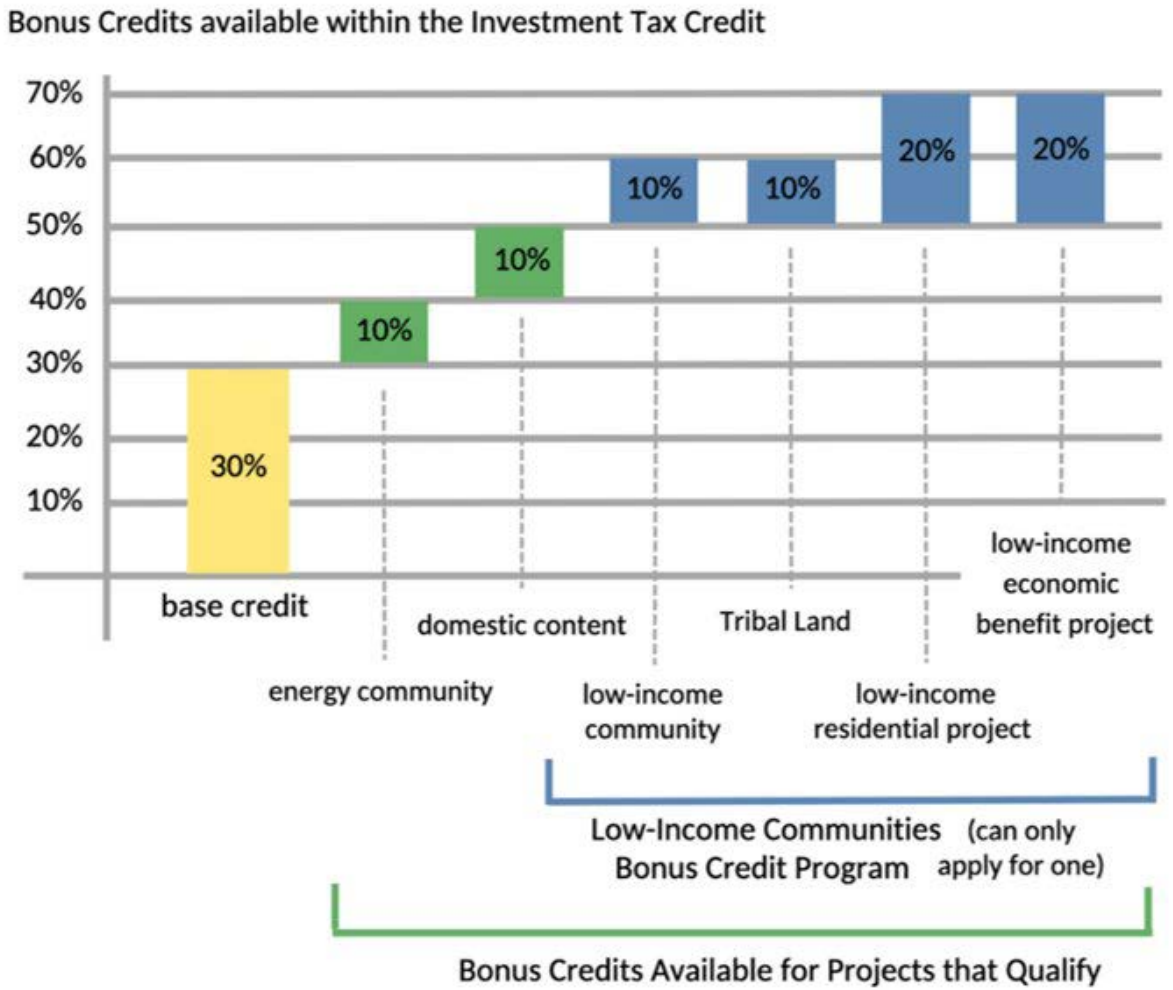
  The Investment Tax Credit (ITC)direct-pay provisions in the Inflation Reduction Act (IRA) make it easier for utilities to self-finance and own solar projects, likely obviating the need for the partnership-flip structure.

Impact of Inflation Reduction Act (IRA)

- Allows for nonprofit and government entities to take a direct payment in lieu of the 30% tax credit.

- Adders provide additional 10% credit for:
  - Domestic content
  - Energy communities
  - Low-income communities/tribal land.

https://energycommunities.gov/energy-community-tax-credit-bonus/



IRA Adders Increase Geographic Variability of Commercial Solar Economics

NREL's STEADy tool combines modeled solar economic results with potential Investment Tax Credit (ITC) adder eligibility, based on publicly available data sets, providing a first cut indication of locations where solar may be economical and where ITC adders may apply.

This is a two-dimensional graphical analysis.

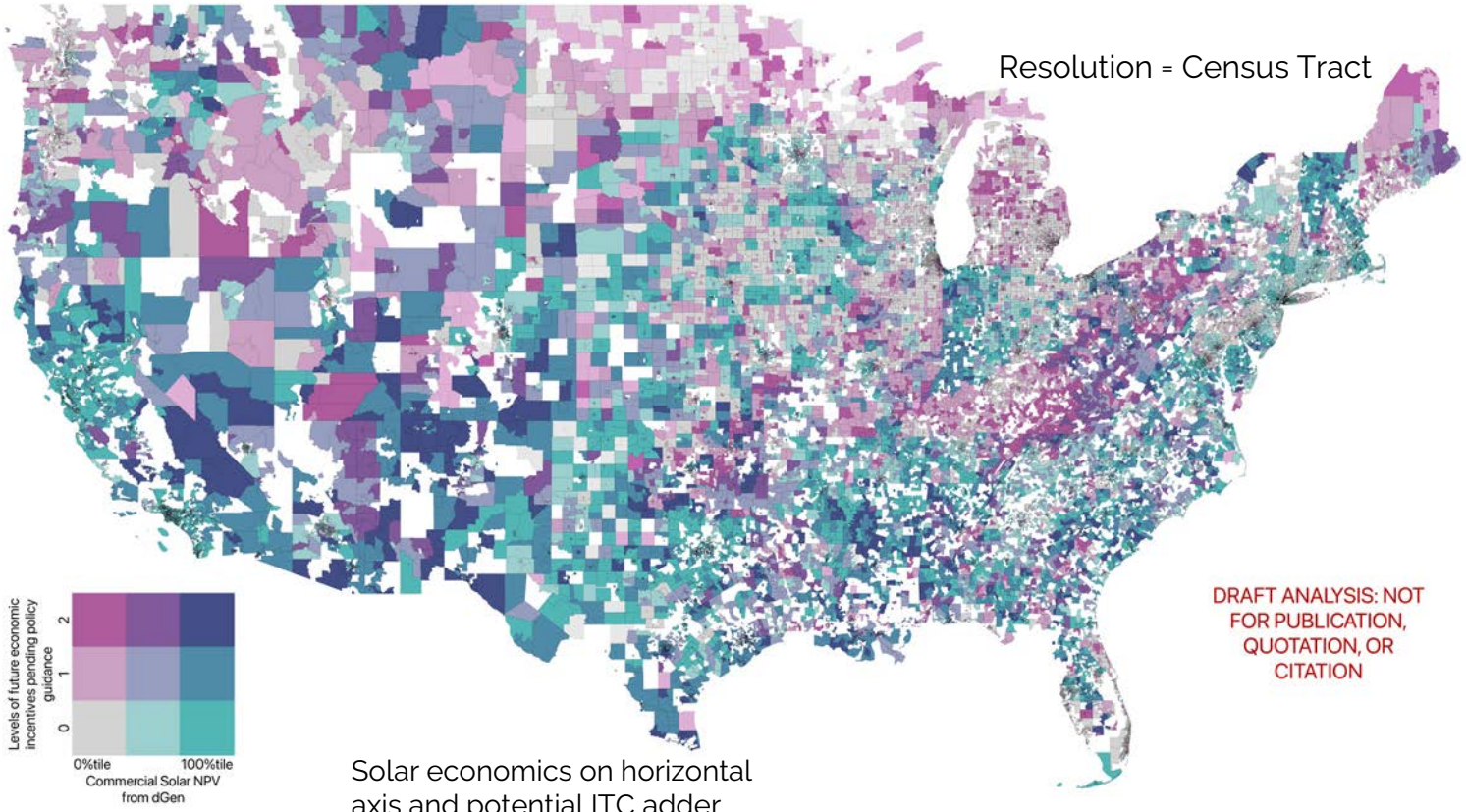
It conveys both the project economics by census tract and the potential IRA adder eligibility by census tracts.

*It does **not** show the interaction between the two.*

Each color represents the overlay of an NPV range and ITC adder potential.

*It does **not** indicate whether ITC adders flip project economics from negative to positive.*

To access this dataset in the near-term, please apply for technical assistance through the National Community Partnership.

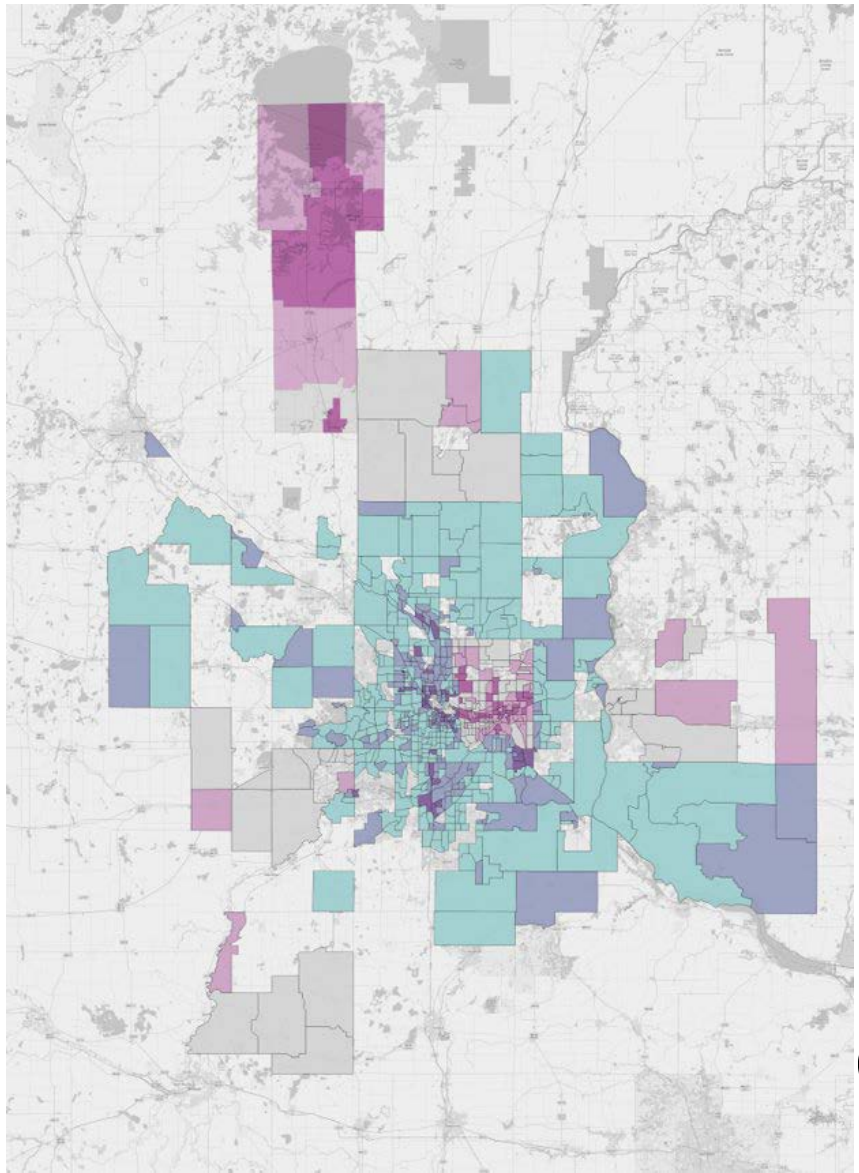


Solar economics on horizontal axis and potential ITC adder eligibility on vertical axis.

Municipal Utility Use Case for NREL's STEADy Tool

- Understand where federal funds are available to support equitable adoption of solar in your location
- First cut of solar economics by census tract
- Prioritize siting of projects among multiple locations.

Join the National Community Solar Partnership to receive free technical assistance, including using the STEADy data set:
www.solarinyourcommunity.org



Ownership and Program Administration Considerations

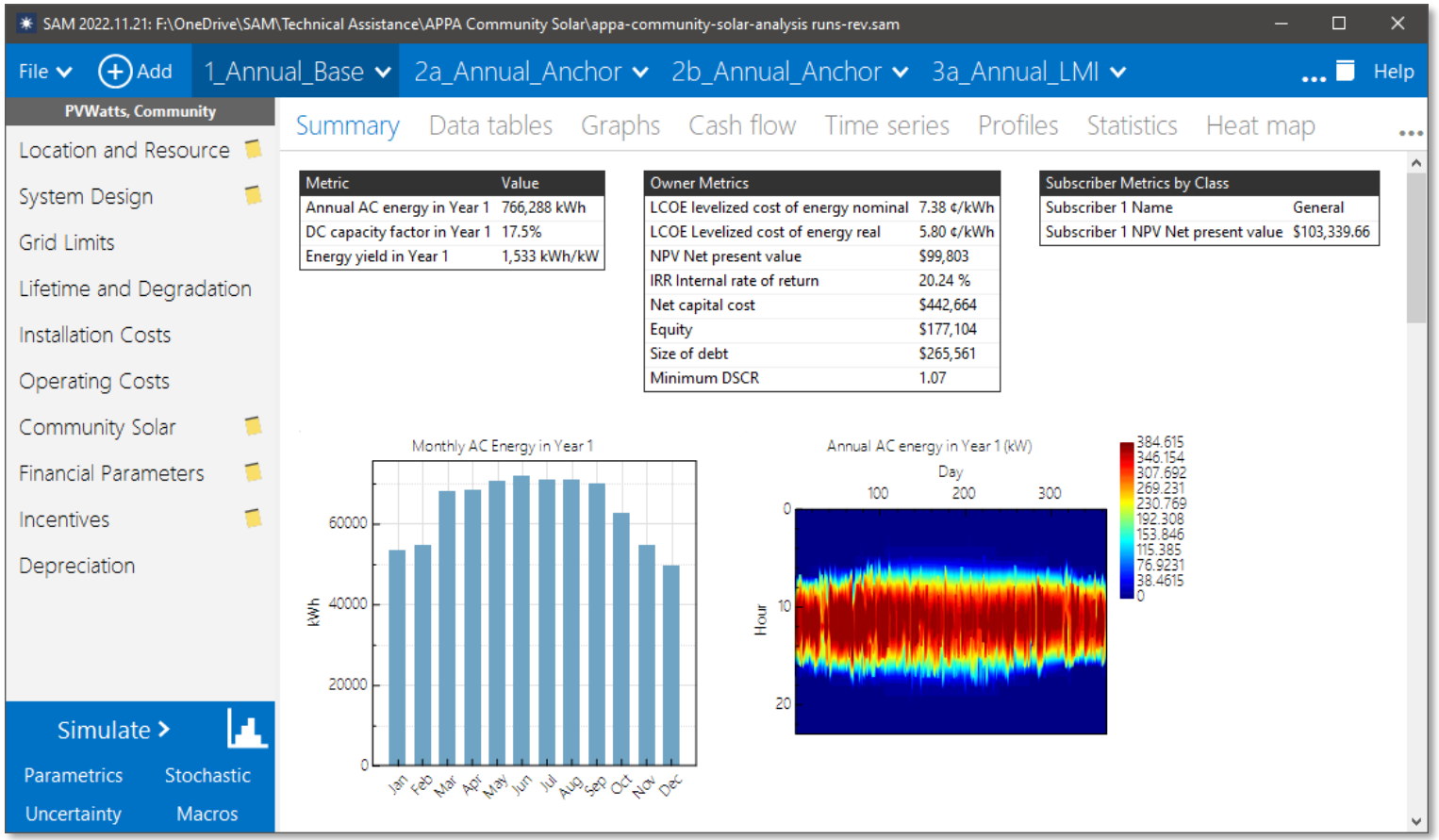
- Will the utility or third party develop the solar array?
- Will the utility or third party operate and maintain the solar array?
- Who will handle subscriber acquisition?
- Who will handle subscriber management and communications?
- Will subscriber payments be on-bill or via a separate bill?
- Will subscriber credits appear on-bill?
- Will the utility billing system need upgrades?

Getting Started With SAM

NREL's System Advisor Model

SAM is a financial modeling tool that can be used to explore community solar financials from the developer perspective. It has a community solar module that allows users to model the cash flow impact of different subscription payments across multiple customer classes.

SAM Calculates System Output and Project Financial Metrics



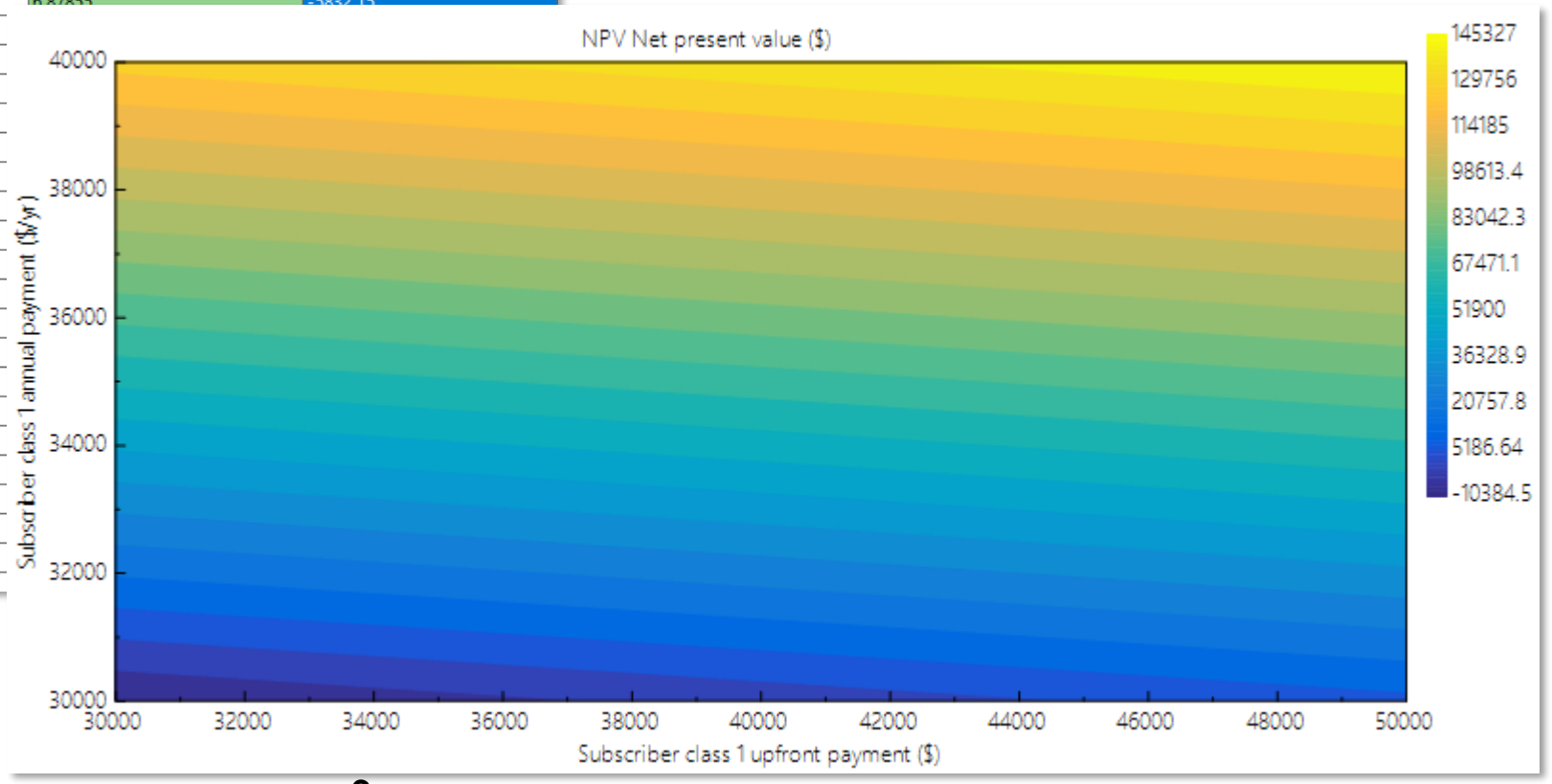
The performance model runs an hour-by-hour simulation of a photovoltaic system.

The financial model calculates the annual cash flows for a community solar project over the multiyear analysis period.

SAM's Parametric Simulations Facilitate Scenario Analysis

Quick setup... Inputs... Outputs... Run simulations > Number of runs: 231

	Subscriber class 1 upfront payment ($)	Subscriber class 1 annual payment ($/yr)	IRR Internal rate of return (%)	NPV Net present value ($)
1	30000	30000	6.3499	-10384.5
2	31000	30000	6.45229	-9474.02
3	32000	30000	6.55629	-8563.55
4	33000	30000	6.66196	-7653.08
5	34000	30000	6.76936	-6742.61
6	35000	30000	6.87855	-5832.15
7	36000	30000		
8	37000	30000		
9	38000	30000		
10	39000	30000		
11	40000	30000		
12	41000	30000		
13	42000	30000		
14	43000	30000		
15	44000	30000		
16	45000	30000		
17	30000	31000		
18	46000	30000		
19	31000	31000		
20	47000	30000		
21	32000	31000		
22	48000	30000		
23	33000	31000		
24	49000	30000		
25	34000	31000		
26	50000	30000		



Useful Links for SAM

Register on the SAM website:
https://sam.nrel.gov/register.html

Download SAM, watch videos, and read reports:
https://sam.nrel.gov/

SAM repository – detailed help files:
https://samrepo.nrelcloud.org/help/index.html

SAM individual support:
Forum: https://sam.nrel.gov/forum
Email: sam.support@nrel.gov

Join NCSP for access to free technical assistance using SAM to model community solar projects:
https://ncsp.solarinyourcommunity.org/registrations/groups/39758

5 min. Break

AMERICAN PUBLIC POWER ASSOCIATION

Impact of Program Design on Project Financials

The median net present value of subscriptions has been positive since 2016, when state-legislated programs began to rapidly expand.
https://www.nrel.gov/docs/fy21osti/80246.pdf

Evaluate Different Community Solar Scenarios

- Use NREL's System Advisor Model (SAM) to model scenarios
- Subscribers (assume project is fully subscribed)
  - General: Residential
  - Anchor: Commercial
  - LMI: Low-income.
- Revenue
  - Upfront: Single payment at start of project
  - Annual: Annual payments over life of project
  - Hybrid: Combine upfront and annual payments.

Solar Project Example

- 500-kW PV system in Longmont, CO
- $1/W installation cost, ~$500,000
- $15/kW annual operating cost, ~$7,500 in Year 1
- 60% debt, 20 years, 5% annual interest rate
- 2.5% inflation rate, 5% real discount rate
- Additional costs for debt closing, construction financing, reserve accounts
- No income or property taxes
- 30% ITC as cash payment, ~$150,000 in Year 1.

Base Case - Scenario 1

Program Design

• General residential subscribers	100
• Capacity-based subscription	5 kW each
• Fixed subscription payment	$400/yr ($33.33/month)
• Residential bill credit rate	6.5 ¢/kWh

Results

• Developer NPV	$100,000
• Internal Rate of Return (IRR)	20%

Do customers see savings in our base case?

- SAM tells us the value of the community solar subscription (e.g., whether customers receive more credits for the community solar than they pay for it).
- SAM does *not* tell us whether the subscriber saves money *as compared to their old electricity bill.*
- Subscriber value is determined by:
  - Subscription payments for community solar
  - Bill credits for community solar
  - kWh of community solar the customer received.
- We do not have inputs for:
  - Customer electricity tariff (non-community solar rate structure)
  - Customer electricity load.

You can do a separate calculation to determine customer savings as compared to the standard electricity rate.

Scenario 2a: General Subscribers + Anchor Tenant

Program Design

• General residential subscribers	70
• Capacity-based subscription	350 kW @ 5 kW each
• Fixed subscription payment	$400/yr ($33.33/month)
• Bill credit rate	6.5 ¢/kWh
• **Anchor tenant**	**1**
• Capacity-based subscription	150 kW
• Fixed subscription payment	$9,750/yr ($812.50/mo)
• Bill credit rate	5.5 ¢/kWh

Results

• Developer NPV	$69,000 (-30% from base case)
• IRR	16%
• General subscriber value	-30% from base (Same NPV/customer)

Anchor tenant pays lower $/kWh:

- Reduces developer NPV
- Reduces value to general subscribers
- Reduces risk of undersubscribed project
- Reduces customer acquisition costs

Scenario 2b: Add Upfront Fee for Anchor Tenant

Program Design

• General residential subscribers	70
• Capacity-based subscription	350 kW @ 5 kW each
• Fixed subscription payment	$400/yr ($33.33/month)
• Bill credit rate	6.5 ¢/kWh
• Anchor tenant	1
• Capacity-based subscription	150 kW
• Fixed subscription payment	$9,750/yr ($812.50/mo)
• **Upfront fee**	**$30,000**
• Bill credit rate	5.5 ¢/kWh

Upfront fee reduces size of debt, contributing to increase in NPV/IRR.

Results

• Developer NPV	$96,000 (-4% from base case)
• IRR	24%
• General subscriber value	Same as 2a scenario

Scenario 3: General and LMI Subscribers

Program Design

- General residential subscribers — 50
- Capacity-based subscription — 5 kW each
- Fixed subscription payment — $400/yr ($33.33/month)
- Bill credit rate — 6.5 ¢/kWh

- **LMI subscribers** — **50**
- Capacity-based subscription — 150 kW
- Fixed subscription payment — $340/yr ($28.33/mo)
- Bill credit rate — 6.5 ¢/kWh

LMI subscriber pays lower subscription fee, reducing NPV and value to general class.

Results

- Developer NPV — $59,000 (-41% from base case)
- IRR — 14%
- General subscriber value — -50% from base case (Same NPV/customer)

Scenario 3a: Increase General Subscriber Rate To Raise NPV

Program Design

• General residential subscribers	50
• Capacity-based subscription	5 kW each
• **Fixed subscription payment**	**$460/yr ($38.33/month)**
• Bill credit rate	6.5 ¢/kWh
• LMI subscribers	50
• Capacity-based subscription	150 kW
• Fixed subscription payment	$340/yr ($28.33/mo)
• Bill credit rate	6.5 ¢/kWh

Higher general subscriber payments restore NPV to base case level but reduce value to general subscribers.

Results

• Developer NPV	$100,000 (same as base case)
• IRR	20%
• General subscriber value	-90% from base case (-80% from Scenario 3)
• LMI subscriber value	Same as Scenario 3

Scenario 4: Hybrid Upfront and Recurring Payment

Program Design

• General residential subscribers	100
• Capacity-based subscription	5 kW each
• **Fixed subscription payment**	**$370/yr ($30.83/month)**
• **Upfront fee**	**$360**
• Bill credit rate	6.5 ¢/kWh

Results

• Developer NPV	$91,000 (-9% from base case)
• IRR	24%
• General subscriber value	+40% from base case

Upfront fee increases general subscriber value but may detract or be a burden for some customers.

Scenario Comparison

	Base Case (1)	+ Anchor Tenant (2a)	+ Anchor Upfront Fee (2b)	+ LMI (3)	+ General Rate Increased (3a)	Hybrid Fees (4)
Subscribers	100 general residential	70 general residential + **1 anchor tenant**	70 general residential + 1 anchor tenant	50 general + **50 LMI**	50 general + 50 LMI	100 general
Capacity	5 kW	5 kW; 150 kW	5 kW; 150 kW	5 kW	5 kW	5 kW
Recurring Payments	$400/year	$400/year; $9,750/year	$400/year; $9,750/year + **$30k upfront**	$400/year $340/year	**$460/year** $340/year	**$370/year + $360 upfront**
Bill Credit Rate	6.5 ¢/kWh	6.5 ¢/kWh 5.5 ¢/kWh	6.5 ¢/kWh 5.5 ¢/kWh	6.5 ¢/kWh	6.5 ¢/kWh	6.5 ¢/kWh
NPV and Δ from Base Case	$100,000	$69,000 -30%	$96,000 -4%	$59,000 -41%	$100,000	$91,000 -9%
IRR	20%	16%	24%	14%	20%	24%
Δ General Subscriber Value based on NPV calculation for the entire class	N/A	-30%	-30%	-50%	-90%	+40%

*Bolded text denotes notable changes between the scenarios.

Austin Energy Example

Project-based versus Portfolio-based Program Design - Impact on Financials

AMERICAN PUBLIC POWER ASSOCIATION

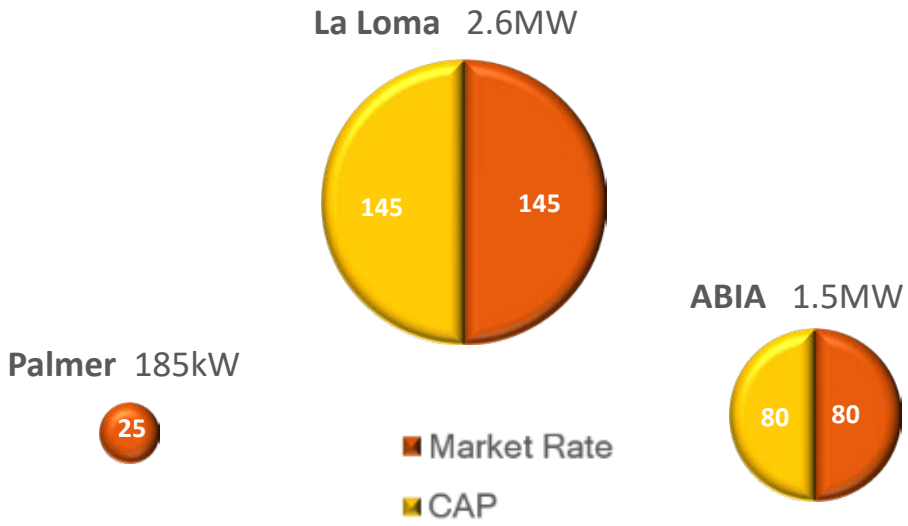
Subscription models explored

- **Upfront or Monthly Capacity-Based Subscription**: Customer would pay upfront or make monthly payments based on kW subscribed and receive solar credits on their bill for their subscribed production.
- **Power Supply Adjustment (PSA) +1¢** : Community solar customers would subscribe for 100% of their energy use at a $0.01 premium, added to their PSA fee similar to current GreenChoice.
- ***PSA Lock (CSA)**: Replace the standard PSA with a locked-in Community Solar Adjustment (CSA) fee for 100% of energy use.*
- **Panel Ownership**: Customers would purchase solar panels, starting with the panels Austin Energy has already installed on the Palmer Events Center roof, take tax credits, and receive solar credits for their production.
- ***Low Income Program**: Austin Energy would offer community solar to Customer Assistance Program (CAP) customers at subsidized rate.*

*Underlined bullets denote the models selected by Austin Energy

Austin Energy Community Solar

- First Green-e® certified Community Solar program in the country
- 100% of participants' electric use is offset by energy from local solar projects
- Community Solar Charge replaces Power Supply Adjustment (PSA) on participants' bills
- Half of capacity dedicated to Customer Assistance Program (CAP) customers at discounted rate
- CAP customers currently receiving a penny and a half/kwh bill discount
- Portfolio cost is higher than program recovery, so subsidization is required



Current Program	Market-Rate	Low-Income
Est. # of Participants	270	200
Community Solar Rate	4.27¢/kWh	2.77¢/kWh
Δ vs 2018 PSA	+1.5¢/kWh	0.0¢/kWh
Δ vs 2023 PSA	-0.1¢/kWh	-1.60¢/kWh

Q&A – Discussion

APPA ACADEMY

AMERICAN PUBLIC POWER ASSOCIATION

Thanks for joining us!

EducationInfo@PublicPower.org

Please complete the online evaluation.

NREL/PR-7A40-85716

Join the National Community Solar Partnership Online Platform

https://ncsp.solarinyourcommunity.org/registrations/groups/39758

Questions? Email community.solar@ee.doe.gov

This work was authored [in part] by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Solar Energy Technologies Office. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

AMERICAN PUBLIC POWER ASSOCIATION

Resources

National Community Solar Partnership Webpage
https://www.energy.gov/communitysolar/community-solar

National Renewable Energy Laboratory's Community Solar Webpage
https://www.nrel.gov/state-local-tribal/community-solar.html

Municipal Utility Community Solar Workbook
https://www.publicpower.org/resource/municipal-utility-community-solar-workbook

Expanding Solar Access: State Community Solar Landscape (2022)
https://www.nrel.gov/docs/fy23osti/84247.pdf

Status of State Community Solar Program Caps (2021)
https://www.nrel.gov/docs/fy23osti/84077.pdf

Sharing the Sun: Community Solar Deployment, Subscription Savings, and Energy Burden Reduction (2021)
https://www.nrel.gov/docs/fy21osti/80246.pdf

Sharing the Sun: Understanding Community Solar Deployment and Subscriptions (2020)
https://www.nrel.gov/docs/fy20osti/75438.pdf