# SCALING COMMUNITY SOLAR IN TEXAS:

## Barriers, Strategies, and Roadmap

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TEXAS LBJ School
The University of Texas at Austin
Lyndon B. Johnson School of Public Affairs

HUMPHREY SCHOOL OF PUBLIC AFFAIRS
UNIVERSITY OF MINNESOTA

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A Collaboration between the University of Texas at Austin's LBJ School of Public Affairs and the University of Minnesota's Humphrey School of Public Affairs

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# Acronyms and Abbreviations

| | |
|---|---|
| **4CP** | four coincident peak |
| **CBO** | community-based organization |
| **Co-op** | rural electric cooperative |
| **CSS** | community shared solar |
| **DG** | distributed generation |
| **DSP** | distribution service provider |
| **EPC** | engineering, procurement, and construction |
| **ERCOT** | Electric Reliability Council of Texas |
| **IRR** | internal rate of return |
| **KPUB** | Kerrville Public Utility Board |
| **kW** | kilowatt |
| **LCOE** | levelized cost of energy |
| **LMI** | low-moderate income |
| **LSE** | load-serving entity |
| **Muni** | municipal utility |
| **MW** | megawatt |
| **NOIE** | non-opt-in entity |
| **NREL** | National Renewable Energy Laboratory |
| **PUCT** | Public Utility Commission of Texas |
| **QSE** | qualified scheduling entity |
| **REP** | retail electric provider |
| **RPS** | renewable portfolio standard |
| **SODG** | settlement only distribution generator |
| **TEPRI** | Texas Energy Poverty Research Institute |
| **THI** | Texas Hunger Initiative |
| **TSP** | transmission service provider |
| **VEIC** | Vermont Energy Investment Corporation |
| **VPPA** | virtual power purchase agreement |

# Executive Summary

This study proposes a roadmap for the development of community shared solar in Texas. Community shared solar (also referred to as "community solar" or "CSS" in this report) represents a promising deployment strategy for solar in Texas that, if scaled, has the potential to create significant local economic and environmental benefits. However, to date, community solar has only been deployed in small pockets of activity in the state (see Appendix for list of Texas CSS projects through 2019). The roadmap developed in this study is based on a detailed analysis of the barriers to CSS and the strategies to overcome these barriers in the near-term through developing the policy, stakeholder, and market-actor ecosystem necessary to activate and scale CSS in Texas for the long-term.

Community solar presents a substantial opportunity because it can offer directed benefits to many stakeholders. Community solar provides access to the benefits of solar ownership with the possibility of little to no upfront costs and without requiring access to a rooftop. Because of this, CSS is a promising model to expand the benefits of solar to the nearly half of households in the U.S. that do not have access to rooftop solar, either because they rent their home, live in a multi-unit apartment complex, or have a roof that is not suitable for solar.[1] Moreover, CSS can be inclusive of low- and moderate-income (LMI) households that lack the capital or access to finance to afford the upfront cost of rooftop solar. Many states that have developed CSS programs have also adopted provisions to require or incentivize LMI participation in their programs.[2] Community solar can also provide a vehicle for local jobs and economic development.

The findings in this report are oriented around a discussion of the following questions:

- What ecosystem-level and project-level functions are necessary for successful community solar projects and ecosystem support? (Section 2)
- What key barriers exist for scaling up community solar in Texas? How can those barriers be addressed through a combination of policy and stakeholder actions? (Sections 3 & 4)
- What are the essential roles for community-based organizations? How can these organizations be activated to collaborate with developers and other stakeholders in a community solar program? (Section 5)

### Ecosystem-level and project-level functions

Every CSS project, program, and policy has pre-development, development, and operations phases. In each of these phases, there are a number of critical functions that need to occur. Unlike many traditional energy-sector activities, solar developers and utilities are not the only types of organizations performing these functions for CSS; many organizations without electric industry expertise can and do perform these functions. Between utilities and developers on the one hand and non-industry actors on the other, CSS models are cross-sector collaborations that build toward specific project-, program-, and policy-wide successes. Section 2 defines the key functions that were consistently important for scaling up CSS deployment (Figure 3). Considering the cycles of development and diffusion, we matched functions to ecosystem or project levels, (or both) where the function could scale between large, state- or region-level functions or within an organization

[1] Feldman, D., A. Brockway, E. Ulrich, and R. Margolis. (2015). *Shared Solar: Current Landscape, Market Potential, and the Impact of Federal Securities Regulation*. National Renewable Energy Laboratory Technical Report NREL/TP-6A20-63892.

[2] Heeter, J., L. Bird, E. O'Shaughnessy, and S. Koebrich. (2018). *Design and Implementation of Community Solar Programs for Low- and Moderate-Income Customers*. National Renewable Energy Laboratory Technical Report NREL/TP-6A20-71652.

for a certain project or policy. While these functions may not all be necessary for a particular project or program to take place, we understand their complementarity to be paramount for scaling up CSS.

## Key barriers for scaling community solar in Texas

State and local government regulation, policy, and market conditions influence strategies for enabling CSS development. Registration and interconnection policies influence siting and sizing decisions; local government codes and availability of supportive policies impact project finances and soft costs; and competing generation options or the presence or absence of certain market actors can impact competitive viability. While the CSS market in Texas is showing signs of potential growth, it is relatively small compared with other regions of the United States. Reasons for this may lie in the unique regulatory and market characteristics of the Texas electricity system.

Texas restructured its electricity market to promote retail competition in 1999, making Texas the U.S. state closest to a deregulated retail electricity market. This structure creates two distinct retail market structures, each with opportunities and challenges for CSS. The first, which includes municipal utilities ("munis") and rural electric cooperatives ("co-ops"), serves 25% of electricity users in Texas. The second covers 75% of the state and allows consumer choice from retail electric providers (REPs). Section 3 provides a summary of key regulatory and market barriers and opportunities for CSS in Texas, including an ecosystem analysis of the statewide regulation that applies to all areas of Texas, as well as market-specific ecosystem barriers.

Section 4 provides a stakeholder analysis detailing the characteristics and resulting barriers in the two distinct market environments, with specific focus on retail electric providers and project developers. There are several market and regulatory barriers varying in degree of the difficulties they pose for CSS scale-up. These barriers are summarized in Table 2 (Section 6).

## Activation pathways for community-based organizations

CSS projects and programs require significant cross-sector collaboration, bringing together more diverse stakeholders and resources than other forms of solar development. This type of collaboration often involves multiple types of organizations that need to be "activated" or drawn into collaboration. We focus our analysis specifically on activating community-based organizations (CBOs), which we consider to be any organization, for- or non-profit, that represent aspects of a community. Together with subscribers, they are the "community" in community solar.

Among 1.5 million CBOs nationally and over 100,000 CBOs in Texas, we found that the composition of CBOs in Texas roughly mirrors the national composition; however, compared to other states with ongoing CSS deployment, the density of almost all types of CBOs is lower in Texas. Furthermore, we observe that most of the CBOs in Texas are located close to the urban centers; thus, rural areas have an even lower density of CBOs. This inequity is important, because CBOs are known to:

- Facilitate underserved communities' involvement in and benefits from community solar through governance and economic development support
- Negotiate community support for energy projects, helping to reduce the costs of subscriber acquisition, project scoping, and subscriber management
- Drive business model innovations across the United States with respect to many project and ecosystem functions, adapting programs to local contexts and needs
- Help members view renewable energy development positively, overcoming their own indifference or uncertainty
- Create positive feedback loops for greater support of the energy transition over the long-run

For these reasons, it is important to understand how CBOs are “activated,” since they are an important and often overlooked partner in enabling the scale-up of energy technologies. Our findings (Section 5) suggest that activation depends on: *internal conditions* (mission alignment and pre-existing resources) and *external primers* (new funding or a bridging organization or developer). We also identified four main routes for activation: 1) re-imagining organizations, 2) connecting organizations, 3) funding organizations, and 4) structuring an organization’s network, which is an activation of all three prior paths. We also found numerous windows of opportunity that include series of formal, planned events—such as board meetings, as well as more informal, events—such as networking. The case studies presented in Section 5 exemplify the types of long-developing activation paths enumerated above.

Successful activation of the CBOs that have experience in the key functions for community solar could act as a multiplier to scale opportunities for CBO activation. Key activities include planning around 1) organizationally based, routine events, 2) larger, ecosystem-based spillover events, and 3) individual-based, discretionary events; and working with 1) broad missions that can relate easily to different sectors’ missions and local conditions; 2) bridging organizations and developers that enhance and suggest full community solar technical solutions that can fit local contexts; and 3) regionally-specific networks that convene CBOs, energy developers, and utilities to provide an opportunity for individuals to meet and discuss ideas and solutions. Section 5 discusses recommendations in more detail and provides National and Texas CBO examples, functions, and opportunities for aligning CBO mission with community solar in Texas (Table 1, Section 5).

## Roadmap for scaling community solar in Texas

Based on our findings, we believe that in the absence of top-down policy in Texas, the unique characteristics and capabilities of CBOs will be essential in forming the bottom-up activation pathways that overcome the barriers to development of CSS in Texas. The findings in this report can also serve as a useful example to states wanting to build a market-driven, bottom-up scalable approach to CSS development. Our roadmap (next page) encompasses three key strategies for activating community solar in Texas:

1. **Statewide Coalition Building.** To build successful cross-sector partnerships and a supportive policy ecosystem, groups within Texas could organize with each other by recognizing and broadening their overlapping missions.

2. **Market-Specific Community Activation and Technical Assistance.** Resources are needed to educate and activate 1) community-based organizations, 2) technical organizations like utilities and community solar developers, and 3) diverse bases of subscribers for CSS projects.

3. **Regional Knowledge and Resource Building.** Regional groups of bridging organizations have unique capacity in local siting-related functions, given the need for groups that can translate technical policies, such as zoning or interconnection, to lay audiences and perform them with local or regional interests in mind.

## Scaling Community Solar in Texas – Trajectories of Change

| Level | FUNCTION | OBJECTIVE | STRATEGIES | ACTIONS (CBO / Developer / Utilities) |
|---|---|---|---|---|
| Ecosystem Level | **Policymaking** | • Create access to ERCOT for distributed generation under 10 MW for ancillary services and other revenue streams<br>• Create standardized and open information about distribution grid<br>• Create statewide support policies for community shared solar (CSS)<br>• Streamline local permitting and interconnection rules | **Statewide Coalition Building:** Convene regular meetings of interested stakeholders for CSS and other distributed energy resource topics on a regular basis | Environmental/ Energy: **Environmental and energy CBOs** can help advocate and convene for rule changes/**Local agencies** can also help develop uniform policies for CSS projects<br>Developer: CSS **developers** can convene and advocate for rule changes<br>TDSP: **TDSPs** could be encouraged to collaborate on developing more uniform distribution grid rules |
| | **Ecosystem Legitimating** | • Create viable models of CSS for REPs averse to risky product and marketing innovations in complex, highly competitive, low-margin arenas<br>• Create viable models for muni/co-ops that still do not see CSS as a legitimate or viable option for their community | **Market-Specific Community Activation and Technical Assistance:** Support competition or funding program for innovative, regional CSS programs that connect REPs and munis/co-ops with CBOs | Local Government, Financial: **Local, trusted, legitimate CBOs**, such as religious and community development organizations and local governments, can help subscribe, educate, and convene networks/ **Financial CBOs** can also provide stable financial services<br>Muni/Co-op: **Munis/Co-ops** with existing CSS can collaborate to demonstrate viability to non-adopter munis/co-ops |
| | **Siting** | • Create pathways for project siting that can decrease cost of grid build-out and interconnection<br>• Create pathways for CSS supportive and regionally consistent local permitting, zoning, and building codes | **Regional Knowledge and Resource Building:** Support regional knowledge networks for distribution grid and zoning practices | Local Government: **Rulemaking CBOs** such as local governments can help convene and provide policymaking, while **energy CBOs** can educate and convene<br>Energy: **Landowning CBOs** such as churches, community development corporations, or housing nonprofits can also facilitate siting |
| Project Level | **Project Legitimating**<br>**Project Scoping**<br>**Acquiring and Managing Subscribers** | • Create consumer awareness and understanding of CSS in communities with and without CSS<br>• Create viable business models for CSS developers (including muni/co-ops and REPs) who may have limited experience<br>• Create customer acquisition and subscriber management pathways | **Market-Specific Community Activation and Technical Assistance:** Support competition or funding program for innovative, regional CSS programs that connect REPs and munis/co-ops utilities with CBOs and developers | Local Government, Schools, Housing: **Important local CBOs** such as local governments, schools, housing authorities, and community development corporations can help educate customers and facilitate subscription<br>Engage with **national organizations** with existing capacity |

*CBOs: Community-based organizations; Munis/Co-ops: Municipally-owned electric utilities/rural electric cooperatives; REPs: Retail electric providers; and TDSPs: Transmission/distribution service providers

# I. Introduction

## Scope and goals of the study

This study proposes a roadmap for the development of community shared solar in Texas. Community shared solar (also referred to as "community solar" or "CSS" in this report) represents a promising deployment strategy for solar in Texas that, if scaled, has the potential to create significant local economic and environmental benefits. However, to date, community solar has only been deployed in small pockets of activity in the state. The roadmap developed in this study is based on a detailed analysis of the barriers to community solar and the strategies to overcome these barriers in the near-term through developing the policy, stakeholder, and market-actor ecosystem necessary to activate and scale CSS in Texas for the long-term.

The findings in this report are oriented around a discussion of the following questions:

- What are the ecosystem-level and project-level functions that are necessary for successful community solar projects and ecosystem support? (Section 2)
- What are the key barriers for scaling up community solar in Texas and how can those barriers be addressed through a combination of policy and stakeholder actions? (Sections 3 & 4)
- What are the essential roles for community-based organizations (CBOs) and how can these organizations be activated to collaborate with developers and other stakeholders in a community solar program? (Section 5)

## What is community solar and what defines "community" in community solar?

There is no widely adopted definition of "community solar" and different organizations have adopted different definitions. For the purposes of this report, we adopt the following definition:

*Community solar is a solar installation with multiple offtakers (referred to as 'subscribers') who 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.*[3]

Not all community solar works the same, and in some cases, there can be very little community involvement in community solar. Simultaneously, the term "community solar" can be used in practice to describe projects that would not meet the above definition.[4] Still, there are aspects of community solar, as defined above, that warrant specific analysis of solar deployment that meets this definition. While not all CSS projects always do, community solar that meets the definition above can:

- Create tangible financial benefits for many retail electricity customers from offsite solar arrays, including those customers who cannot otherwise benefit from solar because of inappropriate rooftop space or because they are renters, owners in a multistory building, or lack sufficient financial resources to otherwise adopt solar;

[3] All CSS projects include terms for energy offtake tied to specific user's bill and many include explicit treatment of renewable energy credits. While community solar can share offtake among a large number of energy users, solar projects where participation as an offtaker is not made actively and voluntarily by a customer (or a distribution-tied aggregator or intermediary that assumes the offtake on behalf of a customer) is not community solar.

Other definitions of community solar may factor in community member participation, array size limits, workforce training, renewable energy credit provisions, and other amenities may be applicable as the creative space for community solar business models evolves (Energy Sage; Brehm et al. 2016).

[4] For a discussion of definitional challenges in community solar see:
Leon, W., Farley, C., Hausman, N., Herbert, B., Hammer, N. H., Paulos, B., Reames, T., Sanders, R., Schieb, L., Deane-Ryan, D., & Navarra, R. (2019). *Solar with Justice Strategies for Powering Up Under-Resourced Communities and Growing an Inclusive Solar Market.*

- Allow for greater community engagement and local preference to influence the siting and design of solar projects; and
- Create (intangible) benefits for individuals and communities who can become local stewards of renewable energy projects.

These potential benefits of community solar stand in contrast to residential rooftop solar and utility-scale solar. Whereas rooftop solar requires the requisite ownership of appropriate rooftop space and access to capital or finance, community solar does not. Further, community solar can benefit from more favorable economies of scale than rooftop solar by sizing projects to meet the load of multiple subscribers. Also, where as traditional utility-owned solar predominantly does not create benefits for specific end-users or fully incorporate local preferences of project host communities, community solar can.

## Why community solar?

Solar deployment in the United States totaled 77.7 GW by the end of 2019. Solar deployment continues to grow rapidly, expanding by 13.3 GW in 2019, constituting nearly 40% of all new electric generating capacity installed that year. Of this growth, about two-thirds was driven by utility-scale solar and about 20% was driven by residential solar.[5]

While utility-scale and behind-the-meter solar are expected to play a significant role in the future energy mix nationally, they will likely face challenges. Utility-scale solar could be subject to siting and transmission constraints. Behind-the-meter solar could meet policy and economic constraints, particularly in areas where export incentives are lowered to terms significantly less than the retail rate.[6] Given these challenges, community solar presents an opportunity to complement other solar market segments.

Community solar has proliferated over the past five years. As of the end of 2019, CSS deployment totaled over 2.1 GW nationally, representing 2.7% of total solar deployment and 4% of solar installations in 2019. This deployment was achieved through more than 1,200 projects across 40 states. While 20 states and the District of Columbia have passed legislation to require CSS programs, more than half of the installed capacity by 2019 came from just two states, Minnesota and Massachusetts (although in early 2020, Florida interconnected nearly 450 MW of community solar). Nevertheless, many projects, mostly those of municipal and cooperative utilities (but also some community groups and third-party developers) have come from outside legislatively required CSS programs.[7]

> *"Community solar removes barriers. People don't have to own their home, they don't have to have a roof of a certain age, they don't have to manage the operations and maintenance of the system, they don't have to have a lot of money. We're able to remove more barriers and create access for the communities that we're trying to deliver benefits to."*
>
> *— NORTHWESTERN REGIONAL ENVIRONMENTAL NON-PROFIT*

[5] Mackenzie, W. SEIA. 2020. *US Solar Market Insight 2019 Year-in-Review*.

[6] Brehm, K., Bronski, P., Coleman, K., Doig, S., Goodman, J., Koch Blank, T., & Palazzi, T. (2016). Community-Scale Solar–Why Developers and Buyers Should Focus on this High-Potential Market Segment. *Washington, DC.*

[7] NREL (May 2020). Community Solar Project Database. https://data.nrel.gov/submissions/131

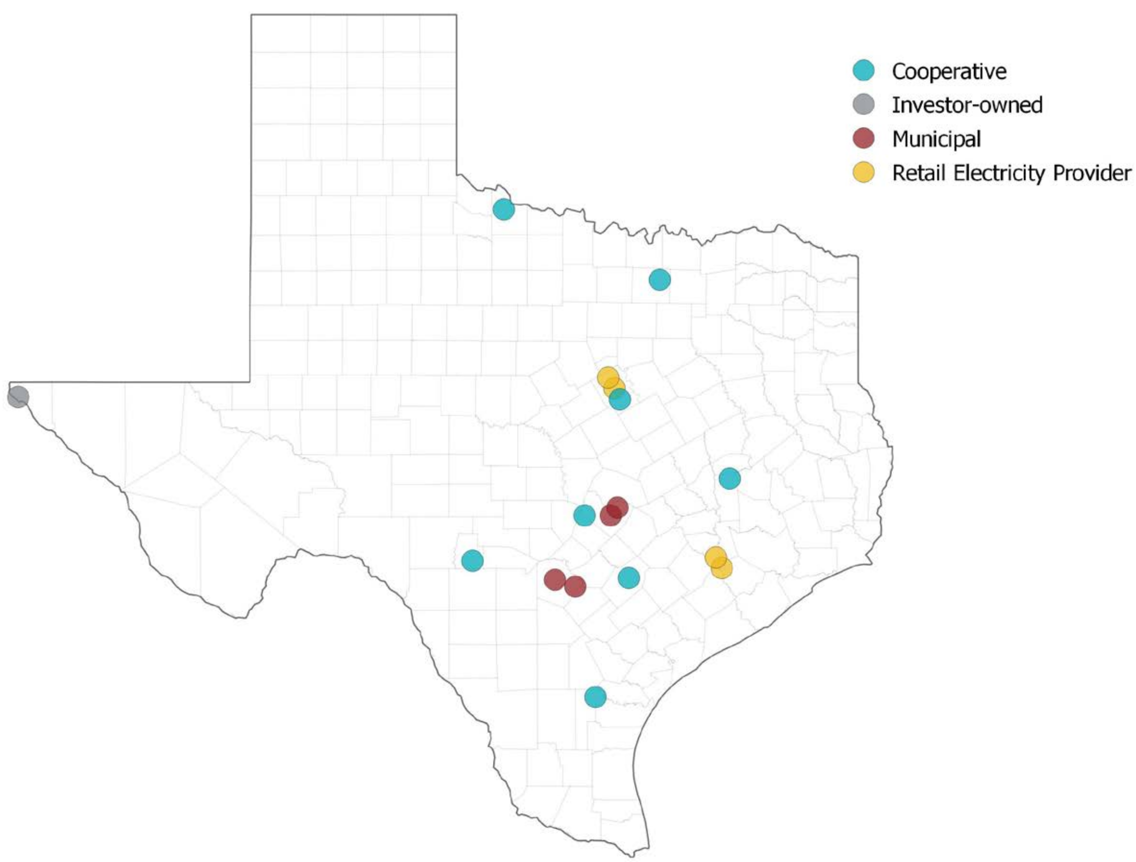
## Why community solar in Texas?

While utility-scale and distributed solar markets have grown considerably in Texas and are projected to continue growing in coming years, CSS projects and programs in Texas have not yet taken off, with 18 CSS projects totaling 65 MW-AC as of the end of 2019 (Figure 1). Large municipal utilities in Austin and San Antonio have developed CSS programs to complement residential rooftop PV programs and eight cooperative utilities, one investor-owned utility, and three retail electric providers (REPs) have also developed CSS programs. However, these models have not yet demonstrated broad replicability and scalability throughout the state.

Community solar programs have been relatively slow to gain traction in Texas compared to other states because, in part, Texas's unique market structure presents challenges for distributed solar generally and community solar specifically. Generally, Texas's approach to energy development has made for a reduced role for legislation and regulatory market intervention. Nationally, community solar deployment is being led by states that have adopted favorable legislation. While 20 states and Washington DC have passed community solar legislation, Texas has not.[8] Furthermore, much of Texas operates in a competitive retail choice environment. Across the country and in Texas, utilities, particularly municipal and cooperative utilities, are demonstrating that community

**Figure 1 – Community solar projects in Texas as of 2019.**

Most community solar projects in the state center around municipal and cooperative utilities. Increasingly, retail electric providers are providing new, innovative models for Texans across the state (see Appendix for a detailed project list).




[8] *Community Solar Policy Decision Matrix Guidance for Designing Community Solar Programs*. (2019). http://www.communitysolaraccess.org/membership/

solar can still be deployed without enabling legislation. In fact, 39 states and Washington DC have at least one CSS project (NREL, 2020). However, within the retail choice market in Texas, robust customer offerings have created a competitive landscape of energy suppliers that make it difficult for community solar to differentiate itself. Still, early experience with community solar in the different markets in Texas suggests that consumer interest for community solar could be high enough to support growth. The combination of transparent and efficient market processes for renewables development along with a number of highly experienced solar developers has set the stage for a deeper consideration of the potential of community solar. Community solar could prove a viable, equitable, and scalable approach to deploying solar in Texas, helping to transition the Texas energy system more broadly for the 21st century.

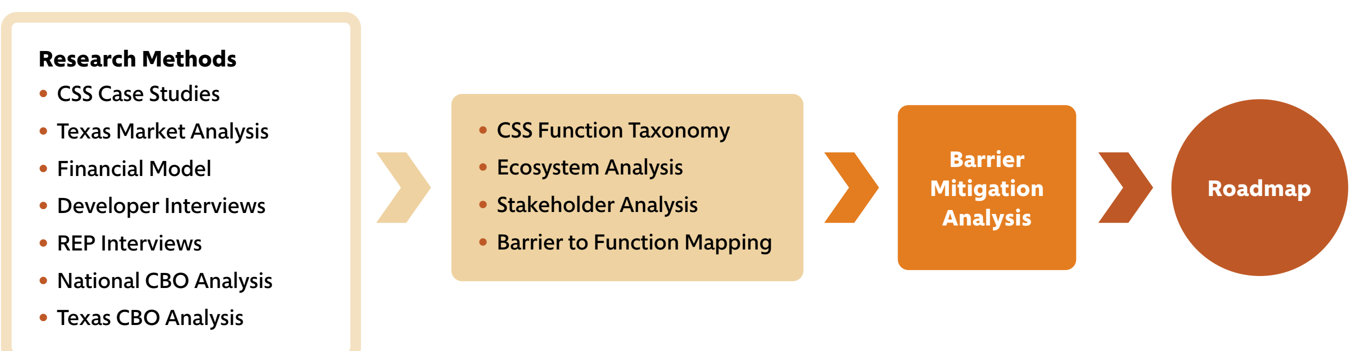
## Project methodology

In this report, we develop a roadmap for scaling community solar in Texas in three stages (see Figure 2). First, we build a multi-method data set and analytic tools that include: case studies; Texas regulatory and market analysis; interviews to build understanding of business models for community solar; a financial model for CSS projects specific to the Texas market; and a comparative analysis of community-based organizations (CBOs) in Texas and nation-wide that engage with or can engage with community solar deployment.

Second, we utilize these tools and data to identify barriers to community solar in Texas markets, understand how these barriers impact the viability of CSS projects, and develop a comprehensive understanding of the functions necessary for successful CSS projects and ecosystem support.

Third, we identify strategies for overcoming barriers to community solar in Texas by activating stakeholders, particularly CBOs, to fill functional gaps in community solar development. Finally, we synthesize these components and analysis into a proposed roadmap to inform potential trajectories of change to expand community solar in Texas in the near-term, and to develop the policy, stakeholder, and market-actor ecosystem necessary to activate and scale community solar in Texas in the long-term. The Appendix provides a more detailed overview of the methods employed in this analysis.

**Figure 2 – Project methodology for “Scaling Community Solar in Texas: Trajectories of Change.”**



## Report overview

This report is organized into five sections , as detailed below. Finally, we present the Texas community solar roadmap for activating CBOs and market actors to overcome barriers to community solar development through example strategies.

We recognize that developing CSS projects will depend on specific contexts, including geographic and technical factors, regulatory conditions and market structures; thus, all interventions require some degree of individualization.

While we do not offer regulatory advice or present a “best practice” model that fits all local conditions in this report, our goal is to provide an outline of barriers and mitigation strategies that are applicable across many different contexts in Texas’s markets and beyond.

## Report overview at-a-glance

### I. Introduction

Defines community solar and the unique role community solar can play in Texas energy markets.

### II. Functions

Discusses the ecosystem and project-relevant functions that are important for a community solar project development and the ecosystem functions that support community solar more generally.

### III. Ecosystem Analysis of Texas Regulatory and Market Structure

Presents an analysis of the ecosystem-level regulatory and market characteristics of the Texas electricity market, discussing state policies that enable or hinder community solar development. This section elaborates on the regulatory challenges and enabling factors for deploying community solar in the muni and co-op market and the retail choice market.

### IV. Texas Stakeholder Analysis

Presents insights into organization- and project-level opportunities and challenges from the perspective of Texas stakeholders, including municipal utilities, electric cooperatives, REPs, and project developers.

### V. Market Actor Activation

Summarizes findings from interviews with CBOs in Texas and across the country, examining how CBOs might be activated to collaborate with solar developers and other key stakeholders involved in the development of a community solar program.

### VI. Roadmap to Texas Community Solar

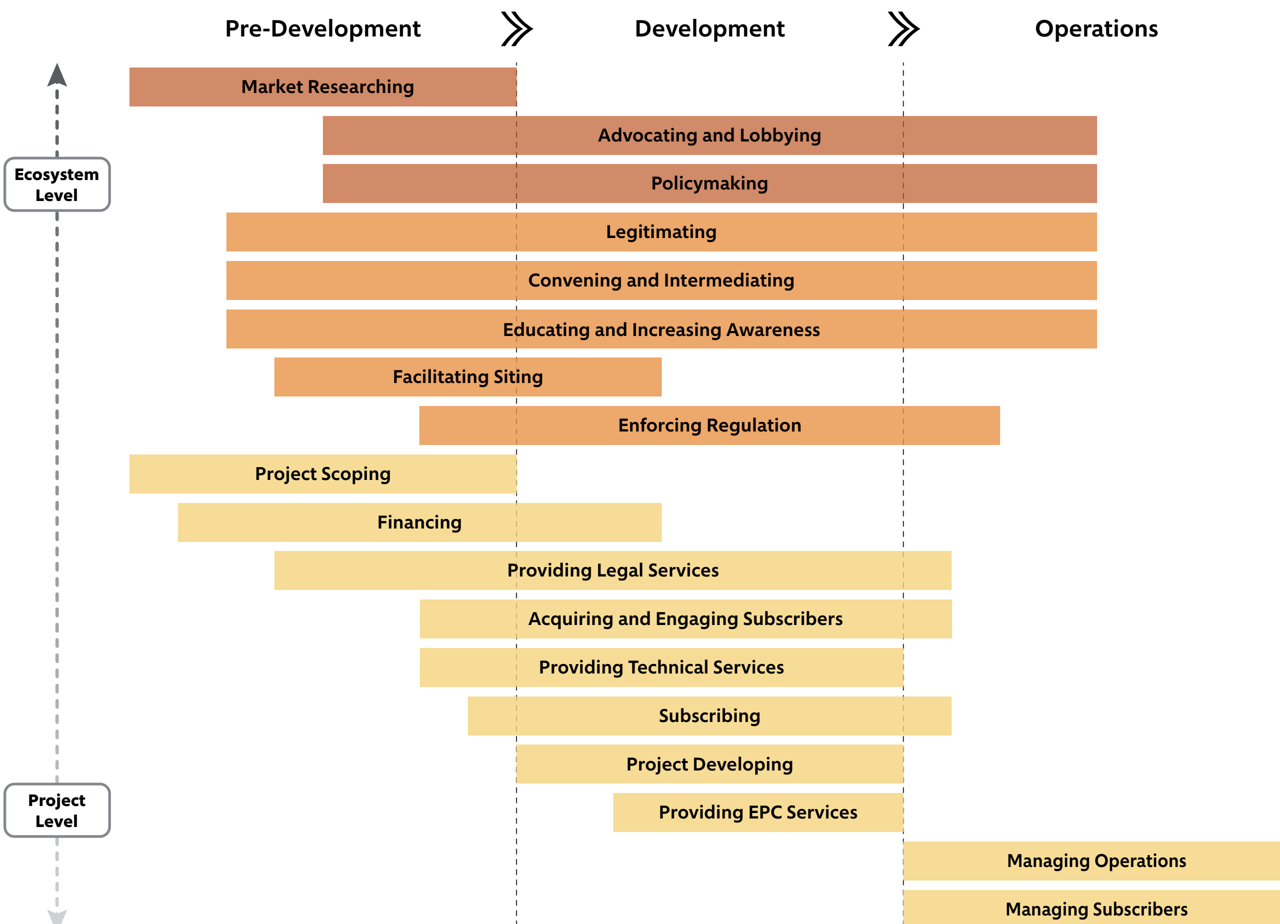
Summarizes the barriers to CSS in Texas and presents a roadmap encompassing three key strategies for activating CSS in Texas.

# II. Functions

Every CSS project, program, and policy has pre-development, development, and operations phases. In each of these phases, there are a number of critical functions that need to occur. From background research, we saw that solar developers and utilities were not the only ones performing these functions. Many organizations without electric industry expertise could and did perform these functions. A local nonprofit could manage subscribers, for instance, or a statewide philanthropy could provide informal regulation or convening power to projects. Between utilities and developers on the one hand and non-industry actors on the other, community solar models are cross-sector collaborations that build toward specific project-, program-, and policy-wide successes.

In this research project, we examined different models of community solar and community group involvement in a randomly selected set of projects. From that selection, and a review of academic and trade literature, we developed a list of functions that were consistently important for any CSS project to be developed (Figure 3). Considering the cycles of development and diffusion,

**Figure 3 – Function map for community solar deployment across a continuum from ecosystem to project level functions.**



we matched functions to ecosystem or project levels, (or both) where the function could scale between large, state- or region-level functions or within an organization for a certain project or policy. Our approach then focused on functions as a way to understand community solar development at project and ecosystem (or program and policy) levels. While these functions may not all be necessary for a particular project or program to take place, we understand their complementarity to be paramount for scaling up CSS. The following section will briefly explain each of the functions and their importance to community solar deployment.

## Summary of ecosystem functions

Ecosystem functions are those functions that happen outside the solar project space. They are functions that work explicitly on rules, norms, and procedures of the innovation space in which CSS projects operate.[9] Many actors involved in project development actively shape ecosystems through these functions in conjunction with their project-level development functions. Others, however, rely on networks of actors to perform work on their behalf.

**Market Researching** seeks to develop research about the state of particular technologies, markets, or policies related to opportunities for community solar, with a goal to better understand trends within the community solar space and how to bring together the right actors and subscribers to make a project successful. Analyses highlight the pros and cons of taking a certain course of action.

**Advocating and Lobbying** actively increases support among policymakers or regulators for CSS programs or projects, including advocating for specific policy proposals or clean energy initiatives that support solar development, advocating for increased or improved access for LMI customers, and creating a network of solar supporters to represent their interests in state and local policies. There are organizations advocating for community solar policies and projects at the national, state, and local level.

**Policymaking** shapes community solar policy either directly (e.g. community solar legislation) or indirectly (e.g. reforming county ordinances to enable CSS projects). Though often undertaken by governments, local agencies can also be involved in the policymaking process to help develop uniform policies for CSS projects. Clear policies around solar projects can help the development process proceed smoothly.

**Legitimating** (Ecosystem and Project) actively increases public perception of CSS in general (at the ecosystem-level) or of a specific community solar project as legitimate (e.g. through awards, certification, or public endorsements). Recognition and participation from entities such as universities, religious organizations, governments, and other reputable organizations can increase support for community solar at both project and ecosystem levels. Organizations with vast experience in the solar industry often recognize outstanding CSS projects at conferences and highlight success in communications with the general public.

**Convening and Intermediating** (Ecosystem and Project) facilitates interactions between the actors necessary for project development (e.g. through meetings, communication channels, community gatherings, networking opportunities). At the ecosystem level, organizations often bring together advocacy groups, developers, and governments to grow the potential of community solar. At the project level, organizations often bring together developers, utilities, households, local governments, and other community organizations to begin and complete projects. Organizations adept at customer management may serve to demystify the technical aspects of solar energy by intermediating between subscribers and developers.

9 Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., & Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. Research policy, 37(3), 407-429.

**Educating and Increasing Awareness** (Ecosystem and Project) improves public understanding of community solar or a specific CSS project (e.g. through informational materials, presentations, demonstrations, social media). Many CBOs perform outreach to potential subscribers in their established networks when gauging interest in community solar and looking for subscribers. Community solar arrays may also be used for educational purposes, especially those located at churches, schools, and universities.

**Facilitating Siting** (Ecosystem and Project) meets land-use requirements of a CSS project either directly (e.g. originating private land) or indirectly (e.g. prospecting possible sites). In many cases, the host of the solar array receives a portion of the energy produced in exchange for the land lease. Community solar arrays have been sited at a variety of locations including churches, housing authorities, farms, and businesses. Specific sites might have the potential to avoid siting and transmission challenges that utility-scale solar faces, because they can be sited close to load on under-utilized land, such as brownfields and parking lots.[10] For parking lots, developers may leverage additional revenue streams (e.g. parking fees) to make projects cost competitive; whereas, the use of brownfields can serve as a way of legitimizing community solar.

**Enforcing Regulation** (Ecosystem and Project) for building and operating a CSS project (particularly local regulations) is most often performed by local governments ensuring that project proposals meet local regulations for things like size and number of subscribers. However, enforcement and administration of CSS programs has in some cases been delegated to a third-party organization to ensure that project proposals meet defined criteria (e.g. serving low income communities, demonstrating community engagement, passing on savings to participants).

## Summary of project-level functions

**Project Scoping** actively engages project partners or potential project partners on possible CSS project development choices (e.g. use of shorter contracts, targeting specific customer segments). For example, faith groups may provide legitimacy and access to a subscriber base through their congregations in exchange for influence over contract details.

**Financing** provides capital for a CSS project with or without the expectation of returns, including tax-equity investment, debt lending, charitable donations, and government grants. Grants for CSS projects are often provided through environmental/energy and LMI-focused organizations.

**Providing Legal Services** for a CSS project, such as helping review contracts and ensuring that the developer, host-site, and subscribers are not taking on liability that could put them at risk, is most frequently performed by a legal entity; however, contract reviews can also be done by an organization with ample experience in community solar.

**Acquiring and Engaging Subscribers** solicits new potential subscribers for a CSS program or project or engages communities that may collectively subscribe. A variety of organizations may undertake this function, including churches, housing authorities, public utility boards, community development organizations, and energy-focused organizations by leveraging existing partnerships, education, and outreach to recruit subscribers and may act as an intermediary between LMI subscribers and stakeholders involved in a CSS project.

**Providing Technical Services**, such as software and technical services to CSS project partners, can help with establishing benchmarks, monitoring outputs and outcomes, and developing improvement strategies. They can also build information management systems, develop data collection procedures, or create mechanisms for timely feedback on performance.

[10] Brehm, K., Bronski, P., Coleman, K., Doig, S., Goodman, J., Koch Blank, T., & Palazzi, T. (2016). Community-Scale Solar–Why Developers and Buyers Should Focus on this High-Potential Market Segment. Washington, DC.

**Subscribing** (Anchor and Non-Anchor Subscribing) includes participating in community solar as an anchor or non-anchor subscriber. Anchor subscribers commit to a large subscription, either a fixed capacity or a flexible amount, to back up defaulted subscribers. Anchor subscribers are not always present, but they can lower a project's financial risk. In some cases, the owner of the land where a project is sited will become an anchor subscriber in exchange for the land lease. Non-anchor subscribers fill out the remaining subscriptions.

**Project Developing** provides pre-development and development planning and design of a CSS project. Traditional solar energy developers often lead CSS projects, but alternative models are also common. For example, a CBO with a non-energy focus could take on the role of a developer by serving as a project sponsor.

**Providing EPC Services** includes provision of upfront engineering, procurement, construction (EPC), or training services for a CSS project. The construction of the array itself is done by organizations that specialize in solar installation.

**Managing Operations** provides ongoing management of engineering, financial, and technical aspects of a CSS project. The components of operations management are not always completed by the same organization. Frequently, the developer is involved in managing operations.

**Managing Subscribers** includes the day-to-day management tasks associated with subscribers, such as billing and applying credits to subscriber accounts and providing customer service to subscribers. Some organizations can handle subscriber management internally, while some outsource to service providers. For example, employers may include CSS subscriptions in benefits packages and manage these subscriptions internally.

# III. Ecosystem Analysis of Texas Regulatory and Market Structure

State and local government regulation, policy, and market conditions influence strategies for enabling CSS development. Registration and interconnection policies influence siting and sizing decisions; local government codes and availability of supportive policies impact project finances and soft costs; and competing generation options or the presence or absence of certain market actors can impact competitive viability. While the CSS market in Texas is showing signs of potential growth, it is relatively small compared with other regions of the United States. Reasons for this may lie in the unique regulatory and market characteristics of the Texas electricity system.

> *"There's a lot of [solar development] that could be I think templatized and sort of standardized to be able to enable communities to do this... You need the legal and technical resources to make it a product that somebody could take advantage of. To me, as far as community-driven and hopefully community-owned community solar... There's no ecosystem [in Texas] for somebody to be able to say I want to own and operate one of these projects."*
>
> — *TEXAS-BASED ENERGY NONPROFIT*

Texas restructured its electricity market to promote retail competition in 1999, making Texas the U.S. state closest to a deregulated retail electricity market. While transmission is regulated at the state level through the Public Utility Commission of Texas (PUCT) and the Electric Reliability Council of Texas (ERCOT), distribution networks and retail sales are unbundled, meaning different services are provided by distinct entities. The key entities and their services are:

1. **Competitive Generator –** Generate and sell power in the wholesale power market.
2. **Transmission Service Provider (TSP) –** Publicly-regulated, privately-owned companies own and operate transmission lines. TSPs are subject to PUCT regulated rates and must provide non-discriminatory access to the transmission grid.
3. **Distribution Service Provider (DSP) –** Publicly-regulated, privately-owned companies, municipally owned utilities, or electric cooperatives own and operate distribution lines. DSPs are subject to PUCT regulated rates and must provide non-discriminatory access to the distribution grid, but these companies can have their own protocols.
4. **Load Serving Entities (LSEs):**
   a. **Non-Opt-In Entity (NOIE) –** Vertically integrated municipal utilities and electric cooperatives. NOIEs can sell retail power and operate as DSPs in their jurisdiction.

   b. **Retail Electric Provider (REP) –** Sell power directly to consumers in retail choice territory.

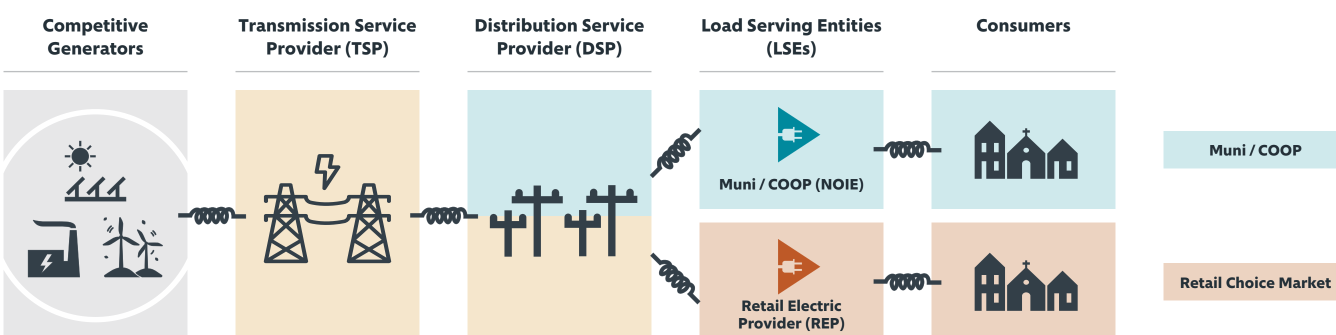
This structure creates two distinct retail market structures (Figure 4), each with opportunities and challenges for CSS.[11] The first, which includes municipal utilities and rural electric cooperatives (referred to in this report as munis and co-ops or the "muni/co-op" market), consists of not-for-profit, consumer-owned, and vertically integrated utilities with exclusive service territories exempt from retail competition. The second covers the remaining area of the state (referred to in this report as the "retail choice market"), is completely unbundled, and allows consumer choice from REPs at the retail level. The retail choice market serves nearly 75% of electricity users in Texas (Figure 5).[12] The remaining 25% of Texans are split evenly between co-ops (74 co-ops) and munis (76 munis).

The following sections provide a summary of key regulatory and market barriers and opportunities for CSS in Texas. First, we provide a summary analysis of the statewide regulation that applies to all areas of Texas. Then we delve into characteristics of and resulting barriers in the two distinct market environments, drawing on a review of secondary literature and key informant interviews of REPs, developers, and experts.

> The barriers are called out in the text following discussion and summarized in Table 2 in Section VI. The reference number to the barrier table appears in brackets at the end of the barrier statement.

**Figure 4 – Levels of Texas electricity markets.**

ERCOT's generators compete with each other on price, and that generation is transmitted along privately owned transmission and distribution lines of investor- and consumer-owned utilities. Where the lines are owned by investor-owned utilities, the electricity is then resold to end consumers by REPs that compete with each other on price. Where the lines are owned by consumer-owned utilities, those same municipal and cooperative utilities that own the lines resell electricity to end consumers.

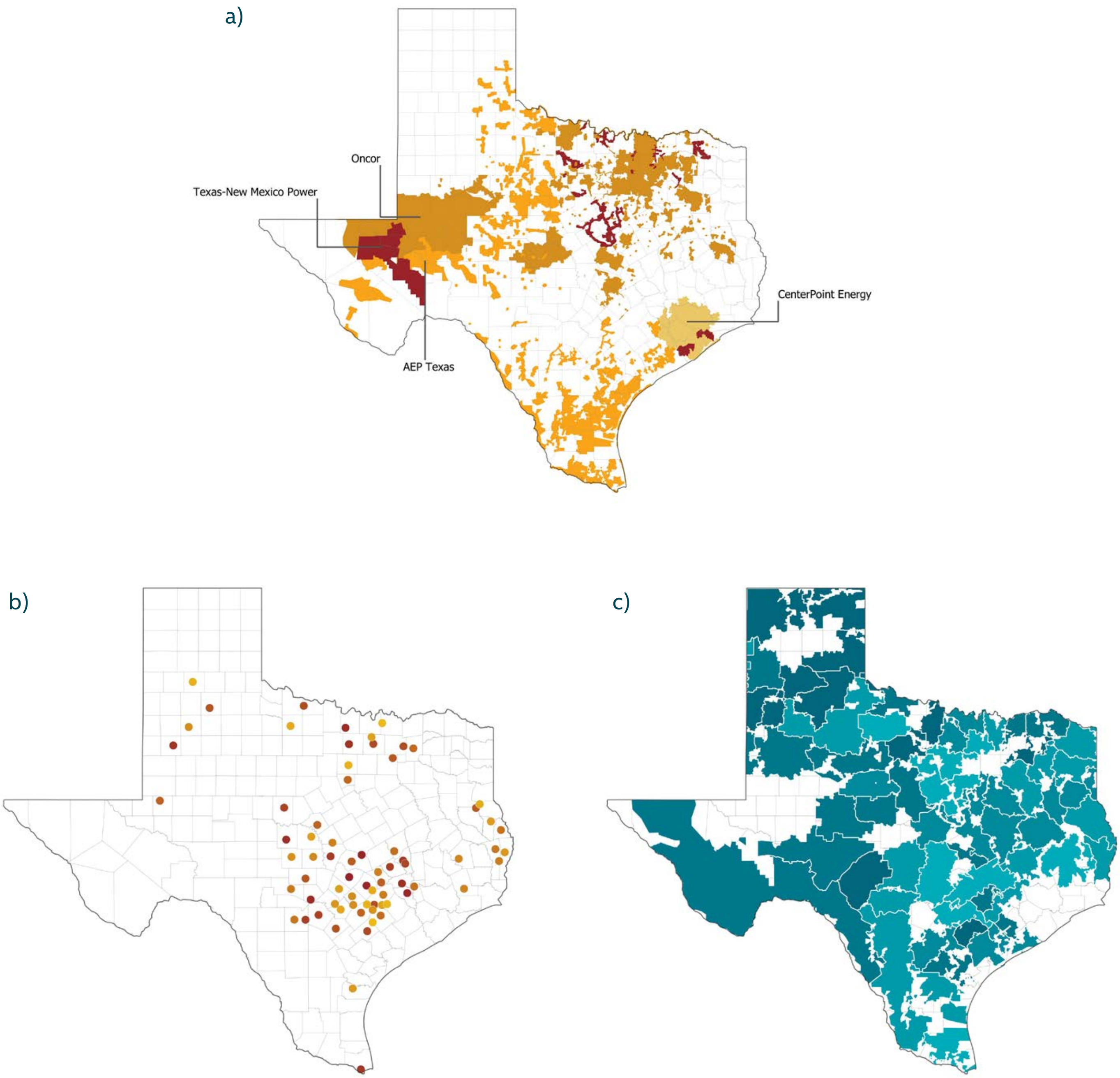



[11] https://www.electricchoice.com/blog/guide-texas-electricity-deregulation/

[12] http://www.ercot.com/content/wcm/lists/172484/ERCOT_Quick_Facts_02.4.19.pdf

**Figure 5 – Municipal, cooperative, and retail electric service areas in Texas's counties.**

a) Five transmission and distribution utilities (AEP Texas North and Central, CenterPoint, Oncor, and Texas-New Mexico Power) and more than 100 associated REPs serve dense, urban areas. b) 72 municipal utilities serve both large and small cities. c) 67 electric cooperatives serve the largest land area of Texas. Not pictured are the four vertically-integrated investor-owned utilities outside of ERCOT.[13]




[13] Service areas are provided via a Public Information Act request to the Public Utility Commission of Texas. Due to discrepancies of overlapping territories, some areas were buffered and trimmed to create more easily defined areas.

## Statewide regulatory ecosystem

The state-level regulatory ecosystem in Texas is generally permissive but not explicitly supportive of CSS. Texas' interconnection rules guarantee equal transmission access to all generation facilities; however, the competitive principles that led to restructuring also stifled statewide policies that could enable CSS and capture its full value. In this section, we provide a brief overview of the statewide Texas electricity market regulatory regime, including key rules pertaining to community solar deployment.

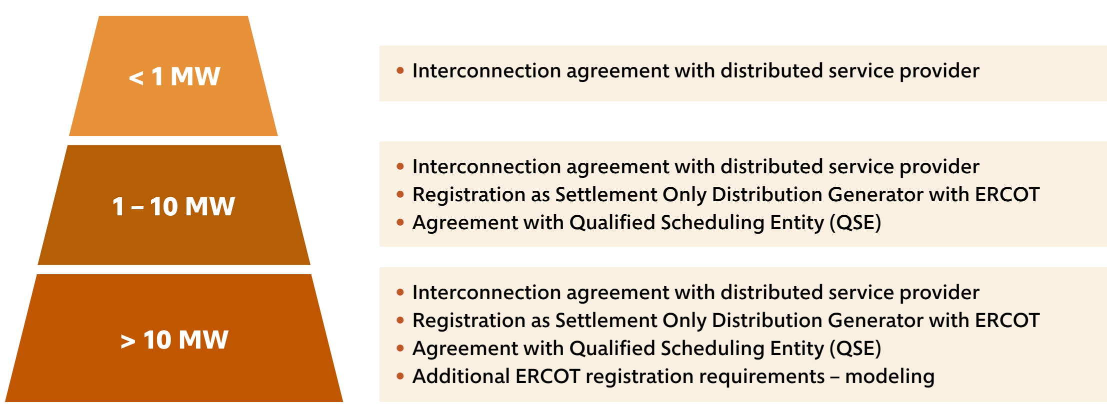
### *Registering and interconnecting distributed generation in ERCOT*

Texas's unique registration and interconnection rules have evolved to accommodate distributed generation (DG) like community solar; however, the current state of these rules is not particularly favorable to resources of the typical size of CSS projects.

The current PUCT Substantive Rules establish ERCOT's open access transmission rules allowing for any new market participants, including DG facilities like community solar, to access transmission through a fair and equal process.[14] Figure 6 summarizes these rules. ERCOT defines a DG facility as an electrical generating facility located at a customer's point of delivery (point of common coupling) that is 10 megawatts (MW) or less.[15] Registration and interconnection requirements depend on the size of the DG system and are related to three generation capacity cut-points. Facilities under 1 MW do not need to register with PUCT or ERCOT, but must enter into an interconnection agreement with the local DSP. Facilities between 1MW and 10MW that are capable of net export of energy into a distribution system must register with PUCT and ERCOT as a Settlement Only Distribution Generator (SODG), and enter into an interconnection agreement with the local DSP. These facilities must also register with a Qualified Scheduling Entity (QSE).[16] Facilities over 10MW are considered utility scale facilities and must follow the full registration requirements for a competitive generator, including registration with PUCT and ERCOT, interconnection agreements with ERCOT and the local TSP and/or DSP, and registration with a QSE.

**Figure 6 – Size requirements for registration and interconnection in ERCOT.**

Due to modeling and policy constraints, distributed generation below 10 megawatts in ERCOT is often limited in the wholesale benefits it can receive.




[14] PUC Substantive Rules. § 25.211 - Interconnection of On-Site Distributed Generation (DG). (Accessed June 24, 2020). https://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.211/25.211ei.aspx

[15] The Point of Common Coupling is the physical point that a generating facility interconnects to the electrical distribution or transmission system.

[16] Qualified scheduling entities (QSEs) are organizations that can submit bids and offers on behalf of resource entities (REs) or load serving entities (LSEs) such as REPs.

An important distinction between facilities under 10MW and facilities over 10MW is inclusion in the ERCOT Network Model. The *ERCOT Network Model* is a geographic representation of the physical ERCOT electric grid network that ERCOT uses to determine prices and settlement of energy. Because of their size and ability to interconnect on distribution networks, facilities over 10MW are considered *modeled generators* and can be valuable for resolving localized voltage and regulation issues. The ability to sell on the wholesale market also provides these generators with a source of revenue and hedging strategy. Facilities under 10MW are considered non-modeled generators and are not included in the Network Model. Non-Modeled Generators are restricted from participating in wholesale market transactions and in ancillary service markets.

> BARRIER **Access to ancillary service revenue or wholesale market participation for DG under 10MW is a significant burden for maximizing the value and competitive viability of community solar resources. [1]**

DG is typically interconnected on the distribution grid. The ERCOT rules that govern the transmission grid do not entirely extend to the distribution grid. While open access requirements still apply, the distribution grid is also subject to practices and policies of the local, regulated TSP or DSP. Each TSP or DSP has differing distribution system structures, practices, and costs. For example, an interconnection study in Oncor's service area (Dallas-Fort Worth and large swaths of sun rich West Texas) can cost as much as $7,932 for larger projects.[17] In contrast, in CenterPoint's service area (Houston and large parts of Eastern Texas) the tariff caps out at $2,655 for the largest facilities.[18] The differing systems can also result in physical differences in the electrical fundamentals of the distribution grids that impact DG penetration, spatial distribution, and sizing of community solar systems on a distribution feeder.[19] Distribution upgrade costs are not subject to a regulated cost sharing structure, unlike transmission costs which are socialized. The only way DSPs can recover costs of distribution grid upgrades associated with DG is to directly assign the costs to the interconnecting generator, presenting a significant cost hurdle for community solar developers.

> BARRIER **At the distribution grid level, lack of standardized practices and highly variable permitting and interconnection costs are a barrier for community solar development strategies across Texas' competitive market. [2]**

Texas has few state-level policies that support renewable DG like community scale solar. In other states, policies like renewable portfolio standards and statewide net metering policy have supported a burgeoning community solar sector. In Texas, the competitive, free market principle that led to deregulation also stifles supportive statewide policies to meet goals the market fails to achieve, such as equity, grid reliability, long-term planning, and environmental protection. For example, unlike many other states, Texas has no statewide net metering policy or virtual net metering policy, and Texas' renewable portfolio standard (RPS) is not binding (the RPS goal of 5,880 MW by 2015 was surpassed several years ago).

> BARRIER **Lack of statewide support policies is a barrier to community solar development. [3]**

[17] Oncor tariff for retail delivery service. http://www.puc.texas.gov/industry/Electric/rates/Trans/oncor.pdf

[18] Centerpoint tariff for retail delivery service https://www.puc.texas.gov/industry/electric/rates/Trans/CNP.pdf

[19] A study conducted by the NREL concluded that small variations in electrical physics could trigger costly upgrades.

Community solar has the potential to provide valuable benefits to the grid through optimized siting and effective land-use. While the existing regulatory structure and substantive rules are generally permissive of DG registration and interconnection, there are barriers to full access to the ERCOT market that could help leverage community solar benefits. In addition, while there are some efforts to provide opportunities for better integration of DG, community solar suffers from a lack of effective representation at the ERCOT and PUCT stakeholder level. Greater stakeholder coordination and advocacy could help promote changes to rules in the market that may help smooth the path for full community solar participation down the line, for example, allowing aggregation of CSS resources and participation in ancillary services or providing authority to ERCOT to dispatch and balance resources interconnected into distribution.[20] Developers can also potentially minimize interconnection expenses by adding a storage component to their CSS project.[21]

## Muni and co-op market ecosystem

Beyond ERCOT regulations, munis and co-ops have few regulatory challenges to developing and deploying community solar. In Texas, "munis" and "co-ops" are essentially self-governed, particularly with regards to their distribution systems and retail sales. They can implement their own rules, supportive policies, and programs to encourage innovative programs like community solar. This gives them latitude to respond to customer interest for solar energy and to diversify power portfolios to include renewable energy resources like community solar.

Beyond the flexibility provided by self-governance, the muni/co-op market has additional enabling factors for CSS. Because these utilities are structured similarly to munis and co-ops around the nation, they can look to existing business models nationally to adopt or adapt to their purposes.[22] In addition, community solar in the muni and co-op context is a strategy they can use to mitigate load loss from rooftop solar adoption, an opportunity realized by other vertical utilities nationwide.[23] Lastly, because munis and co-ops manage their distribution systems, they are better able to maximize the benefits of DG than actors in the retail choice market. For example, ERCOT rules require munis and co-ops to pay 4CP charges[24] based on the load on their distribution grids at the four summer coincident peak periods. Munis and co-ops can use DG facilities under 1MW to reduce their 4CP charges. This effectively incentivizes munis and coops to limit CSS developments to 1MW. Several developers noted that this restricts the size of distribution sited CSS, and that if facilities over 1 MW were allowed to take advantage of 4CP cost reductions, larger CSS projects would be able to successfully monetize these grid benefits.

While several munis and co-ops in Texas have developed CSS projects, the majority have not, indicating that there remain barriers to CSS in this market ecosystem. Of the 150 munis and co-ops, ten have developed one or more CSS projects with most being one-off projects or pilot projects. This indicates limited awareness, perceived viability, or capacity to implement CSS. This is supported by information we received from developers who noted that a challenge in the muni/co-op market is finding utilities who are interested in CSS.

[20] ERCOT's Distributed Resource Energy & Ancillaries Market (DREAM) white paper of 2015 provides a summary of potential rule changes to promote distributed energy resources. http://www.ercot.com/content/wcm/key_documents_lists/72724/ERCOT_DER_Whitepaper_082015.doc

[21] Cliburn, J., Howard, A. J., Powers, O. J., & Energy, E. (2017). Solar Plus Storage Companion Measures For High-Value Community Solar.

[22] Several reports provide a comprehensive review of community solar in these markets.
NRECA. A Solar Revolution in Rural America. 2018. https://www.cooperative.com/programs-services/bts/sunda-solar/Documents/Solar-Revolution.pdf
GoSolar Texas. Texas Community Solar Guidelines for Electric Cooperatives and Municipally Owned Utilities 2016. http://www.gosolartexas.org/community-solar

[23] Funkhouser, E., Blackburn, G., Magee, C., & Rai, V. (2015). Business model innovations for deploying distributed generation: The emerging landscape of community solar in the US. Energy Research & Social Science, 10, 90-101.

[24] 4CP (coincidental peak) charges are monthly fees based on how much electricity a facility consumed during the systemwide Coincident Peak (CP) in each of the four (4) months associated with ERCOT's 4CP season (June, July, August and September).

> *"Finding utilities that are interested in CS is another issue. [We] try to identify municipalities or cities that have very aggressive climate targets."*
>
> *— INTERVIEW WITH A TEXAS DEVELOPER*

BARRIER **Many municipal utilities and electric cooperatives still do not see CSS as a legitimate or viable option for their community. [5]**

CSS programs in the Texas muni/co-op market have typically seen swift uptake and high subscription rates indicating pent up demand. Despite this, consumers in general have low awareness of CSS.[25]

BARRIER **Consumer awareness and understanding of CSS remains low in communities with and without CSS. [6]**

Local regulations were also identified as a challenge to CSS by developers. Rules and regulations covering permitting, building codes, and local tax assessment vary across jurisdictions and are often applied inconsistently within these jurisdictions. Developers noted that this can lead to development delays and increased costs.

BARRIER **Local rules and regulations and how they are applied often varies between and within jurisdictions, increasing uncertainty and costs for developers. [4]**

## Retail choice market ecosystem

ERCOT market restructuring between 1999 and 2001 was designed to limit regulations governing retail sales and increase competition in the retail market. The characteristics of the restructured retail choice market present a unique set of incentives and barriers to innovative products such as CSS projects. On the one hand, the highly competitive nature of the retail choice market pushes REPs and other stakeholders to look for innovative products, like CSS, to differentiate from competition. On the other hand, restructuring removed tariffs or policies to enable or support innovative products like CSS that can have uncompensated benefits or help achieve social goals.

Changes in the Texas retail choice market present opportunities for CSS. In recent years, renewable generation and renewable retail plans in the Texas retail choice market have grown, indicating consumer awareness of and interest in renewable options like CSS. Increased penetration of renewables in recent years has also seen an influx of a number of highly experienced solar developers, which sets the stage for low cost renewable asset development. Renewable energy sources have also seen increased support for solar development in rural communities due to economic benefits like job growth and increased tax revenue, leading to supportive policies at the local level, such as tax abatements that can lower the overall cost of development. The open access rules in ERCOT allow for the opportunity for scalable CSS options; meaning CSS projects can be scaled according to demand in the retail choice market. This is opposite conventional CSS programs, where vertically integrated CSS programs have program caps that often max out quickly. Open access rules can also promote siting of CSS generation closer to load to reduce system costs, particularly transmission costs, curtailment, and basis risk.

While opportunities exist for community solar development, the lack of such development in the retail choice market in Texas indicates the existence of barriers in this ecosystem. Similar to the muni / co-op market the few CSS programs that have been offered are fully subscribed indicating pent up demand; however, consumers in general have low awareness of CSS. REP interview subjects

[25] A 2016 SEPA survey found that despite the popularity of CSS, only 7% of participants were familiar with the term. https://sepa.force.com/CPBase__item?id=a12o000000PVdgDAAT

reported that customers are not well educated about renewables programs in general and certainly not about community solar. REPs are also averse to additional marketing costs if return is uncertain.

> BARRIER **Consumer awareness and understanding of CSS remains low; REPs are averse to additional marketing costs if return is uncertain. [9]**

In addition to low consumer awareness, consumers in the retail choice market have a low appetite for premium products. There was almost unanimous agreement among REPs and developers in our interviews that Texas retail choice customers have a low willingness to pay for premium products. Some REPs attribute this to the nature of the Texas retail choice market in which consumers are trained to shop on price, making premium products difficult to sell. This challenge is exacerbated by the general low cost of power in Texas which reduces the overall margins for retail providers.

> *"The challenge for renewables in Texas is there is very little appetite for premium [products] because consumers have been trained to shop based on price."*
>
> *— INTERVIEW WITH A TEXAS DEVELOPER*

> BARRIER **Consumers in the retail choice market are highly price sensitive and have low willingness to pay for premium products. [19]**

Green pricing program offerings are well established in the retail choice market, providing an option for consumers to choose "green" power.[26] Market actors including REPs, developers, and market experts may perceive CSS and green pricing structures to be in direct competition. It is unclear if consumers are able to differentiate between green pricing and CSS without further education.

> *"I hardly differentiate between green pricing [and community solar], and consumers definitely won't differentiate."*
>
> *— INTERVIEW WITH A TEXAS DEVELOPER*

> BARRIER **Consumers and market actors lack knowledge needed to differentiate between CSS and green pricing programs. [10]**

Utility scale solar development has grown substantially in Texas and is expected to continue growing at a rapid rate. In general, utility scale solar has lower installed costs than CSS with estimates in the difference in the levelized cost of energy (LCOE) between $20/MWH and $112/MWH.[27] There was a common belief among interviewed market actors that under the present market conditions, green pricing backed by utility-scale solar is likely to outcompete community solar on price due to costs of land to develop near load, weaker economies of scale, and barriers of CSS to capture its full contribution to system value, such as grid benefits and avoidance of 4CP charges.

> BARRIER **Market actors uncertain if the economics of CSS can reach a level where CSS can be financially viable without supporting policies. [14]**

[26] Green pricing programs are voluntary options offered by REPs that allow customers to support investments in renewable energy technologies. Customers can choose for some proportion of their electricity to come from green energy sources such as solar, wind, geothermal, and biomass. REPs typically purchase RECs or directly contract with renewable generators.

[27] Lazard. (2019). Lazard's Levelized Cost of Energy Analysis - Version 13. https://www.lazard.com/media/451086/lazards-levelized-cost-of-energy-version-130-vf.pdf

# IV. Texas Stakeholder Analysis

The Texas electricity market is highly complex, with many important market actors. For CSS deployment, we believe that the key actors in the market are munis and co-ops, REPs, and project developers. The following sections present insights into organization and project level opportunities and barriers from the perspective of these stakeholders.

## Municipal utilities and electric cooperatives

Munis and co-ops are self-governed and subject to less state regulatory oversight allowing them to be more responsive and innovative in response to the demands of their consumers. Because of this, munis and co-ops have been at the forefront of CSS development in Texas; however, adoption of CSS has still remained relatively low in this market due to barriers at the project level. In particular, through review of literature and discussion with project developers, we identified two challenges to CSS projects: staff capacity and customer acquisition and management costs.

Munis and co-ops have a responsibility to provide reliable, safe, and cost-competitive electricity to their consumers with limited staff resources. A considerable amount of time and expertise is needed to develop and implement CSS projects and programs. In particular, planning and analyzing siting and interconnection of DG projects at a large scale can present challenges for resource constrained munis and co-ops. Lack of experience interconnecting solar projects, overly conservative interconnection policies, and suboptimal project siting can increase the cost of grid build-out and negatively impact the financial viability of CSS projects.

> BARRIER **Limited staff capacity and expertise in siting and interconnecting distributed generation can lead to risk averse behavior and increased costs. [17]**

Adopting CSS programs requires investment in customer acquisition and management, which requires munis and co-ops to engage in education and advertising campaigns to acquire new customers. Developing new campaigns to implement and promote new programs can be cost prohibitive for munis and co-ops. Once customers/subscribers are acquired, ongoing management frequently requires additional software to manage customers, which can be costly to utilities.

> BARRIER **Customer acquisition costs can be high and frequently require new marketing campaigns and customer education for innovative business models. [20]**

> BARRIER **Subscriber management can be costly; software upgrades are typically needed. [21]**

## Retail electric providers

In the retail choice market, REPs are the only entities permitted to sell retail power to customers. REPs essentially act as a third party intermediary purchasing energy from competitive generators through the wholesale market, bilateral agreements, and electricity brokers, then selling energy to consumers in a competitive market. This makes REPs critical to the deployment of CSS in the complex, highly competitive retail choice market. For community scale solar to be successful in the retail choice market, REPs must be able to identify the value of community solar plans and align them with their business models.

CSS presents several important opportunities for REPs. In a highly competitive market, REPs are constantly looking for new opportunities to differentiate from their competition and capture new customers. For example, many REPs already offer green pricing plans to differentiate from their competitors. CSS plans can be another strategic opportunity for REPs to differentiate. A second consideration for REPs is customer retention. A major cost for REPs is customer turnover; as of 2017, nearly 92% of all electricity customers had switched their retail provider at least once.[28] The longer REPs can retain customers, the lower their costs. CSS is a unique opportunity for REPs to offer subscription plans, or plans with an ownership component that could increase customers retention. REPs also have specific areas of expertise that may help them overcome traditional barriers to CSS programs, such as customer acquisition and customer management. Acquisition and management can be a significant cost hurdle for CSS programs; however, REPs typically have a high level of expertise in these areas.

Despite the promise of CSS as part of a REP business model, interviews with REPs identified several barriers to adoption of CSS programs or projects. These barriers generally centered around risk aversion to new innovations, lack of organizational capacity, and concerns around adopting CSS programs to existing business models. The retail choice market is highly competitive and characterized by low margins, leading REPs to critically evaluate innovations that may be high risk. While each of the REPs interviewed had heard of CSS, to date there are only two REPs in the market that have developed a CSS program.

BARRIER **REPs are averse to innovations that they perceive to be risky in a complex, highly competitive market. [7]**

The retail choice market is complex and REPs must acquire and maintain staff capacity across a wide range of areas of expertise. In many ways REPs are the central market actor in the retail choice market. As a result, they must have expertise in a wide range of functions including marketing and customer management, information technology, wholesale and retail electricity sales, and risk management. Acquisition or development of these areas of expertise can be challenging in a highly competitive talent market. The addition of innovative products like CSS requires additional expertise in which REPs must invest.

BARRIER **REPs may be hesitant to invest in developing new skills and organizational capacity for an innovative product with unknown returns. [8]**

REPs lack experience with designing CSS programs and have concerns particularly regarding ownership models. Without existing models that they can look to, REPs will be hesitant to adopt CSS programs. Of particular concern to REPs was how to manage the ownership element of some CSS program designs and how to manage long term power contracts with generation facilities.

BARRIER **REPs have limited experience with CSS model scoping and implementation. [13]**

## Project developers

Project developers play a central role in CSS projects. To date, developers have been the primary initiators of all three existing or planned CSS projects in the Texas retail choice market. Each of the existing cases has involved an experienced solar developer acting on a specific market opportunity that has included consumer interest, land availability, and other factors. Once developers have identified the opportunity and scoped the project they then have to find a REP to offtake the power and design and manage a program to sell the electricity.

In interviews with five solar developers in Texas, including three who developed community scale solar projects, we heard optimism for solar development and community solar. In particular, developers identified several enabling factors for solar development. The overall cost of solar is reducing rapidly making all forms of solar development more competitive. The investment environment has become more conducive to solar development with growing interest from investors in opportunities to invest in solar development. There is strong support for solar development in rural communities due to the local economic benefits (jobs, tax revenue, etc.) and growing support among consumers. Developers are also more sophisticated and capable than in the past and are able to

[28] http://www.puc.texas.gov/industry/electric/reports/scope/2017/2017scope_elec.pdf

manage the various technical challenges of development. Developers are also very engaged and transparent with communities where they do develop, actively looking for partnerships and community support opportunities.

The primary risk all solar developers noted was identifying and contracting with a reliable, long-term offtaker. For large scale solar developers, this risk was lower as they had multiple options for selling energy, including bilateral agreements with utilities, REPs, or commercial and industrial customers, as well as selling onto the ERCOT wholesale market. For CSS developers, the range of options is generally constrained to utilities and REPs, as these are the only entities in Texas permitted to execute retail sales. It is difficult to gauge the propensity of REPs to agree to a long-term agreement with a CSS project, but to date there have only been two REPs willing to do so (see Appendix for full list of Texas CSS projects). One particular challenge is that developers often need 10- to 15-year offtake agreements to secure project financing. REPs are unlikely to guarantee offtake for this period, particularly when most REP residential retail plans are from 12 to 36 months.

> *"What is key is securing financing and a long term offtaker. [In particular we] need to find a retail partner."*
>
> *— INTERVIEW WITH A TEXAS DEVELOPER*

BARRIER **Developers have difficulty securing financing without long-term offtake agreements. [11]**

BARRIER **Community solar developers have found it challenging to find a REP willing to sign a long-term offtake agreement. [12]**

One potential strategy for CSS projects to reduce project risk is to find an "anchor customer" to participate in the array. An anchor customer is a customer with a large electric load, typically a commercial or industrial customer with positive characteristics like good credit or large buying power. Having an anchor customer can help reduce the costs of the CSS project by guaranteeing offtake, which helps projects reach economies of scale and provides assurance to financiers. CSS developers understand the potential value of an anchor customer, but noted that it can be difficult for developers to identify candidates if they don't have existing relationships. Furthermore, when they are promoting CSS to potential anchor customers they find that the CSS model is difficult for anchor customers to understand. Two developers of CSS projects noted that REPs can help with identifying anchor customers by leveraging their existing relationships.

> *"Anchor customers are out there, but unless they come to me it is hard for me to go find them. Partnering with a REP helped us find an anchor because they have existing relationships. There are companies that want to go green, but CSS may be too cerebral for them."*
>
> *— INTERVIEW WITH A TEXAS DEVELOPER*

BARRIER **Identifying and signing anchor customers can help with project financing, but anchor customers are difficult to find. [18]**

In many ways, the biggest question for CSS in Texas is: ***How can CSS become financially viable without the supportive policies that exist in other states?*** At the project level, for developers, strategies for improving the financial viability of CSS can either be on the revenue side (e.g. through subscription premiums or monetizing grid benefits) or through cost reduction strategies. In addition to interviews with developers to identify key drivers of revenue and costs that inhibit project viability, we also developed a customized financial model for CSS projects in the Texas ERCOT market (see Appendix for details, examples, and methodology).

> *"The business side is unique to Texas in a lot of ways with the retail market. With no top down regulation you have to make models financially viable to work."* — INTERVIEW WITH A TEXAS REP

Developers saw two key barriers on the revenue side of CSS projects. First, similar to REPs they described a retail market where consumers are primarily driven by price, making premium products hard to market. The second barrier was an inability to capture and monetize the grid benefits of CSS projects, in particular the value of transmission infrastructure investment deferral. Currently there is no way to quantify or capture these benefits in part because the value is dispersed across the entire transmission system. One way this could be captured would be through reducing 4CP costs at the CSS project site, but developers were not sure how this could be achieved. One developer noted that at present CSS has a higher cost per MW than utility scale solar, but this could be brought close to parity if these benefits were captured.

> BARRIER **Difficult to capture and monetize grid benefits of distributed CSS in retail choice market. [15]**

Through sensitivity analysis of costs in the customized financial model (see Appendix for details), we identified three cost components that significantly impact the financial performance of CSS projects: 1) customer management (including acquisition costs), 2) transmission interconnection costs, and 3) project sizing and economies of scale. From our interviews with developers and secondary literature we know that each of these components can vary significantly.

A related issue that developers raised is that interconnection costs are also unknown to them at the planning stage of development, increasing cost uncertainty. In particular, CSS projects can incur substantial costs if additional infrastructure is required on the distribution grid to accommodate the additional load (e.g. transformers, substations, and wires). While at the transmission grid level, these costs are socialized, on the distribution grids, the project developer is often responsible for the entire cost. Because developers do not always have access to grid models to optimize siting to avoid costs, these costs may only become apparent after development is underway.

> BARRIER **Suboptimal project siting can increase cost of grid build-out and interconnection, depending on location of project. [16]**

Beyond challenges specific to CSS, CSS developers also face the same complexities in project development faced by utility scale solar developers. From negotiating with landowners and communities to dealing with local wires to managing risk, developing a solar project of any scale has many challenges.

# V. Market Actor Activation

Through our interviews and background research with developers, REPs, and munis and co-ops, we found that CSS projects and programs require significant cross-sector collaboration, bringing together more diverse stakeholders and resources than other forms of solar development. This type of collaboration often needs multiple types of organizations to be "activated" or drawn into collaboration or innovation. Additional market actors that are part of the ecosystem, but not focused on in our study include:

- Financiers from large- and small-scale institutions providing tax equity, debt, grants, and other financial instruments
- Market actors in ERCOT, in particular, that go beyond REPs, including brokers, power marketers, aggregators, and transmission and distribution utilities. Additionally, there are IOUs and other utilities in Texas that participate in other wholesale markets such as SPP and MISO.
- Project-level partners, including engineering, procurement, and construction companies; sales companies; trade allies, such as electricians; and multiple inspectors, planners, and coordinators

## HOW CAN CORPORATIONS HELP?

Corporations in recent years have procured and subscribed to multiple megawatts of solar across the nation. Their activation stems from social responsibility goals, economic of renewable energy, and enterprising developers who spent the time and money bridging sectors. Many corporate renewable deals come from large virtual power purchase agreements (VPPAs), but recently, deals have simultaneously procured energy from multiple projects, project types, and locations.

**Corporate giant Walmart subscribed to 36 CSS gardens across 13 counties in Minnesota.** The company will receive energy savings in the form of bill credits, and its subscription helps reduce churn risk for the developer, thus beneficial to both subscriber and developer.

There are many diverse and innovative examples of corporate involvement in renewable energy. The examples below demonstrate this breadth:

**The "Butter Solar" Portfolio solar development couples corporations with municipal utilities in a community solar-like setup.** Butter Solar is owned and operated by BluEarth Renewables US and builds behind-the-meter, distributed solar projects to align with minimum load of the host municipal utility. The Upper Midwest Municipal Energy Group and participating members buy the power, while other partners, including Organic Valley, Dr. Bronner's, the City of Madison, WI, and Native Energy, purchase the RECs on long-term contracts and claim the green attributes. As an added benefit, the project reduces St. Charles' transmission costs, helps stabilize rates, and provides reliable and affordable power.

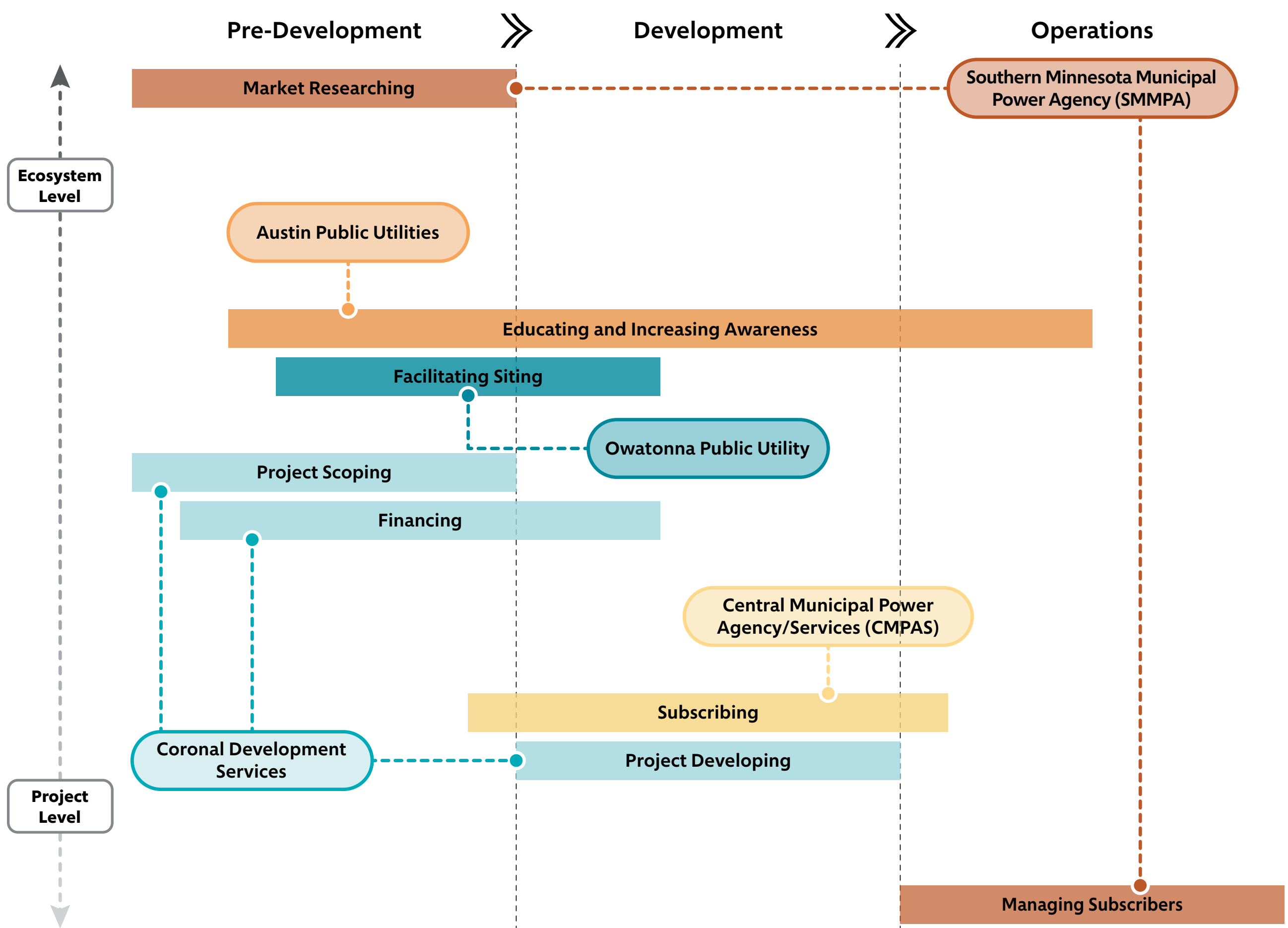
**Hormel Foods has subscribed to CSS gardens at five manufacturing locations, and co-sponsored a CSS garden in Hutchinson, Kansas that uses 20% of the energy produced to help power the company's Dold Foods facility in Wichita, KS.** The remaining energy is available to customers of Westar Energy by regular subscription. Through participation, Hormel Foods has helped deliver CSS benefits to the area.

**Sun Shares, a subsidiary of the nonprofit Vermont Energy Investment Corporation (VEIC), has developed another innovative model for employers to become involved in CSS projects.** Sun Shares partners with employers, facility owners, and electric utilities to develop solar projects and offer the energy as an employee benefit. Under this model, the employer agrees to fund any unsubscribed shares and can apply those credits to lower its utility bill. The first project was constructed on the roof of the Innovation Center where VEIC is headquartered and was funded in large part by the building owner, who acknowledged that the solar array increases the value of the space to tenants who are seeking to engage with their employees. This model allows employers to make the benefits of renewable energy accessible to employees, while also supporting organizational sustainability goals.

There are other activation paths to be considered. We used the function map (Figure 3) to trace functions to the main actors that supported those functions in a number of case studies. We then mapped the separation of project and ecosystem functions by stakeholder. For example, Figure 7 shows a CSS project in Minnesota. Some functions were shared by many actors, so we simplified for clarity. For functions not included, we assume that other private or nonprofit actors performed the function outside of the publicly available knowledge.

A joint action agency in Southern Minnesota Municipal Power Agency provided market research and subscriber management, often in conjunction with its member municipal utilities. Separately, a developer Coronal Developer Services facilitated finance for the eventual 5MW solar project, which they scoped and developed themselves. Member utilities also contributed siting (Owatonna) and created common education materials (Austin). Uniquely, another joint action agency in Central Municipal Power Agency/Services subscribed to the array, with its municipal utilities offering community solar subscriptions.

**Figure 7 – Function map of Southern Minnesota Municipal Power Agency's 5MW Community Solar Project in Owatonna, Minnesota.**



For some of the actors above, CSS is a business, among many other revenue and cost drivers in their company. For others, it is a public good, with benefits stretching beyond upfront accounting. Toward the latter perspective, we focused our analysis specifically on activating **community-based organizations**, which we considered to be any organization, for- or non-profit, that represents aspects of a community. Together with subscribers, they are the "community" in community solar. We believe that in the absence of top-down policy in Texas, these case studies demonstrating the characteristics and capabilities of CBOs will be essential in forming the bottom-up activation paths that determine the development of CSS in Texas.

## Potential benefits of community-based organization participation

CBO involvement in community solar can lead to better outcomes for projects, programs, and policies. For example, CBOs are known to:

- Facilitate underserved communities' involvement in and benefits from community solar through governance and economic development support[29]
- Negotiate community support for energy projects, helping to reduce the costs of subscriber acquisition, project scoping, and subscriber management[30]
- Drive business model innovations across the United States with respect to many project and ecosystem functions, adapting programs to local contexts and needs[31]
- Help members view renewable energy development positively, overcoming their own indifference or uncertainty[32]
- Create positive feedback loops for greater support of the energy transition over the long-run[33]

For these reasons, it is important to understand how CBOs are "activated," since they are an important and often overlooked partner in activating CSS pathways.

## National and Texas community-based organizations activation analysis

The potential for CBOs to be involved in CSS initiatives depends in part on the presence of different types of CBOs in a region and their potential to be activated to engage with community solar. We analyzed the U.S. Internal Revenue Service's database of tax-exempt organizations[34] to understand how the composition of CBOs in Texas compares to other states that also have active or emerging CSS initiatives. Among 1.5 million CBOs nationally and over 100,000 CBOs in Texas, we found that the composition of CBOs in Texas roughly mirrors the national composition (Figure 8). However, compared to other states with ongoing CSS deployment, the density of almost all types of CBOs is lower in Texas (Figure 9). Furthermore, we observe that most of the CBOs in Texas are located close to the urban centers; thus, rural areas have an even lower density of CBOs (Figure 10). These observations align with other findings, such as the 2018 Texas Civic Health Index Report, which showed that the level of civic engagement in Texas is considerably lower compared to other states across different criteria such as political participation, volunteering and group membership.[35]

[29] https://click.icptrack.com/icp/relay.php?r=76950470&msgid=506354&act=6JNV&c=1164501&destination=https%3A%2F%2Fcesa.org%2Fresource-library%2Fresource%2Fsolar-with-justice

[30] Nolden, C., Barnes, J., & Nicholls, J. (2020). Community energy business model evolution: A review of solar photovoltaic developments in England. Renewable and Sustainable Energy Reviews, 122, 109722.

[31] Chan, G., Evans, I., Grimley, M., Ihde, B., & Mazumder, P. (2017). Design choices and equity implications of community shared solar. The Electricity Journal, 30(9), 37-41.

[32] Bauwens, T., & Devine-Wright, P. (2018). Positive energies? An empirical study of community energy participation and attitudes to renewable energy. Energy Policy, 118, 612-625.

[33] Fairchild, D., & Weinrub, A. (2017). Energy democracy. In The Community Resilience Reader (pp. 195-206). Island Press, Washington, DC.

[34] The IRS tax exempt organization list includes charitable organizations, religious organizations, private foundations, social welfare organizations and other non-profits. This list aligns closely with the broad definition of CBOs we use in this report.

[35] https://moody.utexas.edu/sites/default/files/2018-Texas_Civic_Health_Index.pdf

**Figure 8 – Composition of CBOs in Texas.**

This state level composition closely mirrors the composition of CBOs nationally. Source: IRS Exempt Organizations Business Master File 2019.

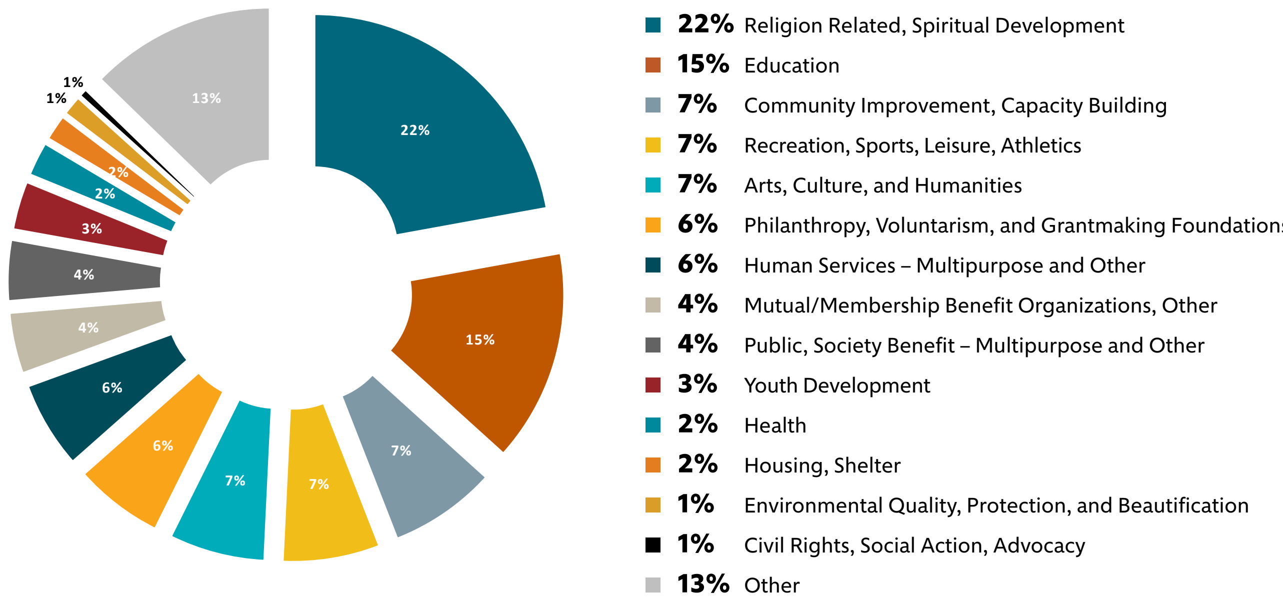



**Figure 9 – Density of CBOs in Texas, relative to other states with ongoing community solar deployment.**

Compared to other states with ongoing community solar deployment, the density of almost all types of CBOs is lower in Texas. Source: IRS Exempt Organizations Business Master File 2019.

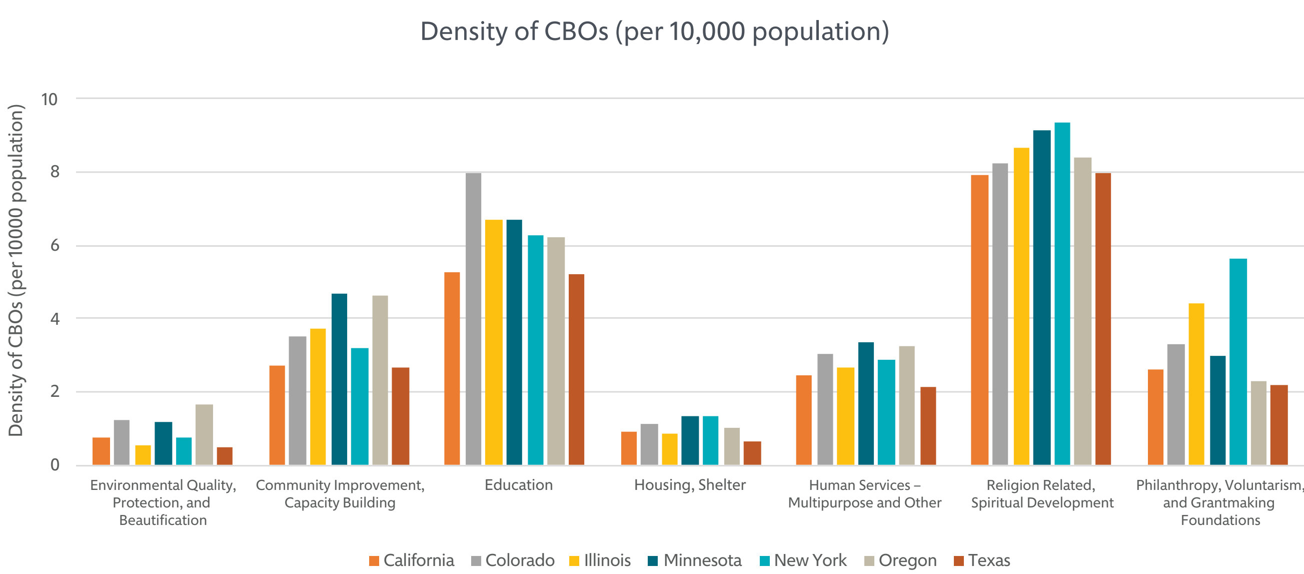
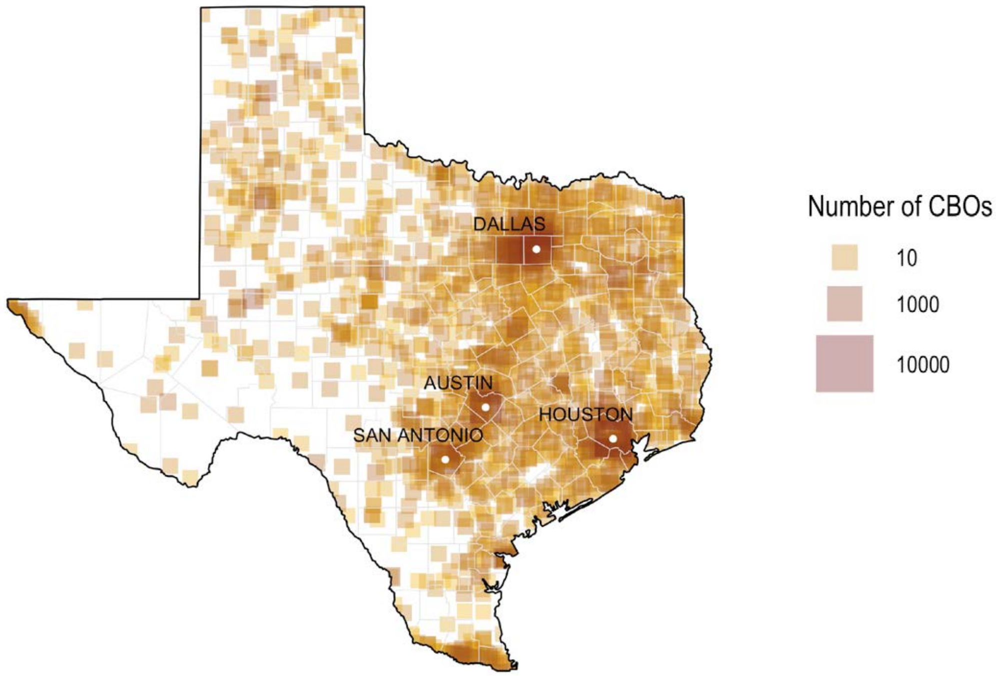


**Figure 10 – Location and density of CBOs in Texas.**

Most of the CBOs in Texas are located close to urban centers. Rural areas have a much lower density of CBOs.
Source: IRS Exempt Organizations Business Master File 2019.




The potential for CBOs to become involved in CSS is still high within many regions of the state, despite their lower-than-average density observed in Texas, especially within rural areas. We base our understanding of this potential on a series of national- and state-focused interviews with the heads and personnel of CBOs to answer the question:

**How can CBOs in Texas be systematically activated to collaborate with developers and other stakeholders in a community solar program?**

To answer this question, we completed two sets of interviews. The first set of interviews focused on CBOs across the nation that already engaged in some function with CSS projects or programs. We focused on their unique functions, organizational characteristics, markets, and activation paths where CBO involvement seemed especially high and varied.

The second set of interviews involved the heads of 19 CBOs in Texas belonging to different sectors, such as affordable housing, environmental conservation, and community development. Unlike the first set of interviews, these CBOs had little to no prior involvement with CSS projects or programs. These CBOs were identified using a snowball sampling technique, and included organizations that worked at local, regional, state, and national levels. Interviews here focused on collaboration, functions, and organizational characteristics.

From the CBO interviews we observed overall that:

- In and outside of community solar projects, CBOs often performed *common functions* based on missions and pre-existing resources;
- These functions and collaborations were initiated through *common activation pathways*; and
- Texas CBOs may be more likely to support community solar programs through *common networks, leaders, and skill activations*.

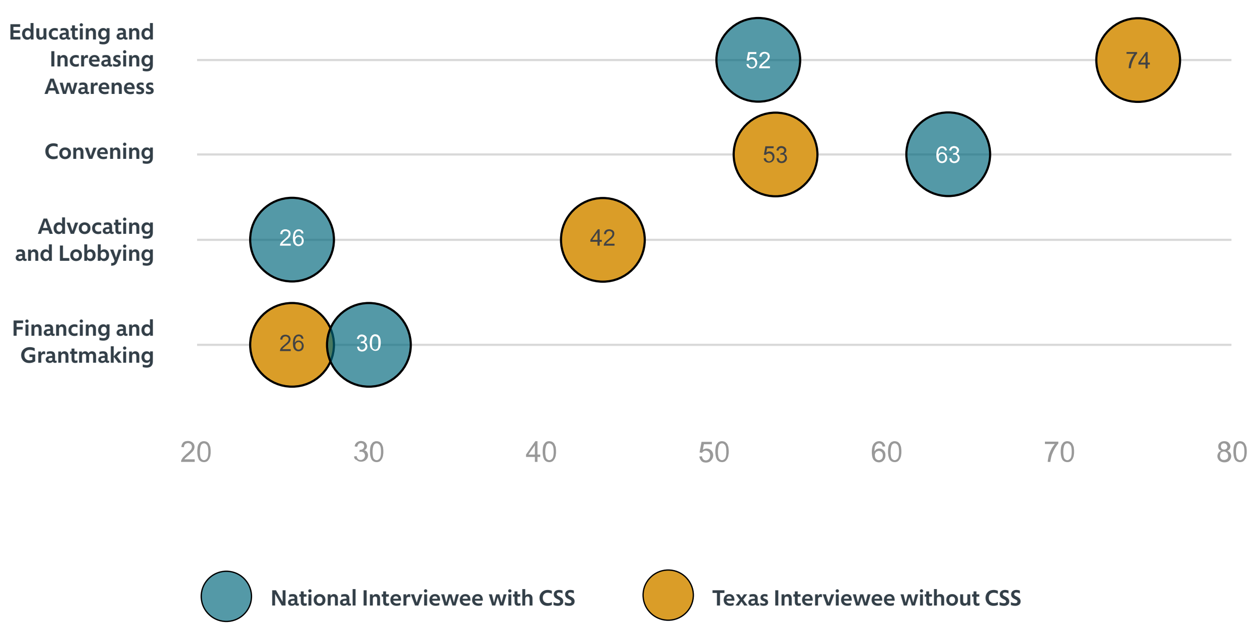
***Common functions among national and Texas CBOs***

Pre-existing organizational capacities, strengths, and roles in projects with myriad objectives situate many CBOs to effectively leverage these resources in new contexts.[36] For many, CSS could provide a new context to achieve their organizational objectives. Nationally, many successful CSS projects have been characterized by successful utilization of CBO strengths to fulfill functions that would otherwise incur prohibitive costs or otherwise pose barriers to development. For example, organizations with existing community relationships are often well situated to perform subscriber acquisition and management while organizations with strong cross-sectoral networks are able to convene the wide array of organizations often involved in CSS projects.

CBOs can perform virtually all of the functions in a CSS project, but some functions are more common for CBOs to perform than others. Many functions are performed simultaneously and within collaborations with communities or at a larger, societal scale. For CBOs in Texas, many of those functions are already being performed, just toward different ends. Figure 11 highlights four functions that many CBOs in TX are currently performing in non-CSS contexts that were also identified as prevalent in national CSS cases.

*Successful activation of the CBOs that have experience in these four functions could be a fruitful pathway to scaling community solar in Texas.*

**Figure 11 – Percent of interviewees performing function among most cited functions.**




[36] Bryson, J. M., Crosby, B. C., & Stone, M. M. (2006). The design and implementation of Cross-Sector collaborations: Propositions from the literature. Public administration review, 66, 44-55.

***Windows of opportunity and activation pathways***

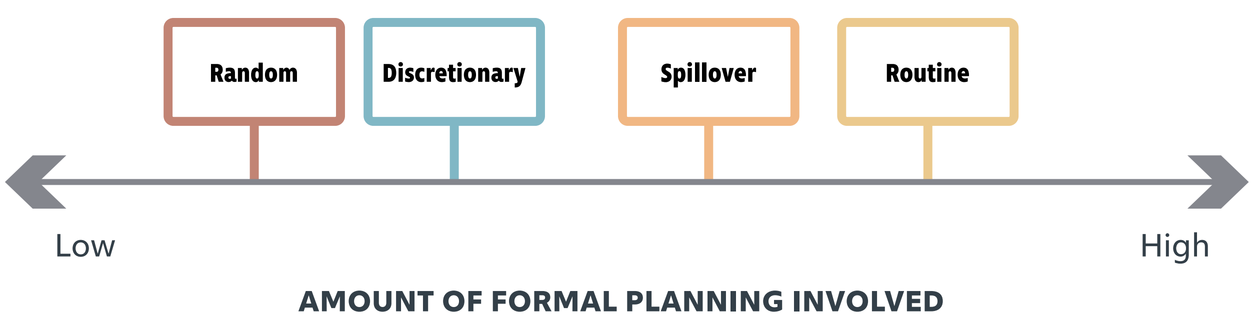
Based on our literature review and interviews with Texas and national CBOs, we determined that activation depends on four pre-conditions organized into internal and external factors: *internal conditions* (mission and pre-existing resources) and *external primers* (new funding or a bridging organization or developer).

From our research, it seems most (if not all) activation paths explicitly involve the CBO's mission, which acts as the organization's goalposts for aligning its resources with public value and other organizations. These conditions intersect with each other to create various "windows of opportunity" that allow a CBO to collaborate and innovate (Figure 12).

> *"If we can reach alignment on our objectives, in a way that's like a win-win-win type partnership, so that we're all getting something valuable out of it."*
>
> *— INTERVIEW WITH TEXAS ENERGY NON-PROFIT*

**Figure 12 – Windows of opportunity.**

Policy windows are thought to come in many different types: routine, spillover, discretionary, and random. Routine windows occur the most frequently and reliably of the windows, happening during organizational planning processes or yearly budgeting. Spillover windows happen when issues are linked into a separate but relatable issues (e.g. CSS for affordable housing). Discretionary windows occur at the behest of individuals within the system. Random windows open during random crises or events, occurring the least of all the types of windows.



Policy windows are thought to come in many different types, including routine, spillover, discretionary, and random. Routine windows occur the most frequently and reliably of the windows, happening during organizational planning processes or yearly budgeting. Spillover windows happen when issues are linked into a separate but relatable issue (e.g. community solar for affordable housing). Discretionary windows occur at the behest of individuals within the system. Random windows open during random crises or events, occurring the least of all the types of windows.

Through different types of internal and external entrepreneurs, these un-activated pre-conditions can be made to overlap and create activation paths for CBOs (Figure 13). We identified four main routes for activation from the interviewees involved with community solar, based on which pre-conditions seemed strongest both initially and throughout the process:

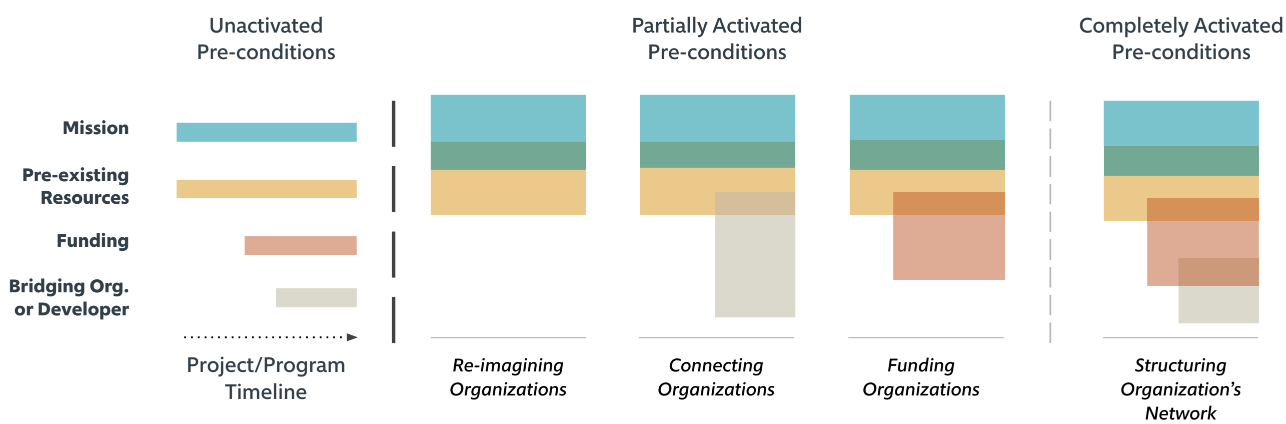
1. **Re-imagining Organizations**, where internal leaders align missions with internal resources, reconfiguring the internal capabilities of the CBO in the process. A little more than a third of interviewees with community solar mentioned this path.

2. **Connecting Organizations**, where external bridging organizations help to collaborate and work with CBOs' functions. Half of organizations with community solar mentioned this path.

3. **Funding Organizations**, where new external funding opportunities activate existing resources or provide new resources for a CBO's innovation. One in eight organizations with community solar focused on this path.

4. The final path, **Structuring Organization's Network**, is an activation of all three prior paths.

**Figure 13 – Creating overlapping pre-conditions to activate community-based organizations.**
Two internal and two external streams or pre-conditions exist separate from each other for a typical CBO. Internally for all activation paths, mission seems most important, followed by pre-existing resources, such as capacity, skills, and collaborations. Externally, funding and bridging organizations can help activate CBOs, although those externally activated paths seemed less present in our interviews.



As interviewed CBOs went through time and developed CSS projects and policies, many of their activation paths began to feature aspects of the fourth path, activating resources internally, acquiring new funding, and collaborating with increasing numbers of actors. Their functions, too, changed as they gained internal competence and skill, often morphing pre-existing functions into related functions. For instance, a business working with its employees began to offer community solar as it did health insurance, or a church educated and subscribed its congregants to an on-site community solar array.

We stress here that community-based organization activation paths are often nonlinear, with long time spans of causes and outcomes for an organization. The paths typically occur over years of CSS project and program development where a broader community solar field has provided stable cues and support for organizations to plan and prospect around. We found that without that stable, long-term field, communication and coordination between CBOs and collaborators can become muddled, and new functions are inhibited.

> *"One [difficulty] is working with a program that hasn't been established yet… Even just trying to communicate the benefit to get landowners to work with us with a program that is very unclear [is difficult]"*
>
> — *INTERVIEWEE FROM PACIFIC NORTHWESTERN ECONOMIC DEVELOPMENT CORPORATION*

We found numerous *windows of opportunity* that included series of formal, planned events like board meetings, as well as more informal, random events like networking. The following case studies exemplify the types of long-developing activation paths enumerated above. TEPRI coordinated with the Texas Hunger Initiative to re-imagine organizations around the issues impacting their shared client base. In the case of South Union Community Development Corporation, the activation was furthered by meeting Wolfe Energy at a regular Houston-area renewable energy board meeting, typifying the connecting organizations pathway. For the Kerrville Public Utility Board, a once-in-a-decade U.S. Department of Energy competition provided the funding boost to pursue the project, demonstrating the role of funding organizations in activation.

Though appearing to be driven mostly by luck and chance, each of these activation paths was reinforced by years of internal preparation and a willingness to re-imagine their organization's functions and mission. Today, these activations are ongoing, signaling the need for further structure to build out the chances of success for these and other emerging CBOs.

> *"..to build trust takes a long time in these communities... We've been talking about energy, which is not easy. So I think that sort of experience certainly played into it."*
>
> — *INTERVIEWEE AT MIDWESTERN NONPROFIT THAT ADMINISTERED COMMUNITY SOLAR*

## CASE STUDIES EXEMPLIFYING ACTIVATION PATHWAYS

### *Re-imagining organizations*

**CBO: Texas Energy Poverty Research Institute** (TEPRI) is located in Austin, Texas. Their mission is to inspire lasting energy solutions for low income communities across Texas.

**Project:** Collaboration with Texas Hunger Initiative

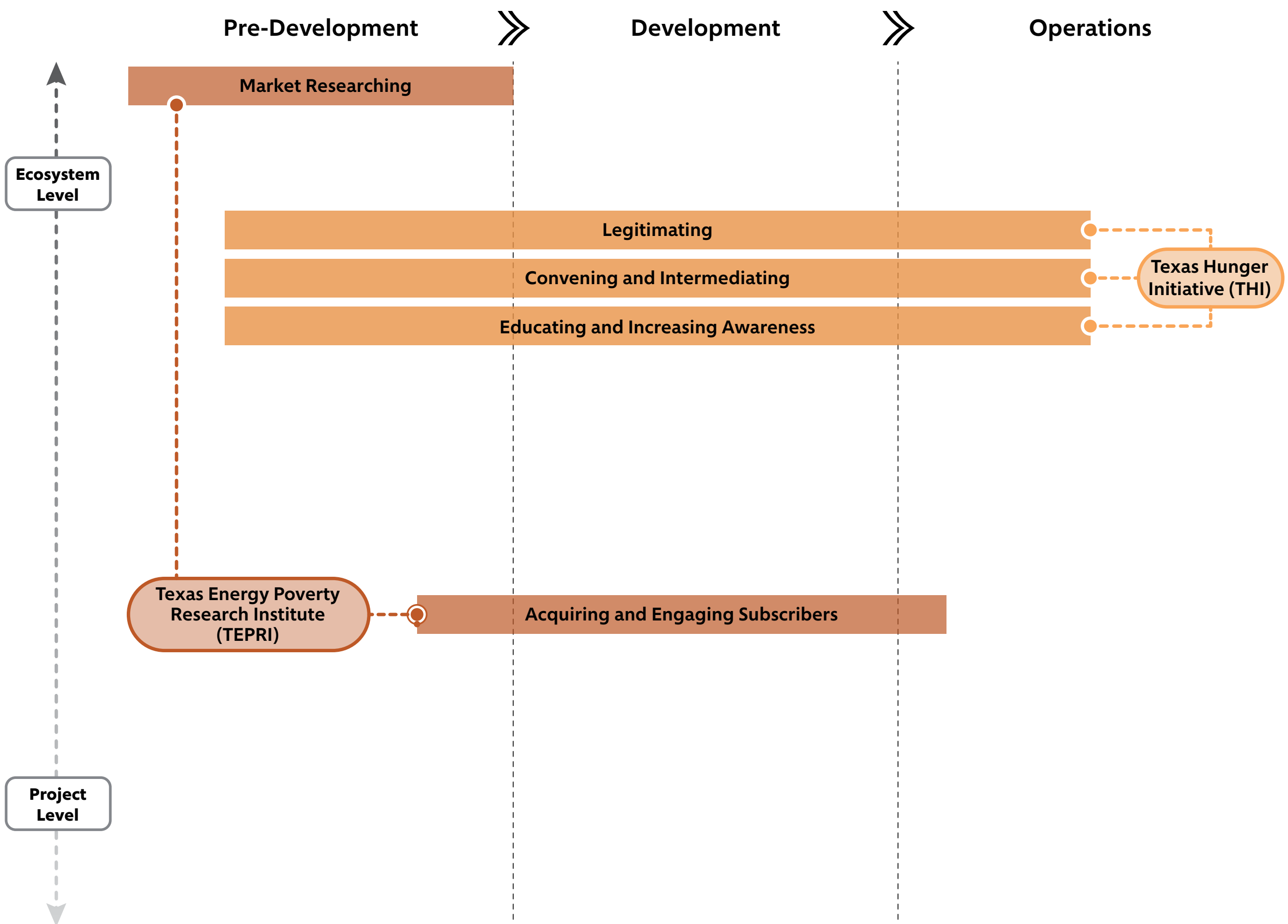
In late 2018, TEPRI was invited to present at the Together at the Table Hunger and Poverty Summit in Waco, TX, a convening that was hosted by the Texas Hunger Initiative (THI). While THI does not deal with energy, they do focus on poverty, which is where the two organizations found common ground. THI acted as the bridging organization, bringing an energy poverty CBO into a room full of representatives from food banks, faith-based organizations, and community and workforce developers. While hunger and energy poverty initially seemed like two different subjects, THI and TEPRI realized a lot of overlap in their missions and the needs of the clients they serve. This openness to re-imaging the organization's mission as being embedded in the multidimensional, interconnected needs of the community can enable wide-ranging, cross-sectoral collaboration (Figure 14).

*"While we are focused pretty specifically on the energy side in our work, I think we constantly make sure that we understand the overlaps between energy and hunger, energy and housing, energy and education, and energy and economic opportunity. While our core mission isn't necessarily to address housing or economic opportunity or education, we do want to make sure that we understand the relationship between the work that we're doing and those aspects of people's lives."*

— INTERVIEWEE AT TEPRI

**Figure 14 – Re-imagining organizations.**

Function map for Texas Energy Poverty Research Institute.



## CASE STUDIES EXEMPLIFYING ACTIVATION PATHWAYS

### *Connecting organizations*

**CBO: The South Union Community Development Corporation** is located in Houston, Texas. Their focus is in large part on "sowing seeds of success" through exposure to science, technology, engineering, and math careers.

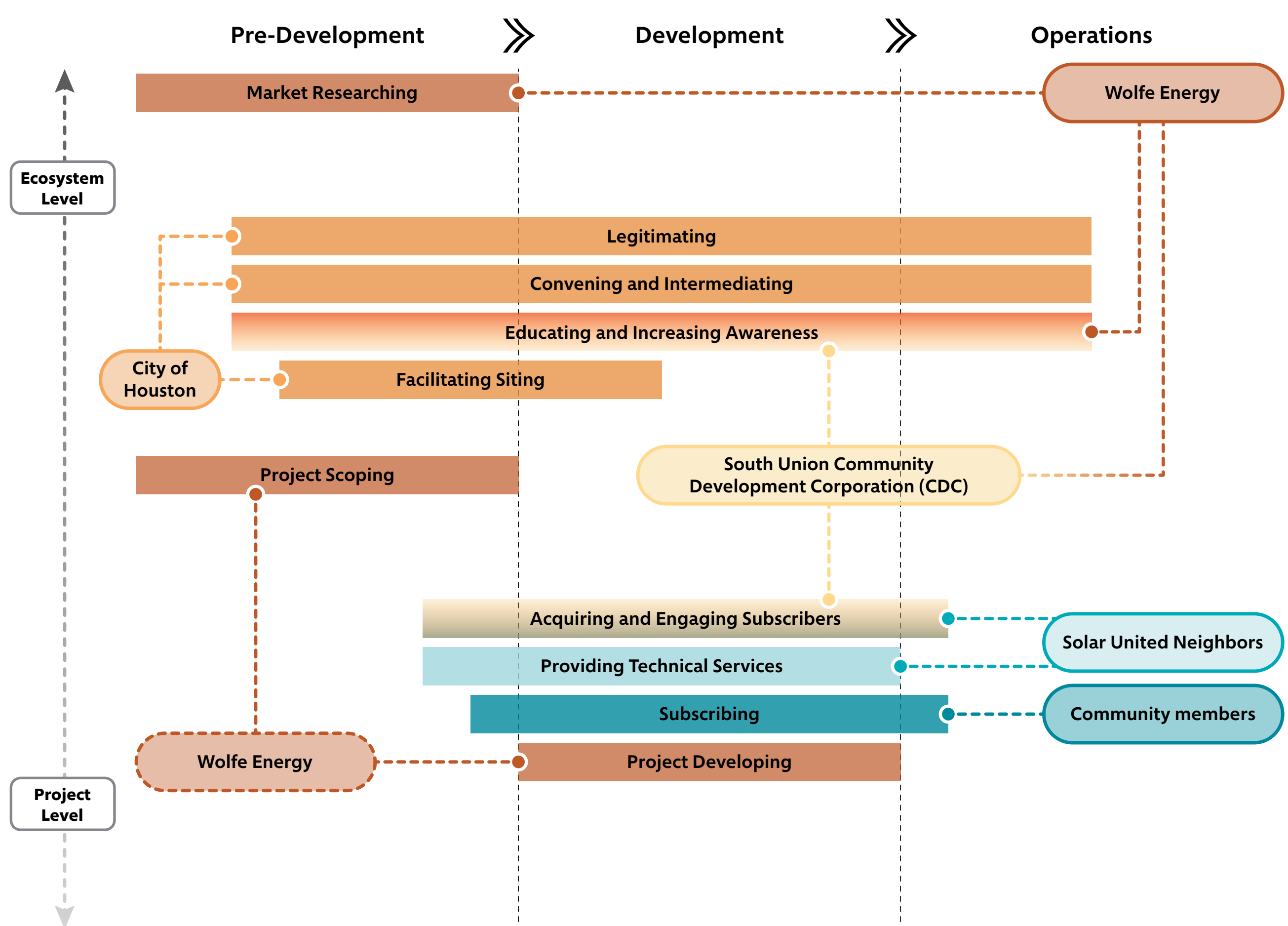
**Project:** Sunnyside Energy Project, 70 MW, with 2 MW carved out for potential community solar

Beginning with a mission of education around science and technology, South Union maintains strong pre-existing resources such as educational programming and direct contact with the Sunnyside community in Houston. South Union also built familiarity with solar technology through its own community education. When the City of Houston and the solar developer Wolfe Energy sought new funding through the C40 Reinventing Cities Competition, South Union joined the application after meeting with Wolfe Energy at a Houston Renewable Energy Group event. Wolfe Energy acted as a bridging developer to South Union, providing solar development expertise that meshed well with South Union's mission and skills in community development (Figure 15).

**Future Plans:** As the 70 MW project is still waiting for a major offtaker of the energy to make its finances viable, South Union continues to work alongside Wolfe Energy in project development. The project is expected to begin producing electricity in early 2021.

**Figure 15 – Connecting organizations.**

Function map for The South Union Community Development Corporation.



## CASE STUDIES EXEMPLIFYING ACTIVATION PATHWAYS

### *Funding organizations*

**CBO: The Kerrville Public Utility Board (KPUB)** is a municipally owned electric utility that serves around 22,750 customers in a 146 square mile service area in Kerr County, Texas

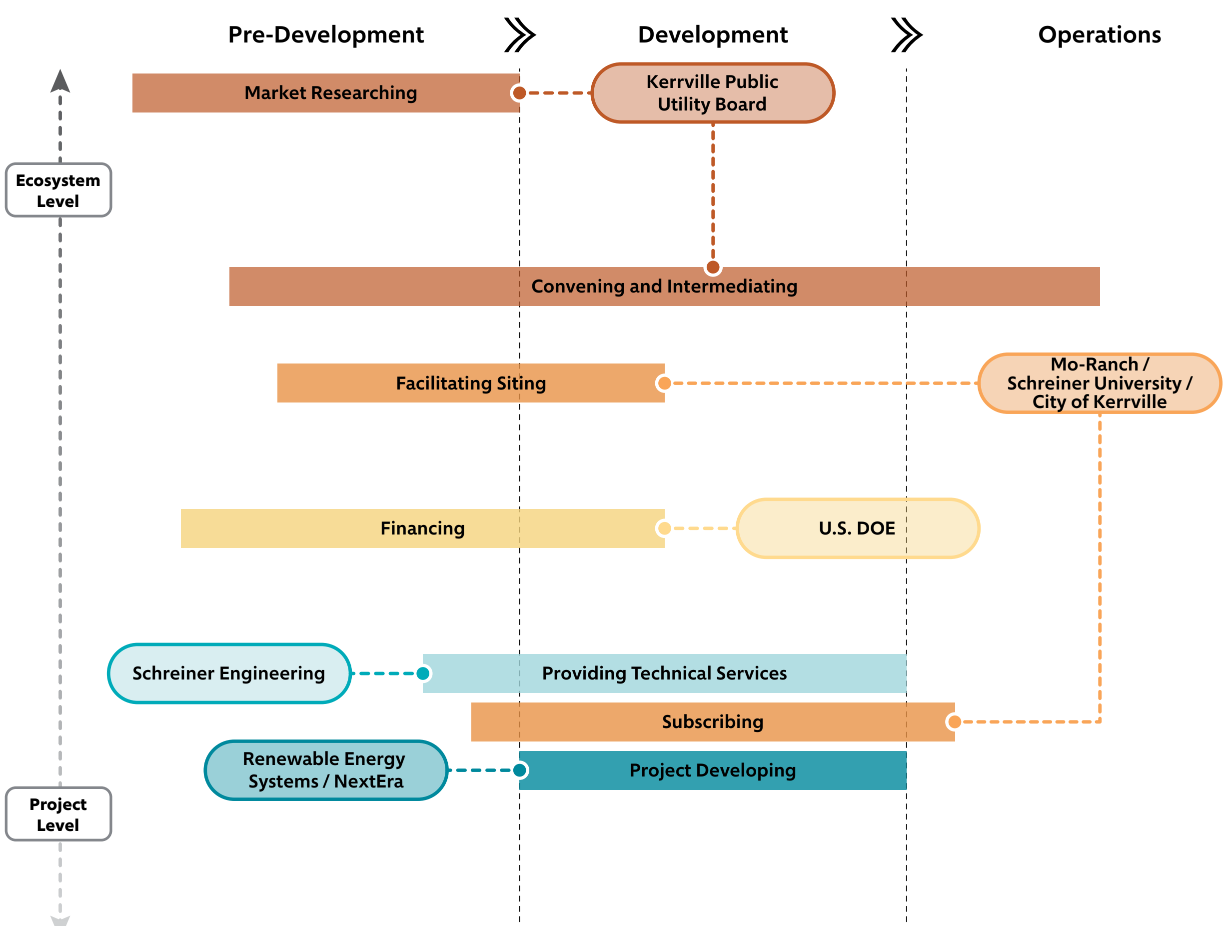
**Project:** Multiple projects under .99MW – total capacity of 5.25 MW.

**Activation Pathways:** KPUB had been waiting for prices to become more competitive with their standard rates so that getting involved in the solar market makes financial sense. After finding an opportunity to size the solar arrays to avoid wholesale market transmission charges, KPUB received a U.S. Department of Energy Solar in Your Community grant. The grant allowed them to move forward with community solar for LMI customers, which aligns with their mission to provide safe, reliable, and cost effective services to their customers. As a utility, KPUB had the pre-existing resources, such as utility expertise and relationships with local nonprofits, to integrate CSS projects. KPUB worked with a bridging developer and arranged a power purchase agreement through which they purchase all of the energy to sell to customers. The arrays were installed on property owned by nonprofits who receive 50% of the energy in exchange for the land agreement. Subscribers were acquired by working with a property manager that leases exclusively to LMI customers, which eliminated the need for KPUB to complete income checks.

**Future Plans:** KPUB can serve another 300-400 LMI customers with the systems they have built, and the focus is now on filling remaining subscriptions. They are also hoping to develop educational opportunities around the solar arrays.

**Figure 16 – Funding organizations.**

Function map for The Kerrville Public Utility Board.



## Recommendations for enhancing CBO involvement in community solar

The motivation to collaborate with other CBOs on common issues seems very strong in Texas. Sixty percent of the interviewed CBOs in Texas mentioned they always prefer collaboration, and the remaining were open to collaborating when needed. Recognizing this latent ability and willingness to collaborate, we provide below some suggestions to activate CBOs in community solar. These suggestions are meant to act as a multiplier to scale opportunities for community-based organizations. Innovation and collaboration that can happen in more ways is, after all, more probable.

### *Plan around:*

1. **Organizationally based, routine events.** Most networks have annual meetings. Most organizations have yearly planning meetings and regular board meetings. Most foundations have yearly calls for funding. Getting on the agenda at one of these routinized events is not difficult, and they are the most common of our windows of opportunity. It requires organizing and timing. CBOs and organizations could also create their own routine events to build expectations for community solar in Texas.

2. **Larger, ecosystem-based spillover events.** Mission alignment matters most for these events, which relies on relating community solar to supposedly unconnected issues whose importance ebbs and flows at state and local levels. These events can include problems like resilience for coastal areas (e.g. community solar can provide microgrid hubs post-hurricane recovery) or even for economic development (e.g. community solar provides jobs and lasting economic benefits to local communities). Even now, in the wake of the global COVID-19 pandemic, economic losses might be recovered through community solar-aided responses.

3. **Individual-based, discretionary events.** With windows that open because of individual discretion, often between like-minded leaders in connected organizations, these events create the more-random chance for collaboration and relationships. These discretionary events were important in our interviews, but belied an important conceit: they become more probable when organizations have repeated, meaningful interactions with and awareness of each other. Facilitating the structure for these "chance" encounters should be a main focus of community solar providers in Texas.

### *Work with:*

1. **Broad missions that can relate easily to different sectors' missions and local conditions.** Mission was the most frequently mentioned reason for collaboration and innovation in our interviews. Developing case studies, messaging, and education for alignment with specific missions of sectors will be critical for expanding the appeal and benefit of community solar across the state. In Table 1 below, we provide potential mission alignments and functions for various sectors, identifying common themes from our interviews. These suggestions are meant to provide starting points, since we recognize that true community solar solutions will emerge from the communities and providers that most fully engage with the idea.

2. **Bridging organizations and developers that enhance and suggest full community solar technical solutions that can fit local contexts.** Most interviewed Texas CBOs considered their internal resources to be a strength, along with their pre-existing relationships with other organizations. Many interviewees leveraged past experience or expertise (especially in energy-related projects) into new functions related to community solar. Organizations that support networks of other organizations often provided coordinating and educating expertise

to their member organizations. To augment these strengths, intermediaries such as solar developers and industry-expert CBOs should be engaged to bridge sectors and create new community solar solutions between CBOs. In Minnesota, Clean Energy Resource Teams performs this role by fostering regionally-specific workshops and training for developers, utilities, and nonprofits engaged in community solar.

3. **Regionally specific networks that convene community-based organizations, energy developers, and utilities to provide an opportunity for individuals to meet and discuss ideas and solutions.** Networks such as these can create shared expectations, resources, and planning abilities among CBOs in a way that mimics the more permanent community solar programs and policies of other leading states. For example, the Energy Trust of Oregon recently engaged different community-based organizations involved with low- and moderate-income communities over a years-long solar scouting process.[37] With scholarship grants, meetings around the state, and eventual innovation grants for CBOs and specific projects, the Energy Trust continues to provide support and central coordination for CBOs around the state. Convening models such as these can be replicated.

> *"We maintain regional offices around Texas and their job is to provide backbone support to the coalitions in their region, as well as to do outreach on a number of programs on a local level. And so those field staff are constantly cultivating new relationships so that when opportunities come along, they've got preexisting relationships and trust that they've cultivated with those organizations so that when they come calling and say, Hey, we've got this new program, is this something you'd be interested in, organizations are amenable to trying it out."*
>
> — *TEXAS BASED NON-PROFIT*

[37] https://www.osti.gov/servlets/purl/1559529

**Table 1 – National and Texas CBO examples, functions, and opportunities for aligning CBO mission with community solar in Texas.**

| CBO Sector | Potential Mission Alignment | Potential Functions | National CBO Examples with CSS | Texas CBO Examples<br>(1) General characteristics of supportive collaboration<br>(2) Past experience with solar or energy in general<br>(3) Already with CSS |
|---|---|---|---|---|
| **Energy** | Expand portfolio, new business models, utilize incentives, customer engagement | Advocating, Developing, Acquiring Subscribers, Managing Subscribers, Convening | Clean Energy Resource Teams (MN), Solar United Neighbors, National Rural Electric Cooperative Association, New York State Energy Research and Development Authority | TEPRI (3), Texas State Energy Conservation Office (2), Texas Public Power Association (1), Texas Electric Cooperatives (3), aggregators and REPs (1) |
| **Housing/ Real Estate** | Reduction of utility bills, serve members, create housing access and affordability | Subscribing, Educating, Legitimating, Acquiring Subscribers, Managing Subscribers, | Housing authorities in New York City, Denver, and Saint Paul, City of Lakes Community Land Trust (MN), African American Alliance for Homeownership (OR) | Texas State Affordable Housing Corporation (1), Austin Habitat for Humanity (1), Foundation Communities (3) |
| **Environment** | Carbon mitigation, lessen land impact of solar, air and water quality | Advocating, Educating, Legitimating, Siting | Environmental Law and Policy Center, Ecology Action Center (IL), New Jersey Conservation Foundation | Hill Country Alliance (1), Sierra Club (3), Public Citizen (3), Citizens Environmental Coalition Houston (1) |
| **Religious** | Stewardship, serving members, serving environment | Convening, Siting, Subscriber Acquisition, Subscriber Management, Subscribing | Minnesota Interfaith Power and Light, Archdiocese of New York, Monastery of Our Lady of Mt. Carmel (D.C.) | Texas Hunger Initiative (3), Alliance of Community Assistance Ministries of Greater Houston (1), Texas Interfaith Power and Light (2) |
| **Community Development** | Local economic development, job training, community control over energy | Siting, Education, Legitimating, Acquiring Subscribers, Convening, Financing | PUSH Buffalo (NY), Prairie Rivers Network (IL), UPROSE (NY), Northcountry Cooperative Foundation (MN), Mountain Association for Community Economic Development (KY) | Texas Association for Community Development Corporations (1), Local CDCs and EDCs (1), Enterprise Community Partners (1), Rural LISC (1), Southeast Texas Nonprofit Development Center (1) |
| **Local Government** | Municipal climate and economic goals | Convening, Subscribing, Financing | Northwest Colorado Council of Governments, Metropolitan Council (MN), North Carolina Weatherization Assistance Program (NC), City of Cedar Falls (IA) | City of Kerrville (3), City of Houston (2), North Texas Council of Governments (3) and other regional Councils of Governments (1) |
| **Schools and Universities** | Reduction of utility bills, build student awareness, technology demonstration | Anchor Subscribing, Educating, Legitimating, Providing Technical Services, Siting | University of Arizona Science and Technology Park, Colorado Springs School, University of Northern Iowa, University of Minnesota | University of Texas (2), Rice University (2), Austin Independent School District (2) |
| **Financial** | Diversify lending and investment portfolios, social and environmental responsibility, community development | Financing, Legitimating, Convening, Educating | National Renewables Cooperative Organization, Energy Trust (OR), Boston Community Capital (MA) | Texas Rural Funders Collaborative (1), Cornerstone Credit Union League (2), local banks and credit unions (1), The 80/20 Foundation (1) |

# VI. Roadmap to Texas Community Solar

Overcoming barriers is accomplished by activating stakeholders to help fill gaps in functions (Section 2). Barriers depend on local and statewide policies and conditions in Texas' electricity markets, as well as the capacity of local actors within those markets (Section 3). We focus on how to activate CBOs to fill functions in community solar, identifying particular CBOs in Texas that have had experience in community solar, solar in general, or general characteristics that indicate some readiness to begin work on community solar (Section 4).

Through this research, we found many specific and general barriers to community solar deployment. In Table 2 (next page), we present a summary of barriers to CSS in Texas, followed by a roadmap (Figure 17) for activating CBOs and market actors to overcome these barriers through example strategies.

While there are many different local barriers to community solar across the state, including some we inevitably missed, we summarize topline barriers below mapping each of the barriers to our function framework. In this table, barriers are color coded depending on which market they pertain to primarily.

Our roadmap, Figure 17, encompasses three key strategies for activating community solar in Texas:

1. **Statewide coalition building**
   To build successful cross-sector partnerships and a supportive policy ecosystem, groups within Texas could organize with each other by recognizing and broadening their overlapping missions. This should include regular meetings and a broad renewable energy mission to be represented at the legislature, utilities commission, and ERCOT. While energy and environmental CBOs are highlighted here for their expertise and current organizing infrastructure, stakeholders from other sectors, such as public housing and economic development, should be engaged as well. A broader mission should be used to highlight support for adjacent energy needs (e.g. distributed energy-friendly rules in ERCOT), as well as adjacent environmental needs (e.g. community-scale solar making better use of land than utility-scale solar) or social needs (e.g. CSS for poverty alleviation). This strategy requires the activation of core groups that can bridge across various organizations with an array of missions.

2. **Market-specific community activation and technical assistance**
   There is a need to educate and activate 1) community-based organizations, 2) technical organizations like utilities and developers of community solar, and 3) diverse bases of subscribers for those projects. To drive interest, resources are also needed so that these actors can innovate new community solar business models that fit local needs. Resources could be used to facilitate technical assistance in competitions similar to the national Solar In Your Community program, wherein utilities and developers partnered with CBOs and were awarded technical assistance grants and funding for their business model development. Other investments could go toward building network resources for projects that include community-based partners or program-related investments or other credit enhancements that help de-risk what are new investments to many communities in Texas.

3. **Regional knowledge and resource building**
   Regional groups of bridging organizations can play a key role in activating CBOs. We highlight them again here for local siting-related functions, seeing the need for groups that can translate technical policies, such as zoning or interconnection, to lay audiences and perform them with local or regional interests in mind. In some states, extension offices run energy programs that can assist in convening, educating, and providing resources to local projects or organizations in need of assistance. The same approach might fit well in Texas, where local interests and an incredibly diverse market landscape require tailored outcomes that only locally situated stakeholders might produce.

## Table 2 – Summary of Community Shared Solar barriers by market type.

| Function | Summary | Barrier | | Key (All Markets / Muni/Coop / Retail Choice) |
|---|---|---|---|---|
| Policymaking | Statewide policy is permissive but not supportive of community solar. Stakeholders can act to promote market-based policy changes to help maximize and attribute benefits of community solar. | 1 | Access to ancillary service revenue or wholesale market participation for DG under 10MW (non-modeled generators) | All Markets |
| | | 2 | Lack of standardized practices and highly variable permitting and interconnection costs | All Markets |
| | | 3 | Lack of statewide support policies | All Markets |
| | | 4 | Local rules and regulations and how they are applied often varies between and within jurisdictions, increasing uncertainty and costs for developers. | Muni/Coop |
| Legitimating | Community solar is a nascent market in Texas. Legitimation of the business model to consumers, utilities, and community organizations is necessary for community solar to transcend novelty and enter the mainstream. Trusted organizations and corporations are primed to provide legitimacy by participating in and advocating for community solar programs. | 5 | Municipal utilities and cooperatives still do not see CSS as a legitimate or viable option for their community | Muni/Coop |
| | | 6 | Consumer awareness and understanding of CSS remains low | Muni/Coop |
| | | 7 | REPs are averse to innovations that they perceive to be risky in a complex, highly competitive market. | Retail Choice |
| | | 8 | REPs may be hesitant to invest in developing new skills and organizational capacity for an innovative product with unknown returns. | Retail Choice |
| | | 9 | Consumer awareness and understanding of CSS remains low; REPs are averse to additional marketing costs with uncertain returns. | Retail Choice |
| | | 10 | Consumers and market actors lack knowledge needed to differentiate between CSS and green pricing programs. | Retail Choice |
| Project Scoping | There are few examples of CSS programs in Texas. Interconnection and peak demand charge rules create unique trade offs in Texas that aren't directly comparable to projects in other states. Incubation of innovative models for the Texas regulatory environment are required to optimize project design. | 11 | Developers have difficulty securing financing without long-term offtake agreements. | Muni/Coop |
| | | 12 | Community solar developers have found it challenging to find a REP willing to sign a long-term offtake agreement. | Retail Choice |
| | | 13 | REPs have limited experience with CSS model scoping and implementation | Retail Choice |
| | | 14 | Market actors uncertain if the economics of CSS can reach a level where CSS can be financially viable without supporting policies. | Retail Choice |
| | | 15 | Difficult to capture and monetize grid benefits of distributed CSS in the retail choice market. | Retail Choice |
| Facilitating Siting | Grid expansion and interconnection represents a potentially significant expense depending on location and design. Increased knowledge of hosting capacity costs and opportunities would foster efficient community solar deployment. | 16 | Suboptimal project siting can increase cost of grid build-out and interconnection, depending on project location. | Muni/Coop |
| | | 17 | Limited staff capacity and expertise in siting and interconnecting distributed generation can lead to risk averse behavior and increased costs. | All Markets |
| Acquiring and Managing Subscribers | It is unclear that a broad community solar subscriber base exists. Green pricing is prevalent in Texas and may crowd out demand for community solar. One strategy to grow the subscriber base is to engage CBOs with relationships with potential subscribers. High subscriber management costs can make projects unviable. Outsourcing subscriber management to external organizations with capacity may be a cost-effective solution. | 18 | Identifying and signing anchor customers can help with project financing, but anchor customers are difficult to find. | Muni/Coop |
| | | 19 | Consumers in the retail choice market are highly price sensitive and have low willingness to pay for premium products. | Retail Choice |
| | | 20 | Customer acquisition costs can be high and frequently require new marketing campaigns and customer education for innovative business models. | All Markets |
| | | 21 | Subscriber management can be costly; software upgrades are typically needed. | All Markets |

## Figure 17 – Scaling Community Solar in Texas – Trajectories of Change

Ecosystem Level → Project Level

| FUNCTION | OBJECTIVE | STRATEGIES | ACTIONS (CBO, Developer, Utilities) |
|---|---|---|---|
| **Policymaking** | • Create access to ERCOT for distributed generation under 10 MW for ancillary services and other revenue streams (1, 15)<br>• Create standardized and open information about distribution grid (2, 16)<br>• Create statewide support policies for community shared solar (CSS) (3)<br>• Streamline local permitting and interconnection rules (4) | **Statewide Coalition Building:** Convene regular meetings of interested stakeholders for CSS and other distributed energy resource topics on a regular basis | Environmental/ Energy: **Environmental and energy CBOs** can help advocate and convene for rule changes/**Local agencies** can also help develop uniform policies for CSS projects<br>Developer: CSS **developers** can convene and advocate for rule changes<br>TDSP: **TDSPs** could be encouraged to collaborate on developing more uniform distribution grid rules |
| **Ecosystem Legitimating** | • Create viable models of CSS for REPs averse to risky product and marketing innovations in complex, highly competitive, low-margin arenas (7, 8, 9, 13, 14)<br>• Create viable models for muni/co-ops that still do not see CSS as a legitimate or viable option for their community (5) | **Market-Specific Community Activation and Technical Assistance:** Support competition or funding program for innovative, regional CSS programs that connect REPs and munis/co-ops with CBOs | Local Government, Financial: **Local, trusted, legitimate CBOs**, such as religious and community development organizations and local governments, can help subscribe, educate, and convene networks/ **Financial CBOs** can also provide stable financial services<br>Muni/Co-op: **Munis/Co-ops** with existing CSS can collaborate to demonstrate viability to non-adopter munis/co-ops |
| **Siting** | • Create pathways for project siting that can decrease cost of grid build-out and interconnection (16)<br>• Create pathways for CSS supportive and regionally consistent local permitting, zoning, and building codes (3) | **Regional Knowledge and Resource Building:** Support regional knowledge networks for distribution grid and zoning practices | Local Government: **Rulemaking CBOs** such as local governments can help convene and provide policymaking, while **energy CBOs** can educate and convene<br>Energy: **Landowning CBOs** such as churches, community development corporations, or housing nonprofits can also facilitate siting |
| **Project Legitimating**<br>**Project Scoping**<br>**Acquiring and Managing Subscribers** | • Create consumer awareness and understanding of CSS in communities with and without CSS (6, 9, 10)<br>• Create viable business models for CSS developers (including muni/co-ops and REPs) who may have limited experience (5, 7, 11, 12, 13, 14, 17)<br>• Create customer acquisition and subscriber management pathways (18, 19, 20) | **Market-Specific Community Activation and Technical Assistance:** Support competition or funding program for innovative, regional CSS programs that connect REPs and munis/co-ops utilities with CBOs and developers | Local Government, Schools, Housing: **Important local CBOs** such as local governments, schools, housing authorities, and community development corporations can help educate customers and facilitate subscription<br>Engage with **national organizations** with existing capacity |

* CBOs: Community-based organizations; Munis/Co-ops: Municipal utilities/rural electric cooperatives; REPs: Retail electric providers; TDSPs: Transmission/distribution service providers; and (#) indicates “barrier number” in Table 2.

# Appendix

## Community solar projects in Texas

There are 14 utilities that have developed or are in the process of developing a community solar program in Texas. Across these utilities, there were 18 community solar projects available to Texans totaling 65 MW-AC installed as of 2019.[38] Among these community solar projects, the majority of projects (43.5 MW; over 65% of the total community solar capacity in Texas) are developed in the Muni and Co-op markets, and only four projects in three REPs are based in the retail choice markets. Both the Muni and Co-op markets and the retail choice markets offer their customers various ways to subscribe to community solar programs. Most of the projects developed in Texas (13 projects; about 68% of the total community solar projects in Texas) adopt "pay-as-you-go" (PAYG), which is a subscription model where customers pay a certain rate per kWh or per month for solar energy. PAYG subscriptions can replace a customer's electricity rate for consumption or can be associated with a specific level of generation that is netted with consumption. Amortized subscription payments associated with a specific level of capacity that is reimbursed at a specified rate is discussed below under loan/lease. A few projects offer a subscription model called "pay-upfront" (PUF), where customers pay the upfront cost for solar capacity and receive a monthly bill credit for the agreed term. Only one project by El Paso Electric adopts loan/lease (LL) where customers pay monthly payments based on the amortized upfront cost of solar capacity and receive monthly bill credits for the agreed term. The detailed list of community solar projects in Texas as of 2019 is presented in Table A1.

### Table A1 – List of community solar projects in Texas

| Utility | Utility Type | Project Name | Project Developer | Location | Size (MW-AC) | Year | Subscription Model |
|---|---|---|---|---|---|---|---|
| Austin Energy | Muni | Austin Energy Community Solar Program (Palmer Array) | PowerFin Texas Solar Projects | Austin | 0.19 | 2017 | PAYG |
| | | Austin Energy Community Solar Program (La Loma) | | | 2.6 | 2018 | |
| Bandera Electric Cooperative | Co-op | BEC Community Solar | SoCore Energy | Leakey | 1.9 | 2018 | PAYG |
| Co-serv Electric | Co-op | CoServ Solar Station | Co-serv for-profit entity | Krugerville | 2.0 | 2015 | PAYG |
| CPS Energy | Muni | RooflessSolar | Clean Energy Collective | Adkins | 1.2 | 2016 | PUF |
| | | Big Sun Community Solar | Go Smart Solar | San Antonio | 5.0 | 2019 | PUF |
| El Paso Electric | IOU | El Paso Electric Community Solar | M+W Energy | El Paso | 3.0 | 2017 | LL |
| Green Mountain Energy | REP | Go Local Solar Texas (Dakota Solar Park) | Green Mountain Energy | Meridan | 5.0 | 2019 | PAYG |
| | | Go Local Solar Texas (Gable Solar Park) | Green Mountain Energy | Wallis | 10 | 2019 | |
| Guadalupe Valley Electric Cooperative (GVEC) | Co-op | SunHub | SoCore Energy | Gonzales | 2.0 | 2017 | PAYG |
| Mid-South Synergy | Co-op | Synergy Solar | Mid South Synergy Water Resources | Bedias | 1.98 | 2016 | PAYG |
| MP2 Energy | REP | Farm to Market | LocalSun Energy | Sealy | 1.5 | 2016 | PAYG |
| Nueces Electric Cooperative (NEC) | Co-op | RooflessSolar | Clean Energy Collective (CEC) | Orange Grove | 0.7 | 2016 | PUF |
| Pedernales Electric Cooperative (PEC) | Co-op | Cooperative Solar Program | Renewable Energy Systems (RES) | Austin | 12.98 | 2018 | PAYG |
| Southwest Rural Electric Association (SWRE) | Co-op | Frederick Solar Field | Western Farmers Electric Cooperative | Frederick, OK | 0.25 | 2017 | PUF |
| | | SWRE Community Solar Vernon | | Vernon | 0.1 | | |
| TriEagle Energy | REP | SunEagle | Cypress Creek Renewables | Walnut Springs | 5.0 | 2016 | PAYG |
| United Electric Cooperative Services | Co-op | United Community Solar Plant | Turning Point Energy / DEPCOM Power | Clifton | 9.9 | 2019 | PAYG |

[38] Heeter, J. (2019): Sharing the Sun Community Solar Project Data. National Renewable Energy Laboratory (NREL). https://dx.doi.org/10.7799/1560152.

# Methodology

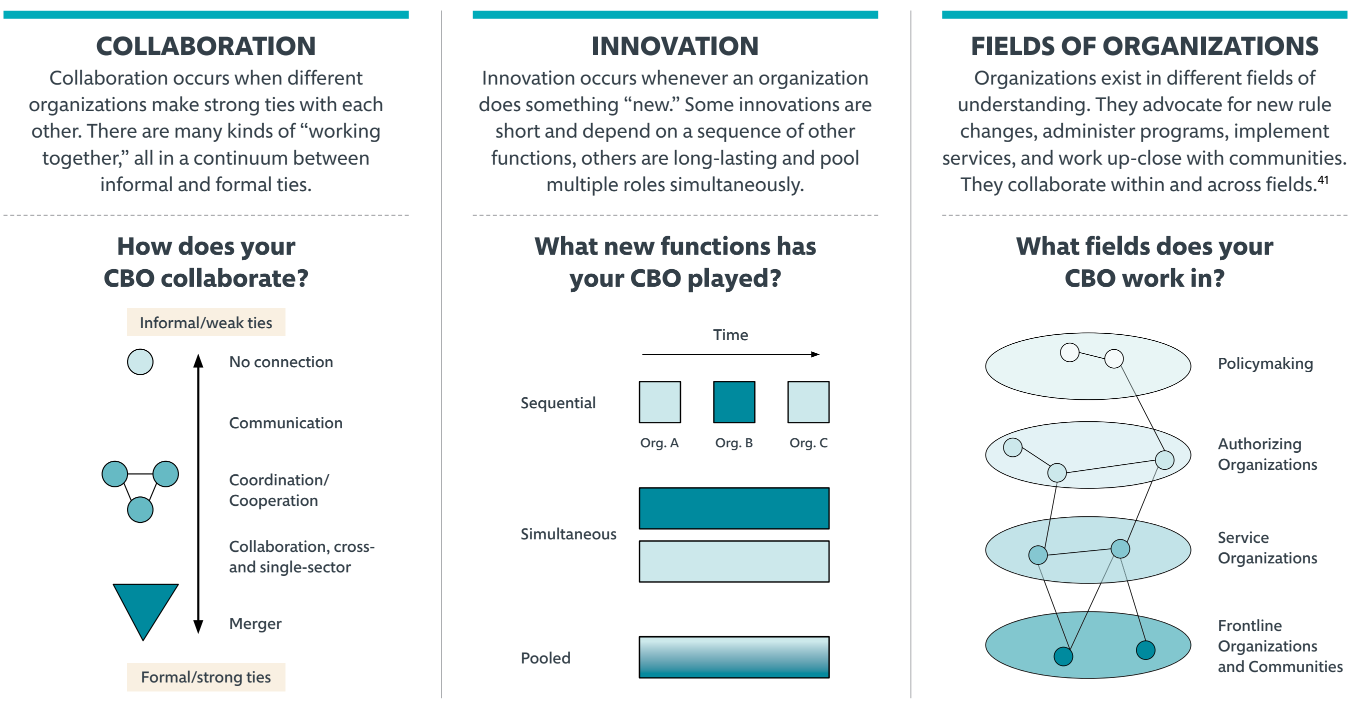
Over the course of several months, we engaged in the following types of research to assess the roadmap for community solar in Texas:

- Case studies
- National CBO interviews
- Texas CBO interviews
- Financial modeling
- Developer interviews
- Retail electric provider interviews

In conjunction, our literature review included sources on organizational learning and collaboration, innovation in energy and organizations, implementation, and the multiple streams approach, which provided a framework to our windows of opportunity and activation paths (Figure A1).

The literature on the multiple streams approach helps clarify how organizations implement programs through periods of ambiguity by combining "three quasi- or semi-independent 'streams' of political, problems and policy (solutions) events and activities [that] periodically flow together across realms."[39] There are strategies that entrepreneurial organizations can use to couple the streams and enact innovations and collaborations.[40] Capturing the nonlinearity of many of our CBO interviewees' activation paths (Figure A1), the multiple streams approach is able to detail the important aspect of timing and sequencing in the notion of windows of opportunity. By addressing windows of opportunity, as well as organizational characteristics in our analysis, we believe we are providing groundwork for others to implement and learn strategies for grassroots and middle-out community solar implementation activities.

**Figure A1 – CBO activation pathways occur when CBOs create stronger collaborations, innovate, and expand the breadth and reach of their organization.**




[39] Howlett, M. (2019). Moving policy implementation theory forward: A multiple streams/critical juncture approach. *Public Policy and Administration*, 34(4), 405-430.

[40] Cairney, P. (2018). Three habits of successful policy entrepreneurs. *Policy & Politics*, 46(2), 199-215.

[41] Adapted from Sandfort, J., & Moulton, S. (2014). Effective implementation in practice: Integrating public policy and management. John Wiley & Sons.

## Financial model analysis

The financial model was adapted from Elevate Energy's Community Solar Business Case Tool and NREL's System Advisor Model.[42] These existing modelling assumptions are further tailored to the Texas electricity market (ERCOT) through the inclusion of regulatory and financial restrictions and revenue sources including production curtailment options, unsubscribed energy management and location-specific cost ranges.

*The Community Solar Business Case Tool provides a flexible financial model that projects the costs and benefits to the system developer and subscriber of a single CSS project. Detailed input options allow for flexible system design.*

Using the financial model tool, five prototypical baselines (Table A2) were designed with unique assumptions based on their regulatory characteristics and ability to participate in specific parts of the Texas market. These baseline characteristics are described in the table below:

**Table A2 – Baseline characteristics for financial model testing scenarios.**

| | Vertically Integrated Muni/Coop | Distribution Coop | REP | Behind-the-Meter Third Party | Third Party |
|---|---|---|---|---|---|
| **Project Lead** | Utility | Utility | Third Party | Third Party | Third Party |
| **Distribution Interconnection Costs** | Costs are known to project lead | Costs unknown to project lead | Costs unknown to project lead | Avoided costs | Costs unknown to project lead |
| **TDU** | N/A | Incentive to build out system | Incentive to build out system | N/A | Incentive to build out system |
| **Subscriber Management** | Depends on capability of existing system | Outsource | Likely higher cost systems | Likely higher cost systems | Likely higher cost systems |
| **Subscriber Contracts** | Pay up-front, loan/lease | Pay up-front, loan/lease | Premium pricing | Pay-as-you-go, loan/lease | Discount on reimbursement |

[42] Elevate Energy. (2017). Community Solar Business Case Tool [https://www.elevateenergy.org/programs/solar-energy/community-solar/communitysolarbusinesscasetool/]. National Renewable Energy Laboratory. (2020). System Advisor Model[https://sam.nrel.gov/].

From these baselines, we then identified the most significant financial barriers by running sensitivity analyses on each revenue or cost component in the model, identifying those components most sensitive at the profitability margin, followed by the potential for a function to move the cost component plausible test value towards positive profitability. Three cost components are used as an example in Figure A2. The base project cost in this theoretical baseline is $2.00/Watt-DC, and the ranges of the three cost components are $0.03-$0.12/Watt-DC, $0.01-$0.64/Watt-DC and $0.10-$0.60/Watt-DC for customer acquisition, distribution interconnection, and customer management, respectively. The iterative process is to perform a sensitivity analysis across the range of values for a single cost component, holding all other baseline assumptions constant to identify:

1. the project baseline IRR at the low-cost test value,
2. the project baseline IRR at the high-cost test value,
3. the test value where profitability clears an assumed hurdle rate (e.g. 10%), and
4. whether this profitability margin (3) test value lies within the assumed cost component range

Cost components with larger ranges of uncertainty were more likely to be identified by this iterative analysis as a potential barrier to project development. In this example baseline (Figure A3), a 1 MW project that had an 11.33% IRR with 100% large subscribers saw a reduction in profitability by 5.53% in the high interconnection cost test scenario, a reduction of 4.56% in the 100% residential subscribers test scenario, and a reduction of 2.49% in the 10% production curtailment scenario.

**Figure A2 – Sensitivity analysis for customer acquisition, distribution interconnection, and customer management using a baseline of $2/Watt-DC.**

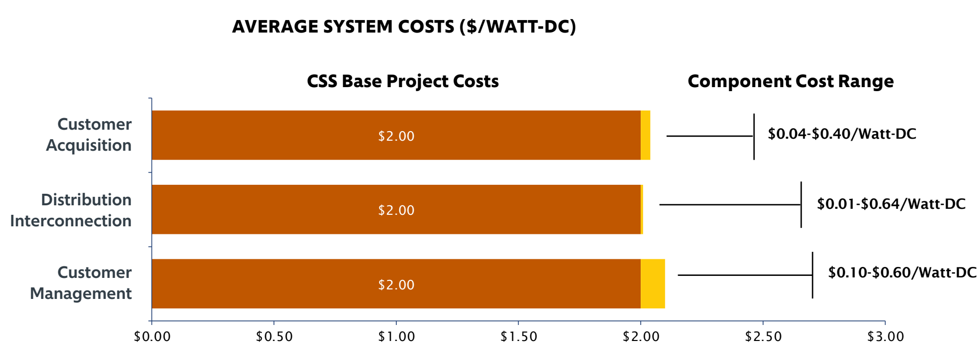
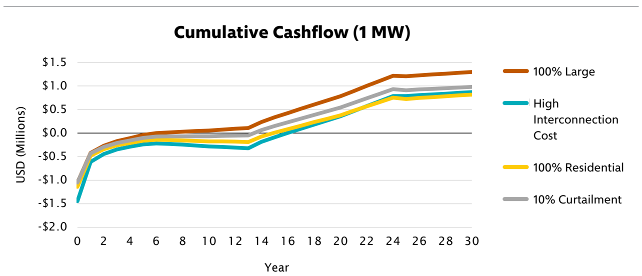



**Figure A3 – Cumulative cashflow and reduction in IRR from baseline for three scenarios: 1) high interconnection cost, 2) 100% residential subscription, and 3) 10% production curtailment.**




| Test Scenario | Sponsor IRR | Change from Baseline |
|---|---|---|
| 100% Large (Baseline) | 11.33% | — |
| High Interconnection Cost | 5.80% | -5.53% |
| 100% Residential | 6.77% | -4.56% |
| 10% Curtailment | 8.84% | -2.49% |

## Financial model assumptions

ERCOT market prices are implemented using Wood Mackenzie's Power and Renewables Short-Term Marginal Cost Curves, which are extended beyond 2040 at an inflation rate of 2%. Distribution interconnection study costs are based on published 2019 TDU cost estimates.

- NREL's bottom-up modeling of solar costs
- Top-down analyses from LBNL's Tracking the Sun and Utility-scale Solar
- Financial assumptions from NREL's On the Path to SunShot report on solar finance, NREL's solar finance trends documents, and other financial industry presentations
- Customer acquisition and management assumptions are as follows:

| Acquisition and Management Sources | Upfront $/Watt | Ongoing $/Watt | Source |
|---|---|---|---|
| **Rhode Island** | 0.25 | 0.03 | IL ABP Appendix |
| **SEPA** | 0.09 | — | Community Solar Design Models |
| **GTM and VoteSolar, 2018** | 0.06<x<0.25; 10% of $2/ Watt cost | — | GTM and Vote Solar |
| **GTM and VoteSolar, 2018** | — | 0.12<x<0.35 | GTM and Vote Solar |
| **GTM and VoteSolar, 2018, pro forma assumptions** | — | 0.02 | GTM and Vote Solar |
| **Elevate Energy** | 0.13 high | — | Elevate Energy |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