PROGRESS AND POTENTIAL FOR COMMUNITY-SCALE SOLAR

HOW RURAL ELECTRIC COOPERATIVES CAN USE LOW-COST, DISTRIBUTED ENERGY TO SAVE MONEY, SERVE CUSTOMERS, AND UNLOCK BILLIONS IN INFRASTRUCTURE SPENDING

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ABOUT US

ABOUT SHINE

Shine[TM] is focused on unlocking a sweet spot in the U.S. clean-energy market: community-scale solar. Shine works with utilities, public agencies, and other buyers to develop innovative distribution-scale projects that make solar energy affordable and accessible for all.

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ABOUT ROCKY MOUNTAIN INSTITUTE

Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. RMI has offices in Basalt and Boulder, Colorado; New York City; Washington, D.C.; and Beijing.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Community-scale solar (CSS) has grown from a promising solar middle market to an important low-cost, high-value power generation solution. Levelized cost of energy (LCOE) for these systems has declined 40% in two years and is now at or below $50/MWh in several parts of the U.S. As a result, CSS is more cost-effective than purchasing energy from central power plants for many electric distribution utilities.

Rocky Mountain Institute's Shine program set out to accelerate the CSS market with a series of initiatives addressing identified barriers around prohibitively high costs, access constraints, and lack of demand. Our hypotheses around the most effective market acceleration levers have been borne out in a series of market interventions over the past 18 months, and the market has outperformed what we assessed to be aggressive cost-reduction targets. There is now a robust and competitive market for community-scale solar, and more utilities are aware of CSS's cost and value.

Community-scale solar is rapidly gaining traction in small utility systems including rural electric cooperatives, but despite its low cost and high value, most utilities have yet to engage with the CSS opportunity. We believe that despite significant progress on addressing market barriers, specific constraints—to some extent specific to each subsegment—continue to inhibit the market. For cooperative distribution utilities, the specific challenges are around high interconnection and development costs, lack of trust, and strategic alignment, as well as gaps in staff capacity and sufficient policy support.

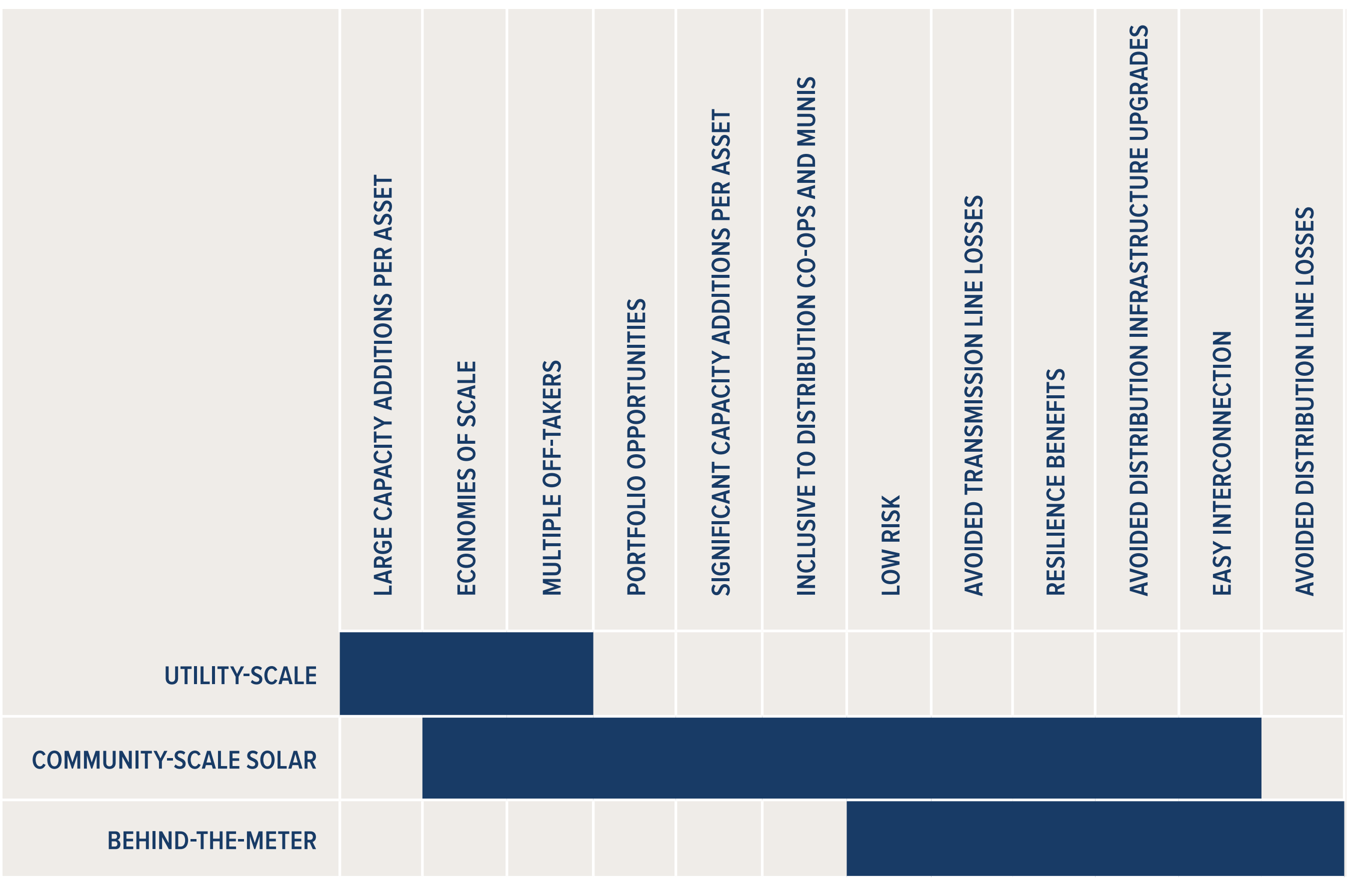
For co-ops, CSS promises to help ensure rates are low and power is reliable, while also providing local and clean energy and investments in their members' communities. As a result, co-ops are well positioned to lead the U.S. transition toward a resilient, affordable, and clean energy future. RMI and the Shine team are committed to staying engaged with the CSS markets to continue to accelerate distributed solar deployment in the U.S., and in particular to leading several collaborative initiatives together with rural co-operatives.

INTRODUCTION

Community-scale solar (CSS) is an important middle market segment between large utility-scale solar photovoltaics (PV) and smaller behind-the-meter systems, such as rooftop solar. Rocky Mountain Institute (RMI) defines CSS as projects that are between 0.5 megawatts (MW) and 10 MW and interconnected to distribution grids. These projects include community solar (shared solar) as well as distribution-scale projects with utility off-takers.

RMI believes CSS occupies a sweet spot in the solar industry. CSS is large enough to leverage the economies of scale enjoyed by utility-scale solar systems, so it can be developed at costs that are highly competitive with renewable and nonrenewable power generation. Like behind-the-meter solar, community-scale solar can be flexibly located and can provide distributed benefits including avoided transmission energy line losses, deferral of distribution infrastructure upgrades, and increased resilience (see Figure 1).

FIGURE 1
BENEFITS OF SOLAR PV BY SCALE



In 2016, RMI's Shine program—which works to accelerate the adoption of CSS across the country—assessed the high potential of the community scale-solar market segment, detailed in an insight brief titled *Community-Scale Solar: Why Developers and Buyers Should Focus on This High-Potential Market Segment.*[1] The report highlighted levers to reduce CSS costs by 40% and enable a 30 GW community-scale solar market—the equivalent of about 50 average-sized coal plants—by 2020, charting the strategic path for the Shine program.

Since then, RMI has supported solar procurement in Colorado, New Mexico, Texas, and New York (see Table 1). Acting as a buyer's representative, RMI educates prospective buyers, aggregates regional demand into portfolios, issues and manages requests for proposals (RFPs), and supports projects from inception through completion. Buyer's representative support and other market interventions have led to direct impact through installed solar capacity, while also generating insight into market dynamics and the more detailed barriers that are inhibiting market growth.

TABLE 1

SHINE COMMUNITY-SCALE SOLAR BUYER SUPPORT

PORTFOLIO	STATE	YEAR	SIZE	NUMBER OF SITES
RURAL ELECTRIC COOPERATIVE PORTFOLIOS	New Mexico	2016	3 MW	3
	Colorado	2017	17 MW	11
	Texas	2018	13 MW	10
MUNICIPAL AND COMMUNITY SOLAR PORTFOLIOS	Central New York	2016	43 MW	48
	Rochester, New York	2016	16 MW	8

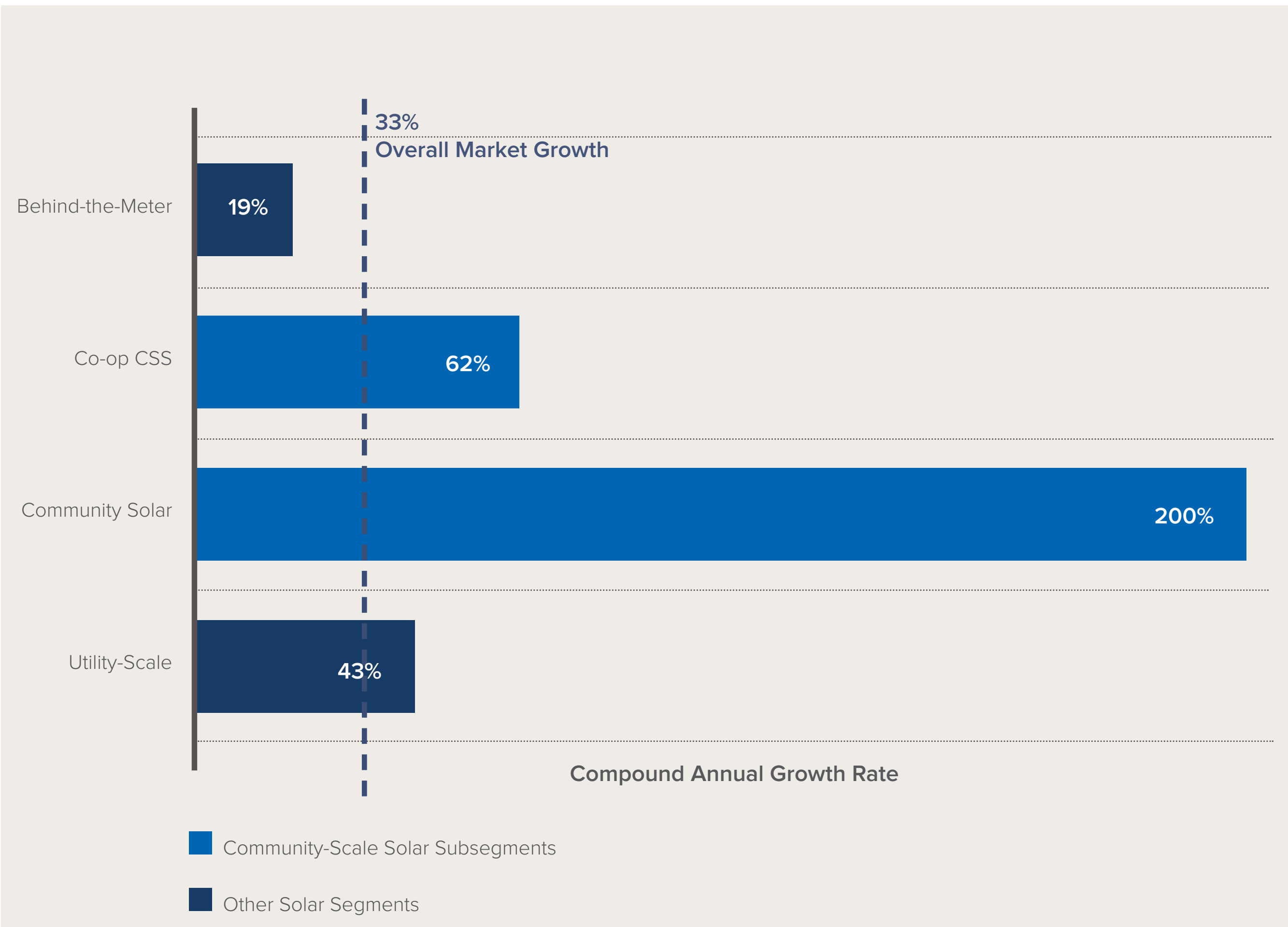
THE CSS MARKET IS GROWING AS BARRIERS ARE ADDRESSED

COMMUNITY-SCALE SOLAR HAS GROWN STRONGLY SINCE 2016

Though there is limited comprehensive market data specific to CSS, what is available shows CSS growth has exceeded recent growth in other segments of the solar market. Two key subsegments of the CSS market, community solar and CSS controlled by co-ops, have grown at healthy 200% and 62% compound annual growth rates,[2] respectively, from 2015 through 2017 (see sidebar). Recent CSS market growth has exceeded behind-the-meter and utility-scale solar growth rates, which have been at 19% and 43% for the period 2015–2017.[3]

FIGURE 2

2015–2017 COMPOUND ANNUAL GROWTH RATE BY SOLAR MARKET SEGMENT AND SUBSEGMENT



MARKET GROWTH CAN BE ATTRIBUTED TO PROPERLY ADDRESSING COST, ACCESS, AND DEMAND BARRIERS

As laid out in RMI's 2016 insight brief, three main barriers were identified as inhibitors of the segment's market growth: cost, access, and demand. Figure 3 illustrates how market innovation, partly supported by RMI's buyer's representation work, is making progress in addressing these barriers.

CSS VS COMMUNITY SOLAR

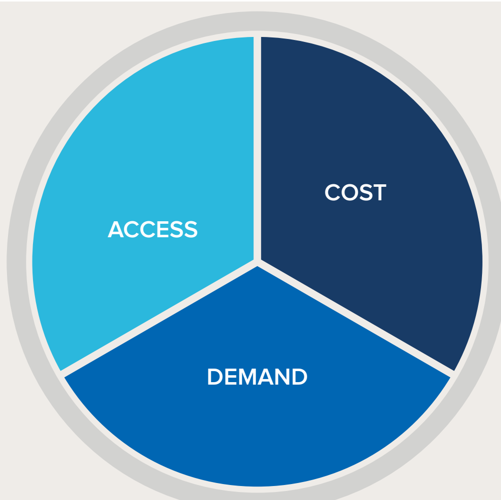
Community solar (or shared solar) refers to projects in which output from a solar array is divided among and credited to multiple subscribers or owners, either through direct ownership of parts of the installation, or through explicit off-taker agreements for shares of the production.

Community-scale solar describes shared solar systems and other midsize solar arrays. The definition includes arrays that are owned by utilities and arrays that are owned by third parties that sell energy to a rural electric cooperative, municipal utility, or investor-owned utility, as well as privately owned assets feeding the system with support of net-metering regulations (i.e., virtual net metering).

FIGURE 3

PROGRESS ON BARRIERS TO CSS MARKET GROWTH 2016–2018

- **New community solar business models for low- and moderate-income households**
- **Increased developer participation in CSS RFPs**
- Increased use of third-party ownership (PPAs)
- generation and transmission provider-led CSS projects



- **Increased procurement through requests for proposals**
- **Cost-reduction through long-term PPAs**
- **Demand aggregation into regional portfolios**
- System cost declines

- **Greater awareness of CSS costs**
- **Greater awareness of CSS value**
- Increased demand from small distribution utilities
- Increased demand from members and customers

RMI's Shine program works on the areas highlighted in bold

PROGRESS ON COST

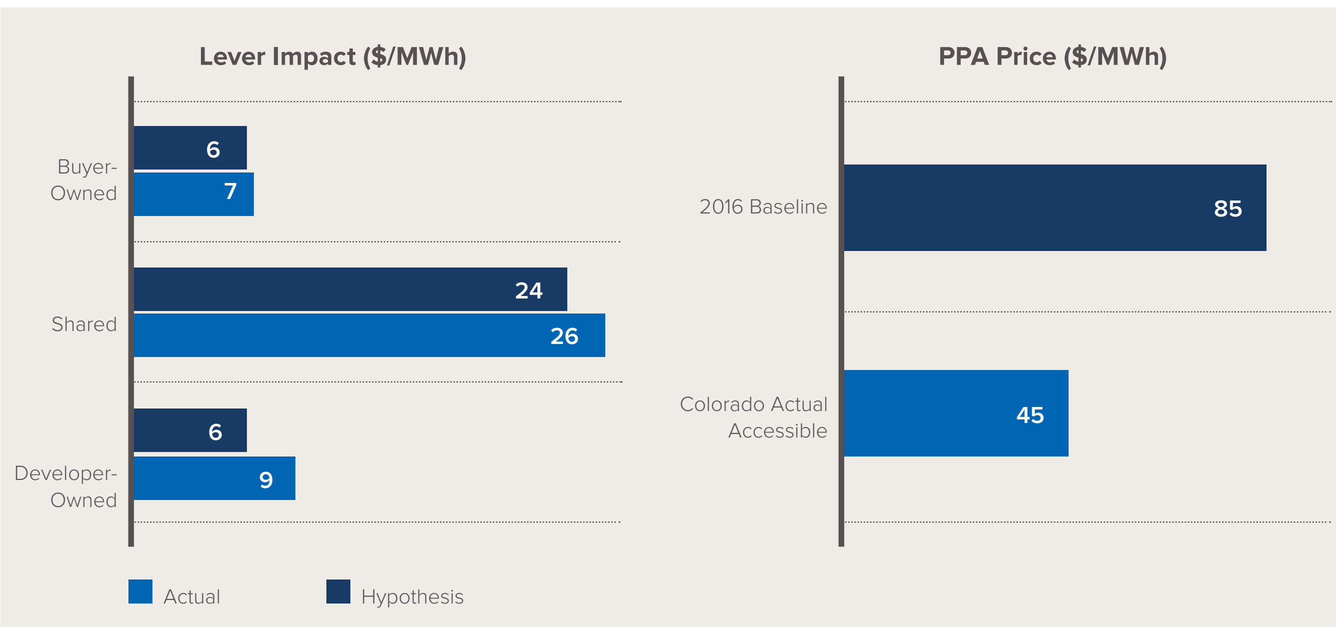
RMI interventions and market innovation have cut costs more than 40% to less than $50/MWh in regions with a strong solar resource

In 2016, the unsubsidized cost of CSS tended to be higher than its economic value, constraining market growth to energy buyers willing to pay a premium for solar. Since 2016, the cost barrier has been addressed through a variety of developer-owned, shared, and buyer-owned cost-reduction levers.

In 2016, RMI predicted CSS power purchase agreement (PPA) prices could be reduced from roughly $85/MWh to $50/MWh through these cost-reduction levers. RMI has tested and confirmed cost-reduction levers by soliciting market input through RFPs. Figure 4 shows results from RMI's 2017 Colorado RFP, verifying the 2016 hypotheses.

FIGURE 4

COST-REDUCTION LEVERS: ACTUAL AND HYPOTHESES



COST-REDUCTION LEVERS:

Hardware- and labor-cost reductions: Hardware- and labor-cost reductions were substantial from 2016 to 2017, resulting in a decrease of around $9/MWh for median bids to RMI RFPs.

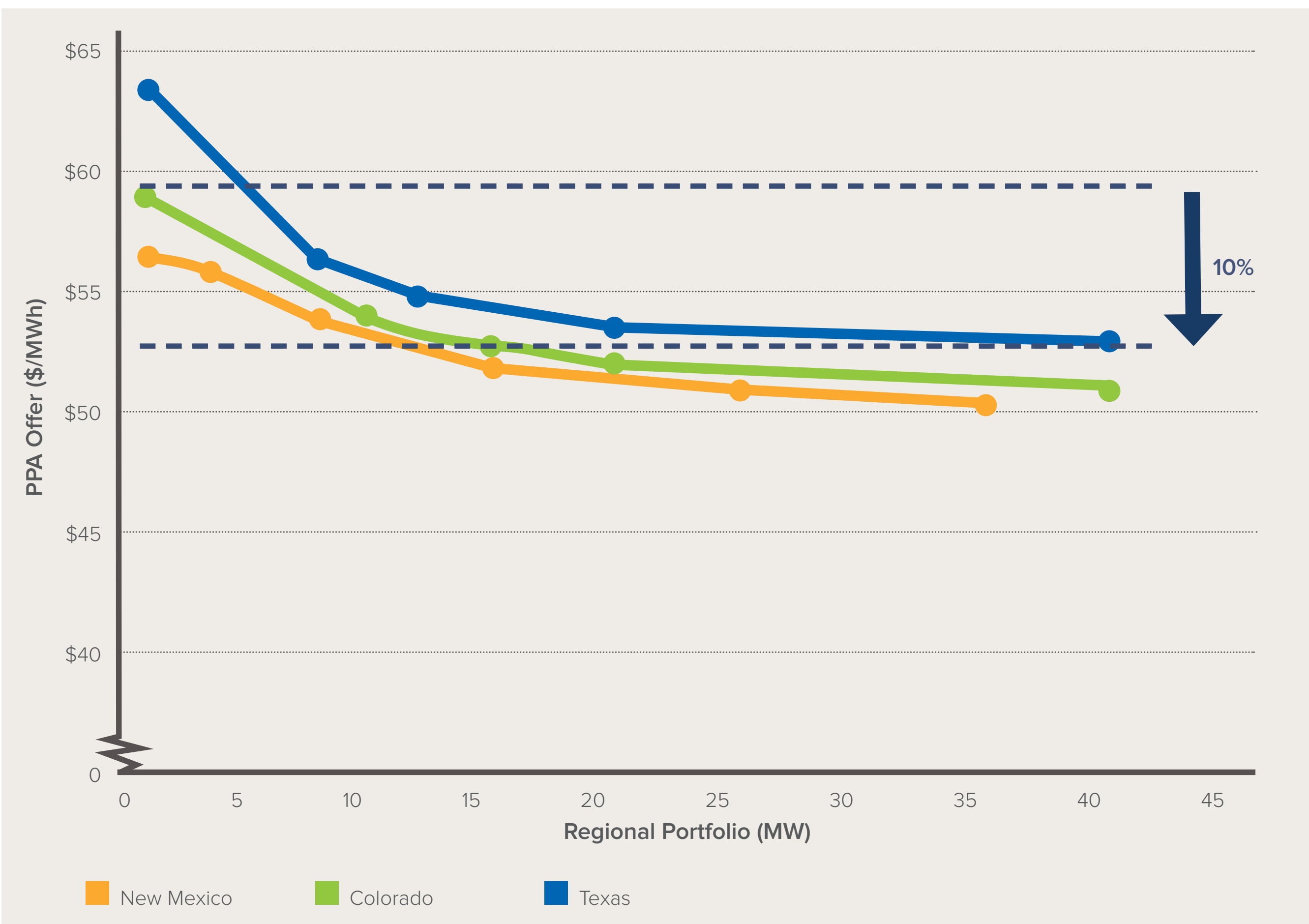
Contract structure: Extending PPA terms from 20 to 25 years provides greater long-term revenue certainty to developers, allowing them to provide lower PPA prices. The typical impact of a term extension was a $2/MWh decrease in PPA price.

System design: The most effective RFPs allow for market innovation by procuring for cost and value instead of specifying a system design. Between 2016 and 2017, single-axis tracking technology advanced considerably, and the market adjusted by shifting from predominantly fixed-tilt to predominantly single-axis-tracking offers for community-scale solar projects. This shift increased production by 15–20% and decreased the levelized cost of energy by around $8/MWh. By procuring for low cost and high value instead of specifying system design, utilities were able to capture the benefits of this innovation.

Volume aggregation: Aggregation of individual projects into regional portfolios reduces prices by 10% or more. Regional portfolio procurement decreases project prices by spreading finance, customer acquisition, and other transaction costs over a larger portfolio and allows for more efficient labor utilization. Volume aggregation also encourages greater competition. Figure 5 shows representative low-cost PPA bids by portfolio size in Colorado, Texas, and New Mexico, indicating that project price in a portfolio of 15 1 MW projects is more than 10% cheaper than the price would be if the projects were developed individually. This portfolio-scale benefit is similar to the cost-savings benefit of building a single 3 MW project instead of smaller 1 MW system.

FIGURE 5

PPA PRICE BY PORTFOLIO SIZE IN NEW MEXICO, COLORADO, AND TEXAS[i]

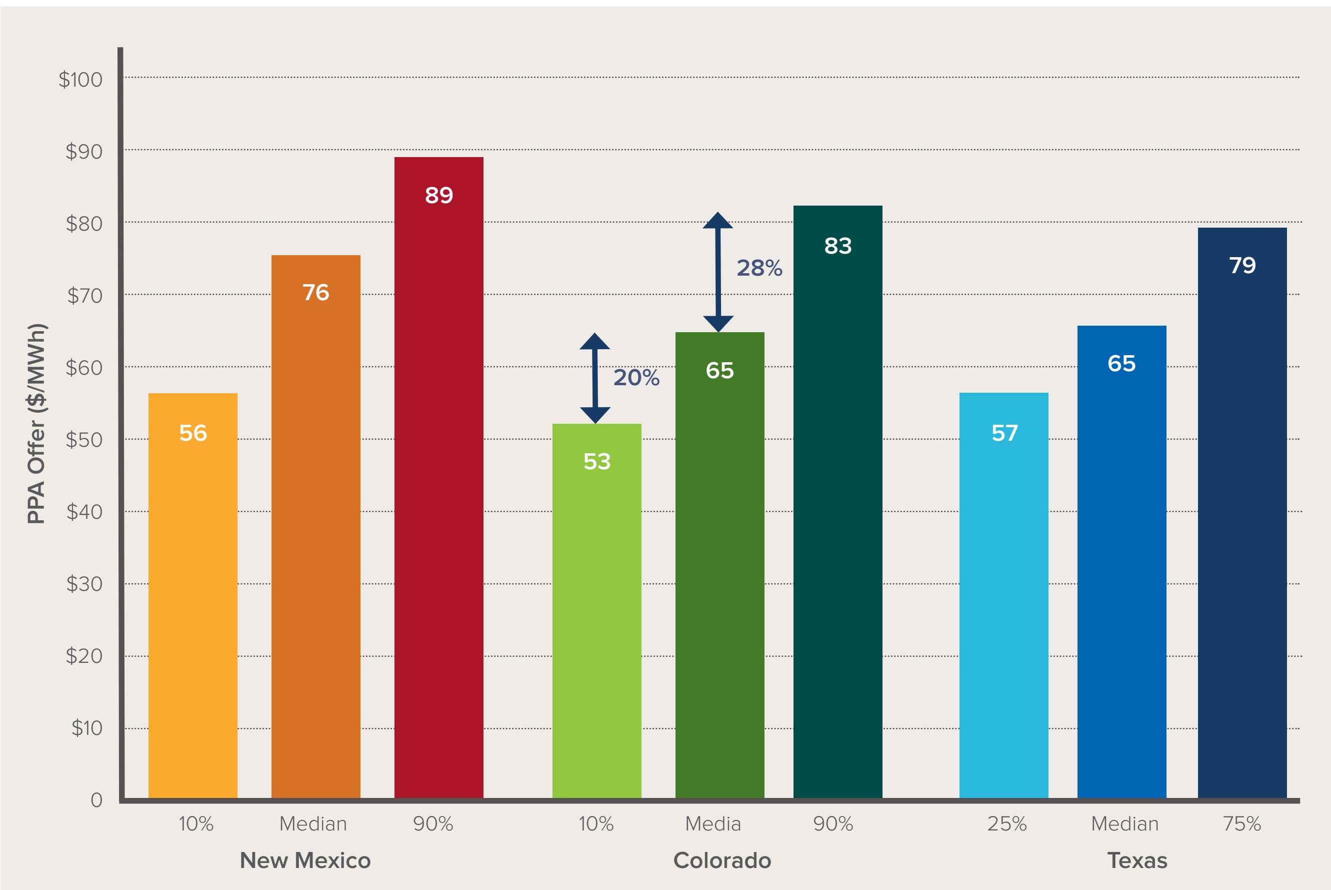


[i] Based on lowest 25% bidder for representative 1 MW project

Competitive procurement: Competitive procurement reduces prices by 20% or more. In regional RFPs, lowest prices were typically 20% lower than the median price, and the highest prices were 20% higher than the median price (Figure 6). For example, via the 30 developers bidding on a representative 1 MW project in the Colorado RFP, the median bid price was $65/MWh, the third-lowest bid was $53/MWh, and the third-highest bid was $83/MWh. It is reasonable to assume that in absence of a robust competitive process, the buyer would access median price. In this instance, it could easily be argued that competitive procurement saves buyers at least 20% on final prices.

FIGURE 6

RANGE OF PPA BIDS IN NEW MEXICO, COLORADO, AND TEXAS



Utility-supported development: Consistent with our 2016 hypotheses, RMI RFPs have shown that a utility can further decrease PPA prices by assuming the cost of land or interconnection. In the Colorado RFP, the impact of providing interconnection was around $2–3/MWh, though actual impact is highly dependent on project-specific land and interconnection costs. Since utility-supported development may shift costs from the developer to the utility, utilities may not wish to cover these costs, and prefer that the developer covers these costs in a “turnkey PPA.”

As a result of the cost-reduction levers identified above, CSS can now be procured for less than $50/MWh in regions with a strong solar resource. Table 2 provides price data on representative projects from each of RMI's three procurement efforts.

PROGRESS ON ACCESS

Developers are showing significant interest in the CSS market segment

In 2016, few solar developers were focused on the CSS market. As a result, CSS projects were served by a small number of regional developers that provided bids that were not always financially attractive or easy to understand.

In 2018, co-ops now can access more robust offers from a more diverse set of project developers. RMI RFPs have confirmed growing developer interest in CSS, including interest from national and international developers. In RMI's most recent RFP in Texas, 20 developers participated, and their typical experience was 40 MW or more per year. RMI has helped enable this development by advocating for the CSS market opportunity and managing RFPs that are compelling to developers and off-takers alike. Buyers also benefit from increased competition by accessing lower-priced and more compelling offerings.

IMPACT OF MODULE TARIFF

The U.S. government's January 2018 decision to impose a tariff on imported solar cells and modules has impacted PPA prices, but is unlikely to derail continued growth of the community scale-solar market. The 30% import tariff is likely to have an impact of around $4/MWh in the short term. That impact will decrease as module prices continue to decline and as the tariff steps down over time. PPA offers for 2018 and 2019 projects have been negatively impacted, but technological innovation is likely to quickly negate any module tariff impact within a year or so.

PROGRESS ON DEMAND

Customer interest, improved economics, and increased awareness are driving stronger demand for CSS systems

In 2016, demand for CSS systems was relatively low, partly because co-ops and other buyers were relying on dated and incorrect views of solar costs, benefits, and risks. RMI has helped address these misconceptions by publicizing low-cost, high-value co-op solar projects and programs. As a result of RMI interventions and the broader evolution of the market, co-op demand for community-scale solar has grown significantly since that time, with a record 107 MW commissioned by co-ops in 2017 (see Figure 7).

TABLE 2

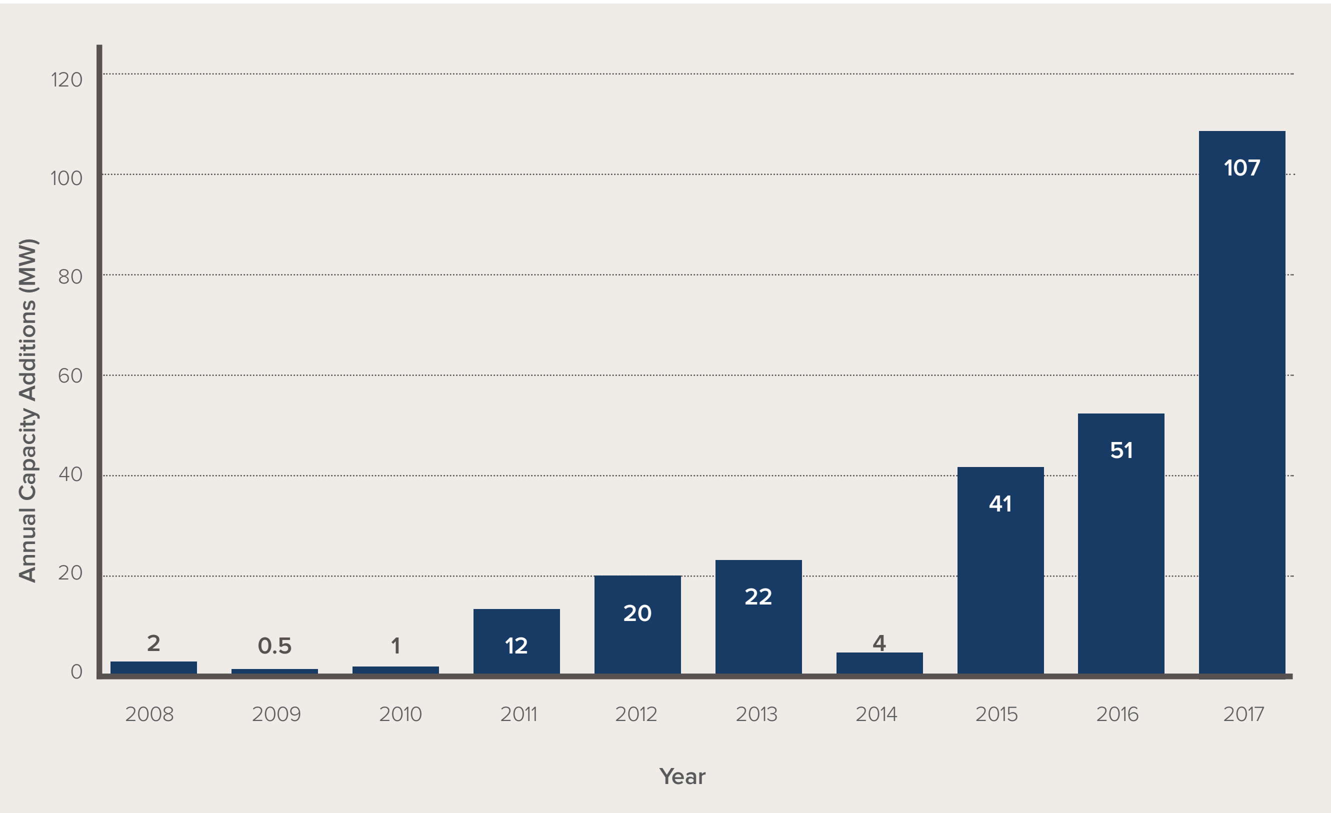
PRICES FOR REPRESENTATIVE PROJECTS FROM RMI RFPS

LOCATION	SIZE OF PROJECT	PPA PRICE
CARRIZOZO, NM	3 MW (developed)	<$45/MWh*
EASTERN COLORADO	2 MW (in development)	~$50-55/MWh (expected)
CENTRAL TEXAS	2 MW (in development)	~$50/MWh (expected)

* Construction began prior to tax reform and module tariff

FIGURE 7

COMMUNITY-SCALE SOLAR CAPACITY ADDITIONS BY RURAL ELECTRIC COOPERATIVES 2008–2017



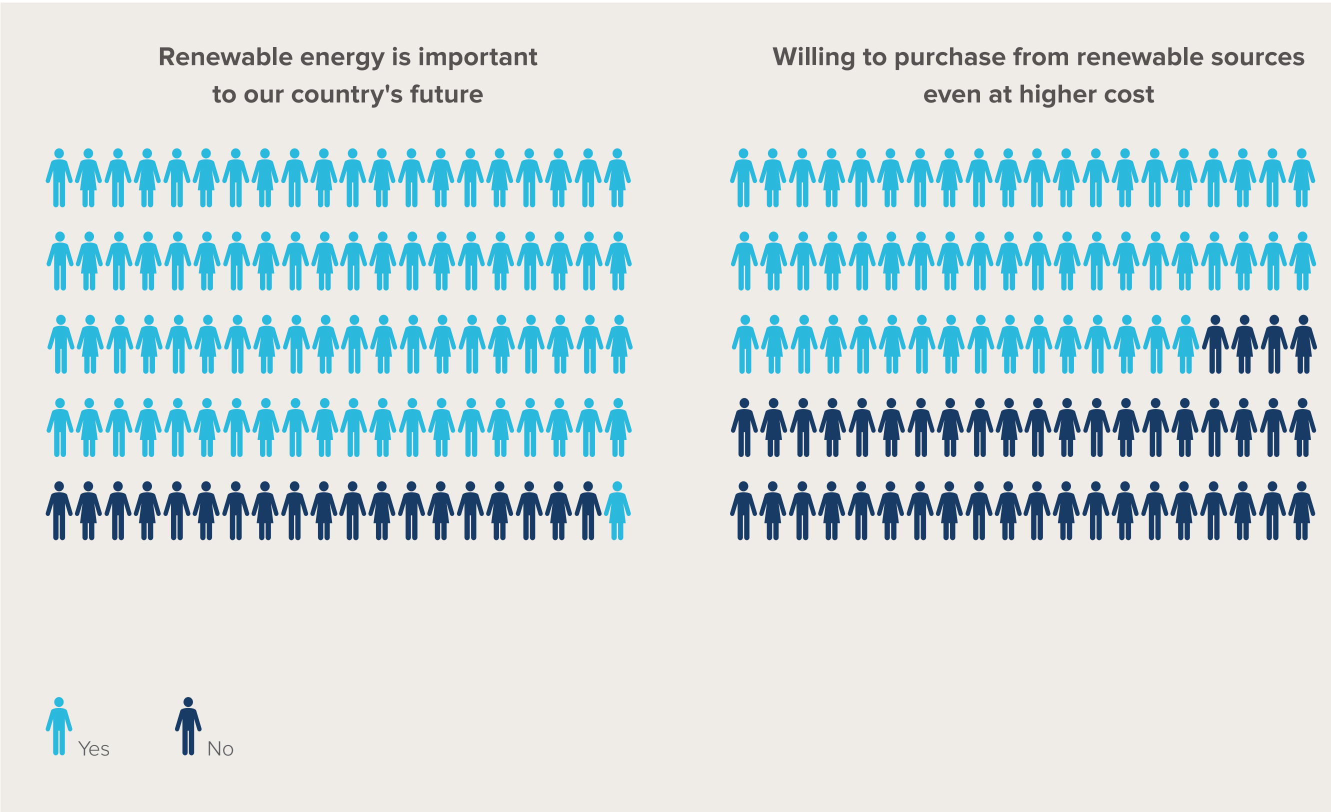
Increased demand is driven by stronger customer interest, improved economics, and increased awareness of the value CSS systems can provide to buyers.

Customer interest: In many co-op communities, members are calling for local and clean power generation. Support for solar is strong among Americans broadly and with co-op members in particular. According to a national survey, more than 80% of co-op members believe renewable energy is important to the country's future, and nearly 60% are willing to pay a premium for renewable energy.[4] Increasingly, co-ops are listening to their members by providing community solar options and by sourcing more energy from community-scale solar.

Improved economics: The value of solar now exceeds the cost of delivered wholesale power in many regions. In our work in Texas, Colorado, and New Mexico, the value of avoided energy purchases, avoided demand charges, and avoided hedge costs exceeds the cost of CSS, and the same holds true in many regions of the country.

FIGURE 8

CO-OP MEMBER SUPPORT FOR RENEWABLE ENERGY



Increased awareness: Traditionally, the CSS market's pricing has been opaque and rarely publicized. As a result, many buyers were not aware of the corresponding values and costs of CSS. RMI has helped bring greater transparency to the CSS market by educating national and regional audiences on CSS cost and value, through the publication of achieved prices and the development of tools that allow potential buyers to model their anticipated cost and value. By doing so, RMI has helped drive greater awareness of the CSS market and demand for these installations.

SOLAR VALUE IN TEXAS

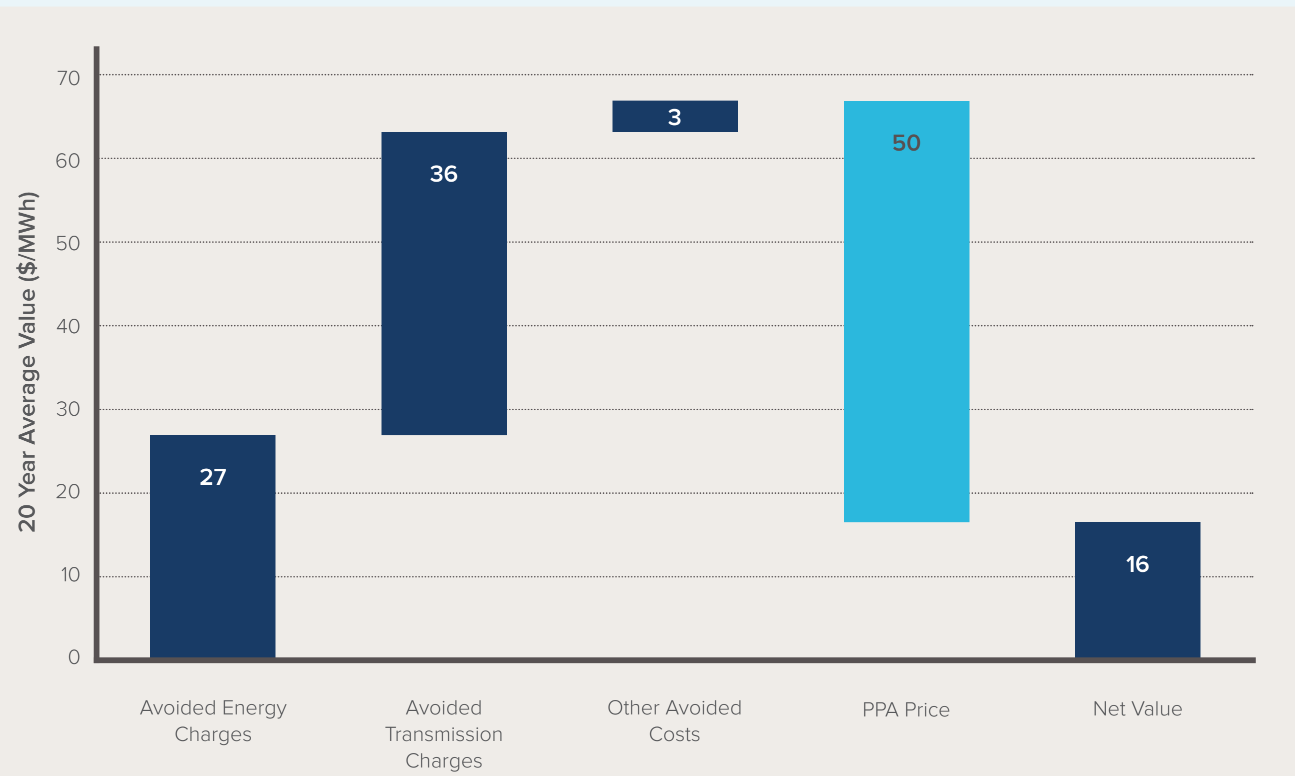
The value of CSS will depend on regional energy economics, a co-op's demand profile, the generation and transmission (G&T) contract structure, and a variety of other factors.

In the Texas ERCOT market, CSS can provide several value streams:

- **Avoided energy charges:** Co-ops will avoid purchasing some energy from the ERCOT market
- **Avoided transmission demand charges:** CSS will decrease the co-ops ERCOT-coincident peak and therefore reduce charges to pay for ERCOT transmission (charges under the 4CP program).
- **Avoided hedge contract charges:** It is common practice for co-ops to enter into hedge contracts to avoid transmission congestion and high prices at times of peak demand. CSS allows co-ops to avoid some of these charges.
- **Avoided ERCOT administration charges:** Finally, CSS can allow a co-op to avoid some ERCOT administration charges.

FIGURE 9

SOLAR COST VS. VALUE IN TEXAS



CSS UPTAKE

THOUGH SOLAR CAN PROVIDE SIGNIFICANT VALUE FOR MANY RURAL ELECTRIC COOPERATIVES, CSS UPTAKE TO DATE HAS BEEN MODEST

The past few years have seen considerable progress made in the CSS market segment, allowing consumers to access the inherent value of this technology. However, at a national level, co-ops have been slow to build or contract with CSS systems. Figure 10 shows that less than a quarter of all co-ops control solar of any kind, and only 8% of co-ops nationwide have developed CSS or larger projects. This low adoption is partly a result of persistent and more specific cost-, access-, and demand-related barriers.

While improvement has been made in addressing cost, access, and demand barriers in general, specific issues continue to constrain market growth. Figure 11 illustrates how we have further detailed these barriers into more specific subcategories, based on our multiple market interventions. It shows that while progress has been made on some subcategories (e.g., system cost, cost of capital, financeability), some persistent barriers remain:

- Interconnection costs
- Development costs
- Market transparency
- Trust of CSS
- Perceived value
- Strategic alignment
- Generation constraints
- Staff capacity

FIGURE 10

PERCENT OF RURAL ELECTRIC COOPERATIVES WITH SOLAR[5]

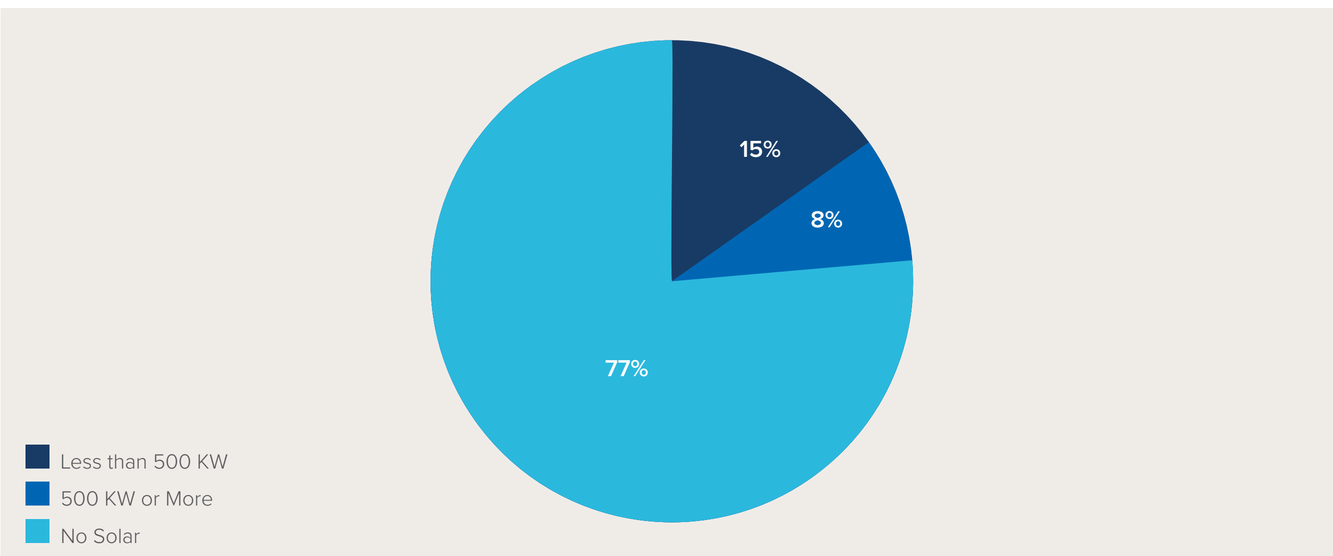


FIGURE 11

SPECIFIC COST, ACCESS, AND DEMAND BARRIERS

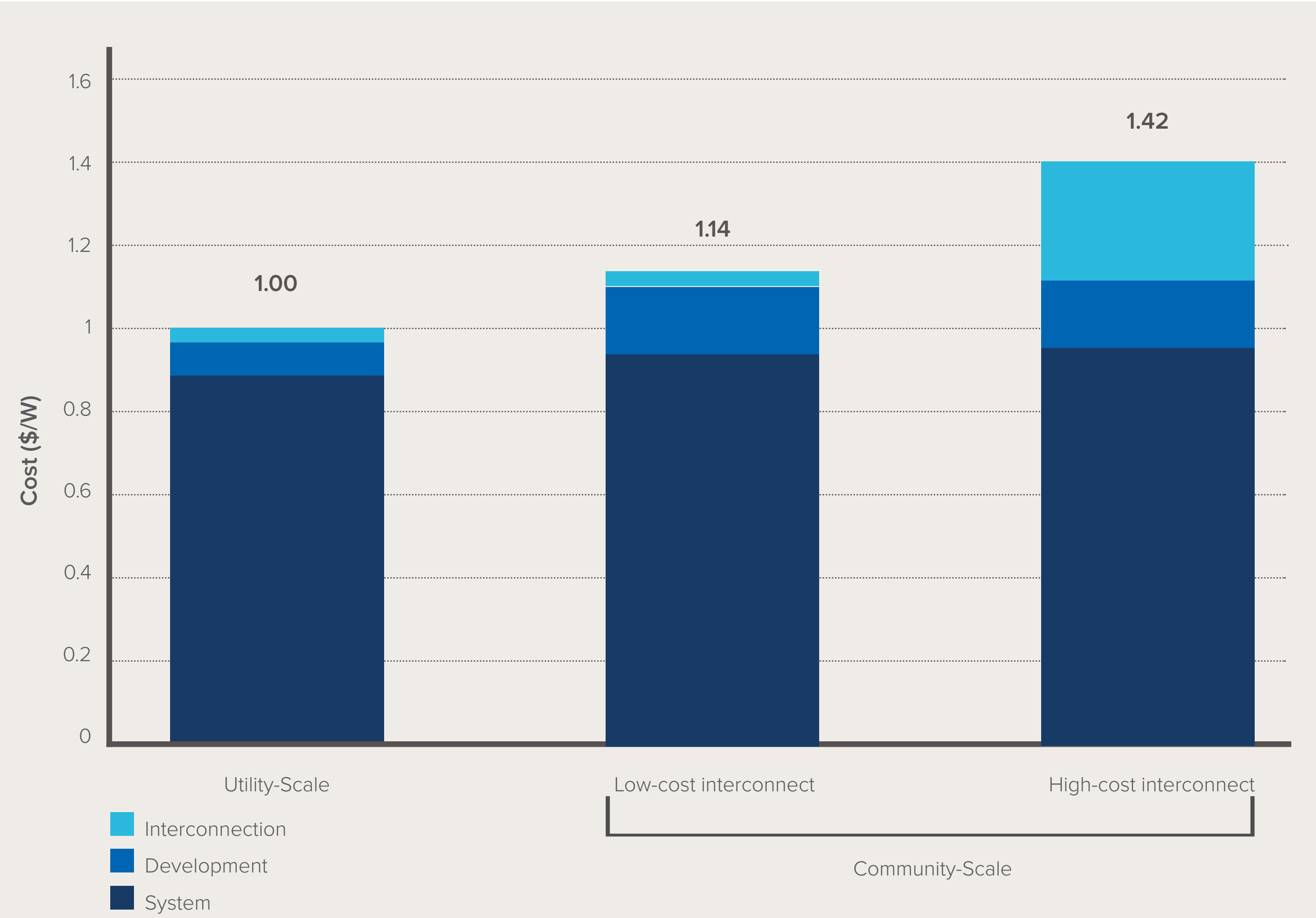
COST

CSS interconnection costs & development costs need to decline further for solar to be cost-competitive in some regions

The cost per watt to design, build, and operate a CSS project (system costs) and the cost to finance CSS projects (cost of capital) are now approaching the corresponding costs for utility-scale solar projects. Interconnection and development costs per watt, however, remain high for CSS projects, contributing to the persistently higher levelized cost of energy for CSS compared to utility-scale solar. Figure 12 compares the

FIGURE 12

COST BREAKDOWN OF TYPICAL UTILITY-SCALE VS COMMUNITY-SCALE PROJECTS[6]



cost of utility-scale solar to two community-scale solar scenarios: one where interconnection costs are low and another where interconnection costs are high. The chart shows that per-watt cost to engineer, procure, and construct the system (system costs) are similar in CSS and utility-scale solar, while development and interconnection costs are higher for CSS.

Interconnection Costs: In theory, interconnection of CSS projects to medium-voltage (MV) distribution systems should be significantly less expensive and more streamlined than the interconnection of utility-scale projects to high-voltage (HV) transmission systems. This is because system impact studies for distribution-level projects are simpler and more straightforward than similar studies for utility-scale projects, and because MV hardware (e.g., protective equipment, transformers, and metering equipment) is significantly lower in cost than HV hardware required for utility-scale projects.

However, CSS projects often require time-consuming interconnection reviews and can trigger costly substation upgrades. Studies may add six months to project delivery. In some instances, in-depth studies are required, but more often the process is drawn out because it is not clear which studies should be completed and which data are required.

Substation upgrades can contribute as much as 20% to project capital costs.[7] In some instances, substation upgrades are necessary to ensure system safety and reliability, but generally projects can be more efficiently interconnected at nonsubstation points of connection without threatening system safety or reliability. Lack of experience interconnecting solar projects, lack of trust of solar technology, and overly conservative interconnection policies contribute to unnecessary interconnection expenditures.

Development Costs: Development costs refer to a wide variety of costs borne by developers as they acquire customers, develop sites, and contract with off-takers. These include transaction costs associated with land-lease execution, PPA negotiation, and interconnection-agreement execution. The industry has yet to adopt standard leases, PPAs, or interconnection agreements for CSS projects. As a result, developments may incur significant costs developing and negotiating agreements. While these transaction costs are a small percentage of total costs for larger projects, they are significant for CSS projects.

DEMAND

Even where solar costs are low and solar value is high, common misconceptions limit co-op demand

Even where the economic value of solar exceeds the cost of a PPA, demand may not exist.

Misconception 1: CSS is not low cost and high value (Transparency)

Shine has helped drive greater awareness of CSS, but the market remains largely opaque. As a result, many co-ops do not have up-to-date information on CSS cost and value. Co-ops may also have misconceptions about internal resources required to access CSS. While third-party developers can now provide turnkey services, many co-ops believe that they must provide land or capital to enable CSS projects.

Misconception 2: CSS threatens grid safety and reliability (Trust)

There is a common misconception that CSS threatens grid safety and reliability. Some co-ops do not trust that CSS can be interconnected to the larger distribution grid without raising safety and reliability concerns, and are hesitant to build CSS projects. However, there are now many examples of safely and reliably operating community-scale solar plants with co-ops nationwide. CSS projects come with protective hardware and switches, just like any other generator on the grid, and smart inverters and battery storage can now be used to maintain energy quality where voltage or frequency irregularities might otherwise be a concern. Furthermore, PV generators and smart inverters can provide soft- and black-start capabilities during grid outages, and when coupled with storage, they can provide valuable dispatchable, load-shifting, and contingency services. Since co-ops' first responsibility to their members is to provide safe and reliable power, some choose not to pursue projects they don't completely trust.

Misconception 3: Members are opposed to CSS (Perceived Value):

Even when clear economic value for solar exists, distribution co-ops may not develop projects because they have not heard explicit support for them from the community. They falsely assume that the absence of explicit support for solar is the same as explicit opposition to solar. As a result, co-op decision makers may falsely conclude that members would prefer to pay more for nonlocal natural gas or coal-fired generation than for local CSS.

Misconception 4: Business as usual is the best strategy (Strategic Alignment)

Many rural electric cooperatives believe that the way they have always operated will continue to be the best way to operate in the future. Therefore, they avoid purchasing power from CSS or local distributed generation and continue to rely entirely on central generation.

Legacy business models may have served co-ops well for 70 years or more, but times are changing. The electric utility business is facing economic, technological, and policy changes, which are accelerating a transition to a more distributed and decarbonized power system. Co-ops can not afford to ignore these changes and fail to prepare for the grid of the future.

ACCESS

Where costs are low and demand exists, staff capacity and G&T policies may limit CSS attainment

Even when cost has been addressed and misconceptions have been addressed, co-ops must be able to access CSS offers. Co-ops must have adequate capacity from staff with the right capabilities, and must have supportive generation and transmission (G&T) policies to proceed with CSS projects.

Staff Capacity: Co-ops are responsible for providing safe, cost-competitive, and reliable electricity with a limited staff. As a result, co-op engineering and management staff can be forced to choose between priorities. Many co-ops have used third-party-supported procurement to reduce staff time required to develop and implement RFPs. Many more have embraced power puchase agreements as a way to reduce staff time required for project development and execution. However, considerable staff time is still required to study and engineer interconnection. Industry best practice for interconnection protocol is unclear, and system data is not easily accessed—exacerbating the staff burden. When staff time and attention are limited, these challenges can compromise the approval of projects even where economics and interest align.

Policy Support: Even when other barriers have been addressed, there is still a need for policy support for the solar sector. Many co-ops are unable to directly access CSS because of prohibitions in contracts with their G&T providers.

Most distribution co-ops are party to “all purposes” contracts with a G&T provider. These contracts vary considerably, but typically require member co-ops to purchase 95% of their energy from the G&T provider while allowing them to source 5% from local sources connected to their distribution grids. These policies were designed to ensure G&Ts have revenue certainty when they make investments in centralized generation infrastructure.

In some instances, distribution co-ops are prohibited from building or contracting with any CSS. In other instances, early-adopter co-ops are constrained by self-generation caps. For example, in Colorado, half of the state’s co-ops are at or are approaching self-generation limits.[8]

UNLOCKING SOLAR GROWTH FOR CO-OPS

A larger, lower-cost, and more-efficient community-scale solar market is on the verge of opening up, and co-operative distribution utilities are well positioned to benefit from its value. Even under a 5% self-generation cap, the current installed base of 260 MW CSS constitutes less than 3% of the total 10 GW market potential of co-ops. Successfully opening up this market could lead to several GW of CSS installed per year in this segment alone, corresponding to a $10 billion to $20 billion investment over several years in building a resilient, renewable, reliable, and affordable power supply for the rural U.S. in the next decade.

While it is not a holistic overview, Figure 13 describes a set of interventions and activities that we believe will address prevailing cost, access, and demand barriers and increase the number of co-ops buying high-value, low-cost CSS. RMI's Shine program will engage with co-ops as well as the developer and investor communities to pursue these opportunities on behalf of and for the benefit of co-op members.

STANDARD SYSTEM DESIGNS, INTERCONNECTIONS, AND DOCUMENTATION WILL DECREASE COSTS

STANDARD CSS

Standardization of CSS can dramatically reduce system costs and create a true distributed solar product that plugs into the distribution grid just as a washing machine or a water heater is installed at a home. The solar industry is already starting to explore standard solutions, such as Nextracker's NX Fusion Powerblock,[9] while NRECA and RMI are advancing standard solutions through SUNDA and Solar Product work respectively. As seen in many mature industries, such as automotive and prefab housing, standard solutions can reduce engineering and development costs and hardware costs, and dramatically reduce labor, installation, and overhead costs. RMI believes a standard CSS project could achieve prices of $0.20/W.[10]

NEW INTERCONNECTION APPROACHES

Just as standard system designs can decrease system costs, standardization and innovation can significantly reduce interconnection costs.

- Standard interconnection designs: Standard designs that directly tap three-phase feeder circuits instead of substations can reduce interconnection hardware and labor costs, while maintaining safety and power quality. By negating the requirement for a substation interconnection, this approach also allows for greater flexibility in the location of a CSS plant, further reducing development costs.

- Technology-enabled interconnection approaches: Rapid advancements in battery-storage and smart-inverter technology have expanded CSS interconnection options. Battery storage and smart inverters can be cost-effectively used to maintain energy quality and avoid backfeed in situations where maximum CSS output is close to minimum circuit load.

STANDARD DOCUMENTS

Standard documents can move the industry toward a more streamlined and lower-cost future. Standard documents could include, but are not limited to, standard PPA documents, standard interconnection agreements, and standard lease agreements.

CONVENINGS THAT ENABLE PEER-TO-PEER LEARNING WILL ADDRESS MISCONCEPTIONS AND INCREASE DEMAND

Persistent misconceptions must be addressed to enable greater CSS demand. Regional convenings are one way co-op general managers, engineering staff, and directors can ask questions, get answers, and explore CSS strategies. These in-person meetings would allow busy co-op staff and leadership to explore questions such as:

- Member communications: How do I poll members about interest in community solar and CSS? How do I communicate successful projects to my membership?
- Economics: What is the economic value of CSS in my region? What are the risks?

FIGURE 13

INITIATIVES AND TOOLS TO ADDRESS CSS MARKET BARRIERS

- **Procurement:** How should I go to market to get the right project at the right price?
- **Strategy:** What is the role of CSS and battery storage for the co-op of the future?
- **G&T relationship:** What is the role of the G&T in enabling, supporting, or leading CSS project development?

All of these questions are best explored through discussions with co-op peers and industry experts. RMI has convened similar regional discussions with co-ops in several states. All have provided significant value to participating co-ops, many of which have decided to proceed to solar procurement.

TOOLS, RESOURCES, AND CASE STUDIES WILL ALLOW STAFF-CONSTRAINED CO-OPS TO ACCESS CSS

The CSS buying process can be convoluted, time-consuming, and costly. First-time CSS buyers need a set of tools, guides, and case studies to help them understand and navigate the decisions they face as they move from understanding costs and benefits to managing interconnection and delivery. Such a set of tools would decrease staff time and improve project outcomes.

Figure 14 shows examples of tools that would benefit buyers at different stages of the buyer's journey.

FIGURE 14

CSS TOOLS AND RESOURCES

UNDERSTAND
Costs & Benefits

SCOPE
Project Size, Location, Contract Structure, and Companion Technologies

SOLICIT
Prices Through Procurement

PARTNER
With a Vendor on Development

MANAGE
Interconnection and Delivery

UNDERSTAND — Tools and Resources
- Economic Analysis Calculator
- Solar Cost Map
- Benefits Case Studies

SCOPE — Tools and Resources
- Solar siting guidelines
- Solar cost estimator
- Battery storage primer
- Microgrid primer
- Utility-supported development handbook

SOLICIT — Tools and Resources
- RFP templates
- RFP tools
- RFP vendor database
- Regional reverse auctions

PARTNER — Tools and Resources
- Standard PPA template
- Standard interconnection agreement template
- Standard lease agreements

MANAGE — Tools and Resources
- Low-cost interconnection handbook
- Standard interconnection designs
- Member communications handbook

JOIN US!

Rocky Mountain Institute's Shine program is collaborating with CSS buyers, developers, and policy makers to open up the CSS market. Our work includes:

- Convenings and education
  Shine shares its insights on the market through publications, presentations, and in-person convenings. Shine shares up-to-date market insight through publications and presentations, whereas facilitated convenings lead to important and impactful peer-to-peer learning.

- Decision-support tools and resources
  RMI is developing tools and resources to help CSS buyers evaluate the economic opportunity and understand the buyer's process, so they can decide if CSS is right for them.

- Standard designs and documents
  RMI is working on standard CSS designs and documents, including a standard PPA, a standard interconnection design, and standard RFP documents.

- Representing buyers
  As a buyer's representative, RMI directly supports regional buyers' groups representing 10 MW or more of total demand. RMI has supported co-op buyers in New Mexico, Colorado, and Texas and is available to support buyers' groups in other regions.

- Gathering feedback from market participants
  RMI is reaching out to seasoned and first-time market participants to learn how the buying process can be improved, and how best practices can be captured through a buyer's roadmap.

- Partnering with utilities and communities
  Shine's goal is to provide clean and affordable electricity to every American. We do that by partnering with utilities and communities to make CSS happen. We are a proud member of NRECA and a proud supporter of rural electric cooperatives. To learn more about Shine, visit www.rmi.org/our-work/electricity/shine-community-scale-solar. To ask a question or explore a partnership opportunity, please contact shine@rmi.org.

ENDNOTES

[1] https://www.rmi.org/wp-content/uploads/2017/03/Shine-Report-CommunityScaleSolarMarketPotential-2016.pdf

[2] For community solar: Greentech Media, Community Solar Outlook: https://www.greentechmedia.com/research/report/us-community-solar-outlook-2017; for solar controlled by co-ops: NRECA: https://www.electric.coop/wp-content/Renewables/solar.html

[3] GTM/ SEIA US Solar Market Insight Report https://www.seia.org/us-solar-market-insight

[4] 2015-2016 Touchstone Energy Cooperative Survey

[5] https://www.electric.coop/wp-content/Renewables/solar.html

[6] RMI Analysis and RMI managed requests for proposal

[7] Based on RMI buyer's representative data

[8] http://www.cleancooperative.com/uncooperative.html

[9] https://www.nextracker.com/wp-content/uploads/2016/04/MKT-000036-Rev.-C-NX-Fusion-SellSheet-4.26.16.pdf

[10] https://www.rmi.org/about/news-and-press/2018-solar-cost-reductions-offset-tariffs-panel-prices/

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